

Contract Documents, Specifications, and Special Provisions of Agreement  
for

**THE CITY OF LEWISVILLE**  
**IH-35E UTILITY RELOCATION**  
**FOX AVE. TO W. COLLEGE ST.**

**November 2021**  
**RCSJ NO. 0196-02-115**  
**CSJ NO. 0196-02-128**  
**PROJECT NO.: U1301**



City of Lewisville  
Engineering Dept.  
151 W. Church St.  
Lewisville, TX 75057

Prepared by:



RJN Group, Inc.  
Texas Registered Engineering Firm F-3260  
14755 Preston Road, Suite 710  
Dallas, TX 75254  
[www.rjn.com](http://www.rjn.com)

**DIVISION 01**  
**GENERAL**  
**REQUIREMENTS**



## 1 11 00 SUMMARY OF WORK

### PART 1 - GENERAL

#### 1.1 WORK INCLUDED

- a. This Section describes the project in general and provides an overview of the extent of the work to be performed. Detailed requirements and extent of work are stated in the applicable Specification sections and/or shown on the Drawings. The Contractor shall, except as otherwise specifically stated herein or in any applicable parts of these Contract Documents, provide and pay for all labor, materials, equipment, tools, construction equipment, and other facilities and services necessary for proper execution, testing, and completion of the work.
- b. Any part or item of the work which is reasonably implied or normally required to make each installation satisfactorily and completely operable shall be performed by the Contractor and the expense thereof included in the applicable lump sum price bid for this project. All miscellaneous appurtenances and other items of work that are incidental to meeting the intent of the plans and these Specifications, are considered to be included in the applicable lump sum price bid for this project, even though these appurtenances and items may not be specifically called for in the Specifications or shown on the Drawings.

#### 1.2 DESCRIPTION OF PROJECT BASE BID

- A. A general summary of the project work to be performed by the Contractor is as follows:
  - a. The relocation of the existing water and wastewater pipelines to the new proposed TxDOT ROW along the IH-35E corridor consists of approximately 1,800 LF of 8-inch diameter wastewater, 3,900 LF of 8-inch diameter water, 1,500 LF of 10-inch water, and 650 LF of 12-inch water and appurtenances.
- B. The project location is approximately bounded as follow:
  - a. Along the IH-35E corridor through the City limits from Fox Avenue to the South to W. College Street to the North.

#### 1.3 STANDARD SPECIFICATIONS

- A. All work shall conform to City of Lewisville General Contract Documents and General Specifications, except as specified herein.

#### 1.4 WORK SEQUENCE

- A. The Contractor is required to determine his own method of construction and detailed work sequence, within the general terms and constraints of the contract. The Contractor's sequence and methods must ensure that the overall project is completed within the allotted time, observe all constraints, safety, and health related guidelines. The Engineer, along with input from the Owner, will provide a recommendation of project sequencing to be discussed at a later date, prior to construction.

#### 1.5 DURATION

- A. One hundred eighty (180) calendar days from notice to proceed shall be allotted for the completion of this project. This is not a working day contract.

## **1.6 PROTECTION OF ADJACENT PROPERTIES**

- A. All bidders shall visit the site and note the buildings, structures, water ways, landscaping, streets, sidewalks, driveways and other facilities near the work areas that may be damaged by this renovation. The Contractor shall make adequate provisions to fully protect the surrounding areas. The Contractor shall be held fully responsible for all damage resulting from its operations. The Contractor shall process all individual claims and pay claims or repair and/or clean damaged property to the satisfaction of the claimant.
- B. The Contractor will be responsible for any damage to structures, vehicles, landscaping, and any other items as a result of construction operations. The Contractor shall hire a cleaning contractor and repair the damage within a seven (7) day period after the damage is reported. If the Contractor fails to satisfactorily repair the damage, the City will facilitate the cleanup and withhold the cost from Contractor's final payment.
- C. The Contractor shall clean daily all trash, waste material, rubbish and debris resulting from his or/her operations. The Contractor shall place steel containers (dumpsters) at the site for the collection of waste material. The contractor shall install silt fence on perimeter fence to prevent trash from entering in the surrounding areas. The site shall be cleaned to the satisfaction of the Owner.

## **1.7 WATER DISTRIBUTION SYSTEM SHUTDOWNS**

- A. The Contractor shall coordinate with the Owner the scheduling of all water distribution system shutdowns if required, as to minimize disruption to customers. THE CONTRACTOR SHALL NOT OPERATE ANY VALVES.

## **1.8 IDENTIFICATION OF PROBLEM AREAS**

- A. Identification of problem areas shall be a joint effort of the Owner and the Contractor with the final determination to be made by the Owner.

## **1.9 SURVEYING**

- A. The Contractor is responsible for all surveying required to construct these facilities per the specifications and plans, and to ensure that proper elevations, flow lines, finished grades, etc. are achieved.

## **1.10 BUILDING PERMITS AND INSPECTIONS**

- A. All work in this contract is subject to the permitting and inspection process of the City of Lewisville. All construction shall comply with the applicable Building, Plumbing and Electrical Codes. All required permits must be obtained by the Contractor, at the Contractor's expense.

## **1.11 CONTRACTOR'S RESPONSIBILITIES**

- A. Execute all work as described on the Drawings and in these Specifications.
- B. Arrange for the necessary equipment and materials required for renovation and testing.
- C. Provide adequate temporary sanitary facilities. The Contractor and his/her subcontractors will not be allowed to use any facilities at the job site.
- D. Furnish, install, maintain, and remove all temporary service facilities for renovation purposes.
- E. Provide and maintain fire-fighting equipment in working order during the entire construction period.

- F. Provide and maintain all required safety and testing equipment during the construction period. The Contractor shall also establish a safety plan and procedure in the case of an emergency.

**PART 2 - PRODUCTS [NOT USED]**

**3.00 EXECUTION [NOT USED]**

**END OF SECTION**

**01 29 00            MEASUREMENT AND PAYMENT**

**PART 1 - MEASUREMENT PROCEDURES**

**IH-35E Utility Relocation Analysis Fox Ave. to W. College St. Bid Items**

Bid Item 2: Abandon Existing Wastewater Line in Place & Grout Fill based on price per bid per Cubic Yard (CY) and shall be total compensation for furnishing all labor, materials, and equipment to complete the necessary work. All work shall be in accordance with City of Lewisville and NCTCOG.

Bid Item 3: Abandon Existing Water Line in Place & Grout Fill is based on price per bid per Cubic Yard (CY) and shall be total compensation for furnishing all labor, materials, and equipment to complete the necessary work. All work shall be in accordance with City of Lewisville and NCTCOG.

Bid Item 4: Remove Existing Wastewater Manhole including all related items, in accordance with specifications, drawings and plans, complete and in place, shall be measured by per Each (EA) and paid for at the per Each (EA) bid price in the Proposal, which price is the total compensation for furnishing design, materials, tools, labor, equipment, and incidentals necessary for construction complete and in place.

Bid Item 5: Remove Existing Wastewater Cleanout including all related items, in accordance with specifications, drawings and plans, complete and in place, shall be measured by per Each (EA) and paid for at the per Each (EA) bid price in the Proposal, which price is the total compensation for furnishing design, materials, tools, labor, equipment, and incidentals necessary for construction complete and in place.

Bid Item 6: Fire Hydrant Remove & Salvage & Transport to City including all related items, in accordance with specifications, drawings and plans, complete and in place, shall be measured by per Each (EA) and paid for at the per Each (EA) bid price in the Proposal, which price is the total compensation for furnishing design, materials, tools, labor, equipment, and incidentals necessary for construction complete and in place.

Bid Item 7: Valve Remove & Salvage & Transport to City including all related items, in accordance with specifications, drawings and plans, complete and in place, shall be measured by per Each (EA) and paid for at the per Each (EA) bid price in the Proposal, which price is the total compensation for furnishing design, materials, tools, labor, equipment, and incidentals necessary for construction complete and in place.

Bid Item 8: Water Meter and Box Remove & Salvage & Transport to City including all related items, in accordance with specifications, drawings and plans, complete and in place, shall be measured by per Each (EA) and paid for at the per Each (EA) bid price in the Proposal, which price is the total compensation for furnishing design, materials, tools, labor, equipment, and incidentals necessary for construction complete and in place.

Bid Item 9: Asphalt Paving Saw Remove & Dispose is based on the bid per Square Yard (SY) and shall include full compensation for labor, materials, and incidentals to include the cost of saw cutting, removing,

and disposing off-site the existing pavement. Neatly sawcut all flatwork along straight lines and to the location shown in plans. All work shall be in accordance with City of Lewisville and NCTCOG.

Bid Item 10: Concrete Paving Saw Remove & Dispose is based on the bid per Square Yard (SY) and shall include full compensation for labor, materials, and incidentals to include the cost of saw cutting, removing, and disposing off-site the existing pavement, curb and gutter, driveways, alleys, sidewalks, flumes, concrete lined channel and rip rap. Neatly sawcut all flatwork along straight lines and to the nearest joint in location shown in plans. All work shall be in accordance with City of Lewisville and NCTCOG.

Bid Item 11: Install 48" Diameter Manhole (+5' Add'l VF each) Furnish and install 48-inch Diameter Standard Precast Manhole (0 – 6 Foot Depth), including all related items, in accordance with specifications, drawings and plans, complete and in place, shall be measured by per Each (EA) and paid for at the per Each (EA) bid price in the Proposal, which price is the total compensation for furnishing design, materials, tools, labor, equipment, and incidentals necessary for construction complete and in place.

Bid Item 12: Install Standard Cleanout Including all related items, in accordance with specifications, drawings and plans, complete and in place, shall be measured by per Each (EA) and paid for at the per Each (EA) bid price in the Proposal, which price is the total compensation for furnishing design, materials, tools, labor, equipment, and incidentals necessary for construction complete and in place.

Bid Item 13: Flowable Fill is based on price per bid per Cubic Yard (CY) and shall be total compensation for furnishing all labor, materials, and equipment to complete the necessary work. All work shall be in accordance with City of Lewisville and NCTCOG.

Bid Item 14: 8" SDR-26 PVC Wastewater Line BOTOE includes the installation of SDR-26 PVC Wastewater pipe by other than open cut method. Shall be measured by Linear Foot (LF) and paid for at the Linear Foot (LF) bid price in the proposal, which price is the total compensation for furnishing design, materials, tools, labor, equipment, and incidentals necessary for construction complete and in place. Scope includes all materials, clearing, grading, trench safety, and dewatering as needed and all related items, complete and in place in accordance with specifications, drawings, and plans.

Bid Item 15: 8" SDR-26 PVC Wastewater Line by Open Cut includes the installation of SDR-26 PVC Wastewater pipe by open cut method. Shall be measured by Linear Foot (LF) and paid for at the Linear Foot (LF) bid price in the proposal, which price is the total compensation for furnishing design, materials, tools, labor, equipment, and incidentals necessary for construction complete and in place. Scope includes all materials, clearing, grading, trench safety, and dewatering as needed and all related items, complete and in place in accordance with specifications, drawings, and plans.

Bid Item 16: 8" PVC Water Line Pipe BOTOE includes the installation of PVC water pipe by other than open cut method. Shall be measured by Linear Foot (LF) and paid for at the Linear Foot (LF) bid price in the proposal, which price is the total compensation for furnishing design, materials, tools, labor, equipment, and incidentals necessary for construction complete and in place. Scope includes all materials, clearing, grading, and dewatering as needed and all related items, complete and in place in accordance with specifications, drawings, and plans.

Bid Item 17: 8" PVC Water Line by Open Cut includes the installation of PVC water pipe by open cut



method. Shall be measured by Linear Foot (LF) and paid for at the Linear Foot (LF) bid price in the proposal, which price is the total compensation for furnishing design, materials, tools, labor, equipment, and incidentals necessary for construction complete and in place. Scope includes all materials, clearing, grading, trench safety, and dewatering as needed and all related items, complete and in place in accordance with specifications, drawings, and plans.

Bid Item 18: 10" PVC Water Line by Open Cut includes the installation of PVC water pipe by open cut method. Shall be measured by Linear Foot (LF) and paid for at the Linear Foot (LF) bid price in the proposal, which price is the total compensation for furnishing design, materials, tools, labor, equipment, and incidentals necessary for construction complete and in place. Scope includes all materials, clearing, grading, trench safety, and dewatering as needed and all related items, complete and in place in accordance with specifications, drawings, and plans.

Bid Item 19: 12" PVC Water Line by Open Cut includes the installation of PVC water pipe by open cut method. Shall be measured by Linear Foot (LF) and paid for at the Linear Foot (LF) bid price in the proposal, which price is the total compensation for furnishing design, materials, tools, labor, equipment, and incidentals necessary for construction complete and in place. Scope includes all materials, clearing, grading, trench safety, and dewatering as needed and all related items, complete and in place in accordance with specifications, drawings, and plans.

Bid Item 20: 6" Gate Valve Furnish and Control: including all related items, in accordance with specifications, drawings and plans, complete and in place, shall be measured by per Each (EA) and paid for at the per Each (EA) bid price in the Proposal, which price is the total compensation for furnishing design, materials, tools, labor, equipment, and incidentals necessary for construction complete and in place.

Bid Item 21: 8" Gate Valve Furnish and Control including all related items, in accordance with specifications, drawings and plans, complete and in place, shall be measured by per Each (EA) and paid for at the per Each (EA) bid price in the Proposal, which price is the total compensation for furnishing design, materials, tools, labor, equipment, and incidentals necessary for construction complete and in place.

Bid Item 22: 10" Gate Valve Furnish and Control including all related items, in accordance with specifications, drawings and plans, complete and in place, shall be measured by per Each (EA) and paid for at the per Each (EA) bid price in the Proposal, which price is the total compensation for furnishing design, materials, tools, labor, equipment, and incidentals necessary for construction complete and in place.

Bid Item 23: 12" Gate Valve Furnish and Control including all related items, in accordance with specifications, drawings and plans, complete and in place, shall be measured by per Each (EA) and paid for at the per Each (EA) bid price in the Proposal, which price is the total compensation for furnishing design, materials, tools, labor, equipment, and incidentals necessary for construction complete and in place.

Bid Item 24: Ductile Iron Water Fittings with Restraint Furnish and Install including all related items in accordance with specifications, drawings and plans, complete and in place, shall be measured by per Ton and paid for at the per Ton bid price in the Proposal, which price is the total compensation for furnishing design, materials, tools, labor, equipment, and incidentals necessary for construction complete and in

place.

Bid Item 25: Water Meter and Box Furnish & Install including all related items, in accordance with specifications, drawings and plans, complete and in place, shall be measured by per Each (EA) and paid for at the per Each (EA) bid price in the Proposal, which price is the total compensation for furnishing design, materials, tools, labor, equipment, and incidentals necessary for construction complete and in place.

Bid Item 26: Connection to Existing Water Meter is based on the price per Each (EA). The unit price bid for this item consists of all material, equipment, labor, tools, and incidentals to complete the work shown in the contract documents. The contractor shall identify the exact locations of existing laterals before beginning work.

Bid Item 27: Connection to Existing 6" Water Line is based on the price per Each (EA). The unit price bid for this item consists of all material, equipment, labor, tools, and incidentals to complete the work shown in the contract documents. The contractor shall identify the exact locations of existing laterals before beginning work.

Bid Item 28: Connection to Existing 8" Water Line is based on the price per Each (EA). The unit price bid for this item consists of all material, equipment, labor, tools, and incidentals to complete the work shown in the contract documents. The contractor shall identify the exact locations of existing laterals before beginning work.

Bid Item 29: Connection to Existing 10" Water Line is based on the price per Each (EA). The unit price bid for this item consists of all material, equipment, labor, tools, and incidentals to complete the work shown in the contract documents. The contractor shall identify the exact locations of existing laterals before beginning work.

Bid Item 30: Connection to Existing 12" Water Line is based on the price per Each (EA). The unit price bid for this item consists of all material, equipment, labor, tools, and incidentals to complete the work shown in the contract documents. The contractor shall identify the exact locations of existing laterals before beginning work.

Bid Item 31: Connection to Existing 6" Sanitary Sewer Line is based on the price per Each (EA). The unit price bid for this item consists of all material, equipment, labor, tools, and incidentals to complete the work shown in the contract documents. The contractor shall identify the exact locations of existing laterals before beginning work.

Bid Item 32: Cut and Plug 6" Wastewater Line is based on price bid per Each (EA) and shall include labor, materials, and incidentals for cutting the existing pipe and installing a cap at each location shown on the plans. All work shall be in accordance with City of Lewisville and NCTCOG.

Bid Item 33: Cut and Plug 8" Wastewater Line is based on price bid per Each (EA) and shall include labor, materials, and incidentals for cutting the existing pipe and installing a cap at each location shown on the plans. All work shall be in accordance with City of Lewisville and NCTCOG.

Bid Item 34: Cut and Plug 6" Water Line is based on price bid per Each (EA) and shall include labor, materials, and incidentals for cutting the existing pipe and installing a cap at each location shown on the

plans. All work shall be in accordance with City of Lewisville and NCTCOG.

Bid Item 35: Cut and Plug 8" Water Line is based on price bid per Each (EA) and shall include labor, materials, and incidentals for cutting the existing pipe and installing a cap at each location shown on the plans. All work shall be in accordance with City of Lewisville and NCTCOG.

Bid Item 36: Cut and Plug 10" Water Line is based on price bid per Each (EA) and shall include labor, materials, and incidentals for cutting the existing pipe and installing a cap at each location shown on the plans. All work shall be in accordance with City of Lewisville and NCTCOG.

Bid Item 37: Cut and Plug 12" Water Line is based on price bid per Each (EA) and shall include labor, materials, and incidentals for cutting the existing pipe and installing a cap at each location shown on the plans. All work shall be in accordance with City of Lewisville and NCTCOG.

Bid Item 38: 18" Encasement Pipe including all related items, in accordance with specifications, drawings and plans, complete and in place, shall be measured by Linear Foot (LF) and paid for at the Linear Foot (LF) bid price in the Proposal, which price is the total compensation for furnishing design, materials, tools, labor, equipment, and incidentals necessary for construction complete and in place.

Bid Item 39: 20" Encasement Pipe including all related items, in accordance with specifications, drawings and plans, complete and in place, shall be measured by Linear Foot (LF) and paid for at the Linear Foot (LF) bid price in the Proposal, which price is the total compensation for furnishing design, materials, tools, labor, equipment, and incidentals necessary for construction complete and in place.

Bid Item 40: 24" Encasement Pipe including all related items, in accordance with specifications, drawings and plans, complete and in place, shall be measured by Linear Foot (LF) and paid for at the Linear Foot (LF) bid price in the Proposal, which price is the total compensation for furnishing design, materials, tools, labor, equipment, and incidentals necessary for construction complete and in place.

Bid Item 41: Fire Hydrant Standard Furnish & Install including all related items, in accordance with specifications, drawings and plans, complete and in place, shall be measured by per Each (EA) and paid for at the per Each (EA) bid price in the Proposal, which price is the total compensation for furnishing design, materials, tools, labor, equipment, and incidentals necessary for construction complete and in place.

Bid Item 42: 6" PVC Water Line by Open Cut includes the installation of PVC water pipe by open cut method. Shall be measured by Linear Foot (LF) and paid for at the Linear Foot (LF) bid price in the proposal, which price is the total compensation for furnishing design, materials, tools, labor, equipment, and incidentals necessary for construction complete and in place. Scope includes all materials, clearing, grading, trench safety, and dewatering as needed and all related items, complete and in place in accordance with specifications, drawings, and plans.

Bid Item 43: Trench Safety including all related items, in accordance with specifications, drawings and plans, complete and in place, shall be measured by Linear Foot (LF) and paid for at the Linear Foot (LF) bid price in the Proposal, which price is the total compensation for furnishing design, materials, tools, labor, equipment, and incidentals necessary for construction complete and in place.

Bid Item 44: Seeding/Sodding of all Disturbed Areas including all related items, in accordance with specifications, drawings and plans, complete and in place, shall be measured by Square Yard (SY) and paid for at the Square Yard (SY) bid price in the Proposal, which price is the total compensation for furnishing design, materials, tools, labor, equipment, and incidentals necessary for construction complete and in place.

Bid Item 45: Silt Fences including all related items, in accordance with specifications, drawings and plans, complete and in place, shall be measured by Linear Foot (LF) and paid for at the Linear Foot (LF) bid price in the Proposal, which price is the total compensation for furnishing design, materials, tools, labor, equipment, and incidentals necessary for construction complete and in place.

Bid Item 46: Filtration Socks including all related items, in accordance with specifications, drawings and plans, complete and in place, shall be measured by Linear Foot (LF) and paid for at the Linear Foot (LF) bid price in the Proposal, which price is the total compensation for furnishing design, materials, tools, labor, equipment, and incidentals necessary for construction complete and in place.

Bid Item 47: Construct Class C Sidewalk 4" is based on the bid price per Square Foot (SF) and is the total compensation for furnishing all labor, materials, equipment, and any incidentals to complete the work. Work shall be constructed in accordance with the City of Lewisville Standard Details in the locations shown in the plans.

Bid Item 48: Curb and Gutter is based on the bid price per Linear Foot (LF) and is the total compensation for furnishing all labor, materials, equipment, and any incidentals to complete the work. Work shall be constructed in accordance with the City of Lewisville Standard Details in the locations shown in the plans.

Bid Item 49: 2-inch Hot Mix Asphalt (Type D) including all related items, in accordance with specifications, drawings and plans, complete and in place, shall be measured by Square Yard (SY) and paid for at the Square Yard (SY) bid price in the Proposal, which price is the total compensation for furnishing design, materials, tools, labor, equipment, and incidentals necessary for construction complete and in place.

Bid Item 50: 4-inch Concrete Pavement Subgrade including all related items, in accordance with specifications, drawings and plans, complete and in place, shall be measured by Square Yard (SY) and paid for at the Square Yard (SY) bid price in the Proposal, which price is the total compensation for furnishing design, materials, tools, labor, equipment, and incidentals necessary for construction complete and in place.

Bid Item 51: Post-Construction CCTV including all related items, in accordance with specifications, drawings and plans, complete and in place, shall be measured by Linear Foot (LF) and paid for at the Linear Foot (LF) bid price in the Proposal, which price is the total compensation for furnishing design, materials, tools, labor, equipment, and incidentals necessary for construction complete and in place.

Bid Item 52: Bypass Pumping/Flow Control including all related items, in accordance with specifications, drawings and plans, complete and in place, shall be measured by Lump Sum (LS) and paid for at the Lump Sum (LS) bid price in the Proposal, which price is the total compensation for furnishing design, materials, tools, labor, equipment, and incidentals necessary for construction complete and in place.

Bid Item 53: Tree Removal and Replacement (if required) including all related items, in accordance with specifications, drawings and plans, complete and in place, shall be measured by per Each (EA) and paid

for at the per Each (EA) bid price in the Proposal, which price is the total compensation for furnishing design, materials, tools, labor, equipment, and incidentals necessary for construction complete and in place.

Bid Item 54: Traffic Control including all related items, in accordance with specifications, drawings and plans, complete and in place, shall be measured per Month (MO) and paid for at the Month (MO) bid price in the Proposal, which price is the total compensation for furnishing design, materials, tools, labor, equipment, and incidentals necessary for construction complete and in place.

**END OF SECTION**

**01 33 00 SUBMITTALS**

**1.0 GENERAL**

**1.1 NUMBER OF COPIES REQUIRED**

- A. For all data which requires review, the Contractor shall submit the required number of copies. The minimum number of copies required for review and distribution is:

Owner's Engineer's File	4
Contractor's File	1
Contractor's Field Copy	1
Supplier's Copy	1
Total (minimum)	7

Up to one additional copy may be added to the above as required by the Owner's Engineer.

- B. For non-review items such as parts lists and operation or maintenance manuals, the number of copies required for distribution is:

Owner's Engineer	4
Operating Division File	2
Contractor's File	1
Total (minimum)	7

**1.2 ROUTING OF SUBMITTALS**

- A. Data to be reviewed and routine correspondence will be routed as follows, according to type of submittal.

- 1. Shop Drawings, Product Data and Samples.
  - a. Supplier to Contractor (through representative if applicable) for preliminary check.
  - b. Contractor to Owner's Engineer.
- 2. Owner's Engineer to Contractor.
- 3. Contractor to supplier.

**1.3 ADDRESSES FOR COMMUNICATIONS**

- A. City of Lewisville (Owner)

Sarena Moore, Civil Engineer  
151 West Church Street  
Lewisville, TX 75057  
Phone: (972) 219-3458  
Fax: (972) 219-3487

- B. RJN Group, Inc. (Engineer)  
Mark Hinton, P.E.  
14755 Preston Road, Suite 710  
Dallas, TX 75254  
Email: [mhinton@rjnmail.com](mailto:mhinton@rjnmail.com)  
Phone: (972) 437-4300, Ext. 1139

#### 1.4 SUBMITTAL REQUIREMENTS

- A. Submit shop drawings, product data and samples required by the contract documents.
- B. Number the submittals consecutively within a section. For example, the first submittal in section 09 34 50 would be numbered 09 34 50-1. For re-submittals, use the suffix letters A for second submittal, B for the third, etc.
- C. Designate in the construction schedule or in a separate coordinated schedule, the dates for submission and the dates that reviewed shop drawings, product data and samples will be needed.
- D. Shop drawings, product data and samples are not considered a part of contract documents.
- E. The use of reproductions of the contract plans by any contractor, subcontractor, erector, and fabricator or material supplier in lieu of preparation of shop drawings will be permitted except for Structural drawings. However, it will signify his acceptance of all information shown on the document as correct and obligates himself to any job expense, real or implied, arising due to any errors that may occur thereon. In addition, all references to RJN Group, Inc., City of Lewisville or a Consultant, including all Engineer's or architect's seals are to be removed if these contract drawings are to be used as shop drawings.

#### 1.5 DATA REQUIRED

- A. Furnish engineering data covering all materials and equipment in this contract. The data should be prepared and transmitted promptly following execution of the general contract.
- B. All data needed to determine the following facts shall be submitted.
  - 1. Conformance to specifications, including: kind, type, size, arrangement, finishes and operation of component materials and devices.
  - 2. Conformance to plans, including dimensions, orientation, appearance, external connections and anchorages and installation clearances.
  - 3. Specific purpose or design conditions and adequacy to meet same: weights, dynamic loads, supports required and operating characteristics.
  - 4. Coordination with other work, including items needed by this trade but furnished by others and information needed by others to perform their part.
  - 5. In all cases, the Contractor shall clearly mark on the front of the submittal the section of the specifications or item that is being referred to.
- C. The manufacturer shall furnish the Owner complete and accurate drawings as required.
- D. Furnish all items specifically asked for, within the individual sections, of these specifications.

## 1.6 SHOP DRAWINGS

- A. Preparation by a qualified detailer is required.
- B. Where necessary for clarity, identify details by reference to sheet and detail numbers as shown on the contract drawings.
- C. Include on the drawing all information required for submission or submit a transmittal letter containing required information.
- D. Furnish all items specifically asked for, within the individual sections, of these specifications.

## 1.7 PRODUCT DATA

- A. Modify the manufacturer's standard schematic drawings to delete or supplement information as applicable.
- B. For manufacturer's catalog sheets, brochures, diagrams, schedules, performance charts, illustrations and other descriptive data:
  - 1. Clearly mark each copy to identify pertinent materials, products or models.
  - 2. Show dimensions and clearances required.
  - 3. Show wiring diagrams and controls.
- C. Include on the data all information required for submission or submit a transmittal letter containing required information.

## 1.8 SUBMISSION REQUIREMENTS

- A. Accompany submittals with a transmittal letter.
- B. Include the following information for each submittal.
  - 1. Date and revision dates.
  - 2. Project title and City of Lewisville Project number.
  - 3. The names of:
    - a. Owner's Engineer
    - b. Contractor
    - c. Subcontractor
    - d. Supplier
    - e. Manufacturer
  - 4. Identification of product or material.
  - 5. Relation to adjacent structure or materials.
  - 6. Field dimensions clearly identified as such.
  - 7. Specification section number.
  - 8. Applicable standards such as ASTM number or Federal Specification.
  - 9. Identification of any and all deviations from contract documents.



10. Contractor's stamp, in green color, initialed or signed, certifying review of submittal, verification of field measurements and compliance with contract documents.

## 1.9 OWNERS DUTIES

- A. Review submittals within fourteen calendar days after receipt.
- B. Affix stamp and initials or signature. The submittal will be marked in the following manner.
  1. **No exceptions Taken.** This means that the Owner takes no exception to the submittal as it is, and that the Contractor may proceed with its installation within the constraints of the contract.
  2. **Make Corrections Noted.** This means that the Owner takes no exception to the submittal as it is except for those items which have been noted. The Contractor may proceed with its installation, as noted and within the constraints of the contract.
  3. **Revise and Re-submit.** This means that the Owner takes exception to the submittal as it is and has noted such. The Contractor must address the Owner's notes and re-submit.
  4. **Rejected.** This means that the submittal does not comply with the plans and specifications.
- C. Return submittals to the Contractor for distribution.

## 1.10 RE-SUBMISSION REQUIREMENTS

- A. Shop Drawings
  1. Revise initial drawings as required and re-submit as specified for initial submittal.
  2. Indicate on drawings any changes which have been made, include those requested by the Owner or Consultant.

## 1.11 SUBSTITUTIONS

- A. When a particular Product Trade Name, Make, or Brand, is specified within these specifications, or shown/called out on the drawings, it shall be considered as the minimum quality standards required for that particular item.
- B. All Manufacturers' literature, technical specifications, quality control and testing measures, construction methods, materials, configuration, industry certifications, ratings and approvals etc., for a product specified by Product Trade Name, Make or Brand, (i.e. TNEMEC), shall be considered as part of these specifications whether actually shown herein or not.
- C. In order to achieve competitive and accurate bids, all Bidders shall base their proposals on the actual items (Product Trade Name, Make or Brand), listed in these specifications. Bidders will not be allowed to submit substitutions (Prospective approved equals) or base their proposals on substitutions when submitting their bids.
- D. After a contract has been awarded by the City, to the low bidder (Contractor), the Contractor shall submit to the Engineer as per section 01 33 00, within ten (10) working days after signing the contract, the following information for all proposed product or material substitutions.
  1. A written explanation on why the proposed substitution is equal to or superior to the product specified.

2. A copy of the Manufactures' literature, technical specifications and factory samples of both the specified product and the substitution, with all differences in the two products highlighted.
  3. The actual benefit the City will receive by using the proposed substitution, including any cost reduction from the original Contract price.
  4. Three (3) job references within fifty (50) miles of the City limits available for inspection, where the proposed substitutes were used under similar conditions.
- E. All substitutions must be approved in writing by the Engineer (approved equal), prior to their use in any manner on this project. The Contractor shall submit to the Engineer any and all additional information, samples, references, etc. as requested by the Engineer for a proposed substitution.
- F. If the proposed substitution(s) are not approved by the Engineer, the Contractor shall proceed with the work utilizing the original products, materials, etc. specified herein, **WHICH THE CONTRACT PRICE IS BASED UPON**. The Engineer's decision on all submittals **shall be final**, and is not subject to debate, appeal, arbitration, or the basis for a contractual dispute or claim filed by the Contractor.

#### 1.12 SAMPLES

- A. Furnish samples of the various materials, together with the finish thereon, as specified for and intended to be used on or in the work. Send samples to the office of the Owner's Representative, carriage pre- paid.
- B. Submit samples before purchasing, fabricating, applying, or installing such materials and finishes.
- C. Submit samples, other than field samples in duplicate. A cover letter shall accompany the sample and shall list all items being transmitted, designating their particular usage and location in the project. Distribute samples marked "Re-submittal Not Required" as follows: one record sample for the Owner's Representative; on record sample for the Contractor.
- D. Samples shall be submitted and re-submitted until acceptable. Materials, finishes and workmanship in the completed project shall be equal in every respect to that of the samples so submitted and accepted.
- E. Samples shall include materials, fixtures, equipment, surface textures, colors, etc., as required by drawings and specifications or as requested by the Owner's Representative.
- F. Identify sample as to product, color, manufacturer, trade name, lot, style, model, etc., location of use and contract document reference as well as the names of the Contractor, supplier, project and Owner's Representative.
- G. Samples shall be 8" x 10" in size and shall be limited in thickness to a minimum consistent with sample presentation. In lieu thereof, submit the actual full-size item.
- H. Samples of value may be returned to the Contractor for use in the project after review, analysis, comparison, and/or testing as may be required by the Owner's Representative.
- I. Furnish one 8" x 10" sample of the finally reviewed materials, colors or textures to the Owner's Representative for final record. Such material samples shall carry on the back all identification as previously described including, if paint sample, manufacturer, mix, proportion, name of color, building, Contractor, subcontractor and surfaces to which applied.

**1.13 CONTRACTOR'S JOB SITE DRAWINGS**

- A. Keep all required shop drawings, product data and samples for the following work in one place. Suitably organize and index 8-½" x 11", 11" x 17" and other compatibly sized material in a 3-ring binder. Larger shop drawings may be kept together rolled or folded. Include an index.
- B. Provide and maintain on the job site one complete set of prints of all drawings which form a part of the contract. Immediately after each portion of the work is installed, indicate all deviations from the original design shown on the drawings either by additional sketches or with red ink thereon. Upon completion of the job, deliver this record set to the Owner's Representative.

**2.00 PRODUCTS [NOT USED]**

**3.00 EXECUTION [NOT USED]**

**END OF SECTION**

**SUBMITTAL TRANSMITTAL COVER SHEET**

Submittal No.: \_\_\_\_\_

Date: \_\_\_\_\_

Project Title: City of \_\_\_\_\_

Project No.: \_\_\_\_\_

Consulting Engineer: RJN Group, Inc.

Name/Address 151 West Church Street  
Lewisville, TX 75057

Contractor: Name/Address \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Subcontractor: Name/Address \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Contents of Submittal: \_\_\_\_\_

The referenced submittal has been reviewed for compliance with the Engineers Plans and Specifications.

**PART 1- GENERAL**

**1.1      SUMMARY**

A.    Section Includes:

1.    The procedures for special project circumstances that includes, but is not limited to:
  - a.    Coordination with the Texas Department of Transportation
  - b.    Work near High Voltage Lines
  - c.    Confined Space Entry Program
  - d.    Air Pollution Watch Days
  - e.    Use of Explosives, Drop Weight, Etc.
  - f.    Water Department Notification
  - g.    Public Notification Prior to Beginning Construction
  - h.    Coordination with United States Army Corps of Engineers
  - i.    Coordination within Railroad permits areas
  - j.    Dust Control
  - k.    Employee Parking

B.    Related Specification Sections include, but are not necessarily limited to:

1.    Division 0 – Bidding Requirements, Contract Forms and Conditions of the Contract
2.    Division 1 – General Requirements

**1.2      PRICE AND PAYMENT PROCEDURES**

A.    Measurement and Payment

1.    Coordination within Railroad permit areas
  - a.    Measurement
    - 1)    Measurement for this Item will be by lump sum.
  - b.    Payment
    - 1)    The work performed and materials furnished in accordance with this Item will be paid for at the lump sum price bid for Railroad Coordination.
  - c.    The price bid shall include:
    - 1)    Mobilization
    - 2)    Inspection
    - 3)    Safety training

- 4) Additional Insurance
  - 5) Insurance Certificates
  - 6) Other requirements associated with general coordination with Railroad, including additional employees required to protect the right-of-way and property of the Railroad from damage arising out of and/or from the construction of the Project.
2. Railroad Flagmen
- a. Measurement
    - 1) Measurement for this Item will be per working day.
  - b. Payment
    - 1) The work performed and materials furnished in accordance with this Item will be paid for each working day that Railroad Flagmen are present at the Site.
  - c. The price bid shall include:
    - 1) Coordination for scheduling flagmen
    - 2) Flagmen
    - 3) Other requirements associated with Railroad
  - d. All other items
    - 1) Work associated with these Items is considered subsidiary to the various Items bid. No separate payment will be allowed for this Item.

### **1.3 REFERENCES**

- A. Reference Standards
- 1. Reference standards cited in this Specification refer to the current reference standard published at the time of the latest revision date logged at the end of this Specification unless a date is specifically cited.
  - 2. Health and Safety Code, Title 9. Safety, Subtitle A. Public Safety, Chapter 752. High Voltage Overhead Lines.
  - 3. North Central Texas Council of Governments (NCTCOG) – Clean Construction Specification

### **1.4 ADMINISTRATIVE REQUIREMENTS**

- A. Coordination with the Texas Department of Transportation
- 1. When work in the right-of-way which is under the jurisdiction of the Texas Department of Transportation (TxDOT):
    - a. Notify the Texas Department of Transportation prior to commencing any work therein in accordance with the provisions of the permit
    - b. All work performed in the TxDOT right-of-way shall be performed in compliance with and subject to approval from the Texas Department of Transportation
- B. Work near High Voltage Lines

1. Regulatory Requirements
    - a. All Work near High Voltage Lines (more than 600 volts measured between conductors or between a conductor and the ground) shall be in accordance with Health and Safety Code, Title 9, Subtitle A, Chapter 752.
  2. Warning sign
    - a. Provide sign of sufficient size meeting all OSHA requirements.
  3. Equipment operating within 10 feet of high voltage lines will require the following safety features
    - a. Insulating cage-type of guard about the boom or arm
    - b. Insulator links on the lift hook connections for back hoes or dippers
    - c. Equipment must meet the safety requirements as set forth by OSHA and the safety requirements of the owner of the high voltage lines
  4. Work within 6 feet of high voltage electric lines
    - a. Notification shall be given to:
      - 1) The power company (example: ONCOR)
      - 2) Maintain an accurate log of all such calls to power company and record action taken in each case.
    - b. Coordination with power company
      - 1) After notification coordinate with the power company to:
      - 2) Erect temporary mechanical barriers, de-energize the lines, or raise or lower the lines
    - c. No personnel may work within 6 feet of a high voltage line before the above requirements have been met.
- C. Confined Space Entry Program
1. Provide and follow approved Confined Space Entry Program in accordance with OSHA requirements.
  2. Confined Spaces include:
    - a. Manholes
    - b. All other confined spaces in accordance with OSHA's Permit Required for Confined Spaces
- D. Air Pollution Watch Days
1. General
    - a. Observe the following guidelines relating to working on City construction sites on days designated as "AIR POLLUTION WATCH DAYS".
    - b. Typical Ozone Season
      - 1) May 1 through October 31.

c. Critical Emission Time

- 1) 6:00 a.m. to 10:00 a.m.

2. Watch Days

a. The Texas Commission on Environmental Quality (TCEQ), in coordination with the National Weather Service, will issue the Air Pollution Watch by 3:00 p.m. on the afternoon prior to the WATCH day.

b. Requirements

- 1) Begin work after 10:00 a.m. whenever construction phasing requires the use of motorized equipment for periods in excess of 1 hour.
- 2) However, the Contractor may begin work prior to 10:00 a.m. if:
  - a) Use of motorized equipment is less than 1 hour, or
  - b) If equipment is new and certified by EPA as "Low Emitting", or equipment burns Ultra Low Sulfur Diesel (ULSD), diesel emulsions, or alternative fuels such as CNG.

E. TCEQ Air Permit

1. Obtain TCEQ Air Permit for construction activities per requirements of TCEQ.

F. Use of Explosives, Drop Weight, Etc.

1. When Contract Documents permit on the project the following will apply:
  - a. Public Notification
    - 1) Submit notice to City and proof of adequate insurance coverage, 24 hours prior to commencing.
    - 2) Minimum 24-hour public notification in accordance with Section 01 31 13

G. Water Department Coordination

1. During the construction of this project, it will be necessary to deactivate, for a period of time, existing lines. The Contractor shall be required to coordinate with the Water Department to determine the best times for deactivating and activating those lines.
2. Coordinate any event that will require connecting to or the operation of an existing City water line system with the City's representative.
  - a. Coordination shall be in accordance with Section 33 12 25.
  - b. If needed, obtain a hydrant water meter from the Water Department for use during the life of named project.
  - c. In the event that a water valve on an existing live system be turned off and on to accommodate the construction of the project is required, coordinate this activity through the appropriate City representative.
    - 1) Do not operate water line valves of existing water system.



- a) Failure to comply will render the Contractor in violation of Texas Penal Code Title 7, Chapter 28.03 (Criminal Mischief) and the Contractor will be prosecuted to the full extent of the law.
- b) In addition, the Contractor will assume all liabilities and responsibilities as a result of these actions.

H. Public Notification Prior to Beginning Construction

- 1. Prior to beginning construction on any block in the project, on a block-by-block basis, prepare and deliver a notice or flyer of the pending construction to the front door of each residence or business that will be impacted by construction. The notice shall be prepared as follows:
  - a. Post notice or flyer 7 days prior to beginning any construction activity on each block in the project area.
    - 1) Prepare flyer on the Contractor's letterhead and include the following information:
      - a) Name of Project
      - b) City Project No (CPN)
      - c) Scope of Project (i.e., type of construction activity)
      - d) Actual construction duration within the block
      - e) Name of the contractor's foreman and phone number
      - f) Name of the City's inspector and phone number
      - g) City's after-hours phone number
    - 2) A sample of the 'pre-construction notification' flyer is attached as Exhibit A.
    - 3) Submit schedule showing the construction start and finish time for each block of the project to the inspector.
    - 4) Deliver flyer to the City Inspector for review prior to distribution.
  - b. No construction will be allowed to begin on any block until the flyer is delivered to all residents of the block.

I. Public Notification of Temporary Water Service Interruption during Construction

- 1. In the event it becomes necessary to temporarily shut down water service to residents or businesses during construction, prepare and deliver a notice or flyer of the pending interruption to the front door of each affected resident.
- 2. Prepared notice as follows:
  - a. The notification or flyer shall be posted 24 hours prior to the temporary interruption.
  - b. Prepare flyer on the contractor's letterhead and include the following information:
    - 1) Name of the project
    - 2) City Project Number

- 3) Date of the interruption of service
  - 4) Period the interruption will take place
  - 5) Name of the contractor's foreman and phone number
  - 6) Name of the City's inspector and phone number
  - c. A sample of the temporary water service interruption notification is attached as Exhibit B.
  - d. Deliver a copy of the temporary interruption notification to the City inspector for review prior to being distributed.
  - e. No interruption of water service can occur until the flyer has been delivered to all affected residents and businesses.
  - f. Electronic versions of the sample flyers can be obtained from the Project Construction Inspector.
- J. Coordination with United States Army Corps of Engineers (USACE)
- 1. At locations in the Project where construction activities occur in areas where USACE permits are required, meet all requirements set forth in each designated permit.
- K. Coordination within Railroad Permit Areas
- 1. At locations in the project where construction activities occur in areas where railroad permits are required, meet all requirements set forth in each designated railroad permit. This includes, but is not limited to, provisions for:
    - a. Flagmen
    - b. Inspectors
    - c. Safety training
    - d. Additional insurance
    - e. Insurance certificates
    - f. Other employees required to protect the right-of-way and property of the Railroad Company from damage arising out of and/or from the construction of the project. Proper utility clearance procedures shall be used in accordance with the permit guidelines.
  - 2. Obtain any supplemental information needed to comply with the railroad's requirements.
  - 3. Railroad Flagmen
    - a. Submit receipts to City for verification of working days that railroad flagmen were present on Site.
- L. Dust Control
- 1. Use acceptable measures to control dust at the Site.
    - a. If water is used to control dust, capture and properly dispose of wastewater.
    - b. If wet saw cutting is performed, capture and properly dispose of slurry.

M. Employee Parking

2. Provide parking for employees at locations approved by the City.

- 1.5 SUBMITTALS [NOT USED]
- 1.6 ACTION SUBMITTALS/INFORMATIONAL SUBMITTALS [NOT USED]
- 1.7 CLOSEOUT SUBMITTALS [NOT USED]
- 1.8 MAINTENANCE MATERIAL SUBMITTALS [NOT USED]
- 1.9 QUALITY ASSURANCE [NOT USED]
- 1.10 DELIVERY, STORAGE, AND HANDLING [NOT USED]
- 1.11 FIELD [SITE] CONDITIONS [NOT USED]
- 1.12 WARRANTY [NOT USED]
  
- 2.00 PRODUCTS [NOT USED]
  
- 3.00 EXECUTION [NOT USED]

**END OF SECTION**

**01 42 13      ABBREVIATIONS**

**1.0      GENERAL**

**1.1      STANDARD SPECIFICATIONS**

A. The following abbreviations supplement the NCTCOG Standard Specifications.

APPURT	APPURTENANCE
B/F V	BUTTERFLY VALVE
C&G	CURB & GUTTER
CHK V	CHECK VALVE
CIRCUM	CIRCUMFERENCE
CL	CENTERLINE OR CLASS
CMC	CEMENT MORTAR COATING
CML	CEMENT MORTAR LINING
CONC	CONCRETE
CPLG	COUPLING
CTE	COAL TAR ENAMEL
DET	DETAIL
DIAPH	DIAPHRAGM
DISCH	DISCHARGE
EX OR EXIST	EXISTING
FLEX	FLEXIBLE
FLG	FLANGE
GV	GATE VALVE
HYD	HYDRAULIC
MOT	MOTOR
NB&G	NUTS, BOLTS AND GASKET
NCTCOG	NORTH CENTRAL TEXAS COUNCIL OF GOVERNMENTS
OPER	OPERATOR
PS	PUMP STATION
RED	REDUCER
REPL	REPLACE
RESTR	RESTRAINT

SPC	SPECIAL
SPECS	SPECIFICATIONS
STL	STEEL
SUCT	SUCTION
TYP	TYPICAL
V	VALVE
W/	WITH

B. Architectural abbreviations:

SECTION -01 33 00: Submittals

□	DIAMETER
#	NUMBER/POUND
&	AND
@	AT
A.B.	ANCHOR BOLT
A.F.F.	ABOVE FINISH FLOOR
ALUM.	ALUMINUM
ANG. (□)	ANGLE
ARCH.	ARCHITECTURAL
B.U. ROOF	BUILT-UP ROOF
BD.	BOARD
BLDG.	BUILDING
BLK	BLOCKING
BM	BEAM
BOT.	BOTTOM
C.G.	CORNER GUARD
C.J.	CONTROL JOINT
C.M.U.	CONCRETE MASONRY UNIT
C.T.	CERAMIC TILE
CEM.	CEMENT
CLG.	CEILING
COL.	COLUMN
CONC.	CONCRETE

COND.	CONDITION
CONST.	CONSTRUCTION
CONT.	CONTINUOUS
CONTR.	CONTRACTOR
CORR.	CORRIDOR
D.S.	DOWN SPOUT
DECOR	DECORATIVE
DIA.	DIAMETER
DN.	DOWN
DR.	DOOR
DRWGS.	DRAWINGS
DTL.	DETAIL
E.J.	EXPANSION JOINT
E.W.	EACH WAY
E.W.C.	ELECTRIC WATER COOLER
EA.	EACH
EL.	ELEVATION
ELEC.	ELECTRIC (AL)
ELEV.	ELEVATOR
EQ.	EQUAL
EXIST. (EX.)	EXISTING
EXT.	EXTERIOR
F.D.	FLOOR DRAIN
F.E.	FIRE EXTINGUISHER
F.E.C.	FIRE EXTINGUISHER CABINET
F.H.C.	FIRE HOSE CABINET
FIN.	FINISH
FLASH.	FLASHING
FLR.	FLOOR
G.I.	GALVANIZED IRON
GA.	GAUGE
GALV.	GALVANIZED

GEN.	GENERAL
GYP.BD.	GYPSUM BOARD
H.M.	HOLLOW METAL
HARDBD.	HARDBOARD
HORIZ.	HORIZONTAL
HR.	HOUR
HT.	HEIGHT
I.D.	INSIDE DIAMETER
INSUL.	INSULATION
INT.	INTERIOR
J.G.	JAMB GUARD
JT.	JOINT
JAN.	JANITOR
M.O.	MASONRY OPENING
M.R.	MOISTURE RESISTANT
MACH.	MACHINE
MAS.	MASONRY
MAX.	MAXIMUM
MECH.	MECHANICAL
MEP	MECH/ELEC/PLUMB
MFR.	MANUFACTURER
MIN.	MINIMUM
MTL.	METAL
N.I.C.	NOT IN CONTRACT
N.T.S.	NOT TO SCALE
O.C.	ON CENTER
O.D.	OUTSIDE DIAMETER/OVERFLOW DRAIN
O.H.	OVERHEAD
OPNG.	OPENING
PL.	PLATE
PLAS.LAM.	PLASTIC LAMINATE
PLUMB	PLUMBING

PLYWD.	PLYWOOD
POL.	POLISHED
PRE-FAB.	PRE-FABRICATED
PTD.	PAINTED
R.	RISER
R.D.	ROOF DRAIN
R.O.	ROUGH OPENING
RAD., R.	RADIUS
RECPT	RECEPTACLE
REF:	REFER TO
REFRIG.	REFRIGERATOR
REINF.	REINFORCING
REQ'D.	REQUIRED
RM.	ROOM
S.S.	STAINLESS STEEL
SCHED.	SCHEDULED
SECT.	SECTION
SIM.	SIMILAR
SPEC.	SPECIFICATION
STD.	STANDARD
STL.	STEEL
STRUCT.	STRUCTURAL
T.	TREAD
T.C.	TOP OF CURB
T.O.S.	TOP OF STEEL
T.W.	TOP OF WALL
THK.	THICK
TOIL.	TOILET
TYP.	TYPICAL
U.N.O.	UNLESS NOTED OTHERWISE
V.C.T.	VINYL COMPOSITE TILE
V.W.C.	VINYL WALL COVERING



VERT.	VERTICAL
VEST.	VESTIBULE
W.F.	WIDE FLANGE
W.P.	WATERPROOF(ING)
W.W.M.	WELDED WIRE MESH
W/	WITH
W/O	WITHOUT
WD.	WOOD

## 1.2 ORGANIZATIONAL ABBREVIATIONS

A. Abbreviations of organizations which may be referenced in these Specifications are:

### Organizational Abbreviation Definition

ACS	American Chemical Society
ACI	American Concrete Institute
AGMA	American Gear Manufacturer's Association
API	American Petroleum Institute
AIChE	American Institute of Chemical Engineers
AISC	American Institute of Steel Construction
AISI	American Iron and Steel Institute
ANSI	American National Standards Institute
APHA	American Public Health Association
AREI	American Railway Engineering Institute
ASTM	American Society for the Testing of Materials
ASCE	American Society of Civil Engineers
ASME	American Society of Mechanical Engineers
ASHRAE Conditioning	American Society of Heating, Refrigeration and Air
AWI	American Woodwork Institute
AWWA	American Water Works Association
AWS	American Welding Society
DIPRA	Ductile Iron Pipe Research Association
CRSI	Concrete Reinforcing Steel Institute
EPA	Environmental Protection Agency

FM	Factory Manual
HEW	Department of Health, Education and Welfare
HUD	Department of Housing and Urban Development
IEEE	Institute of Electrical and Electronic Engineers
IRI	Institute of Risk Insurance
ISA	Instrument Society of America
ISO	Insurance Service Office
JIC	Joint Industrial Council
MSS	Manufacturer's Standardization Society of America
NAAMM	National Association of Architectural Metal Manufacturers
NARUC	National Association of Railway and Utilities Commissioners
NBHA	National Builders Hardware Association
NCTCOG	North Central Texas Council of Governments
NEC	National Electric Code
NEMA	National Electrical Manufacturers Association
NFPA	National Fire Protection Association
NSF	National Sanitation Foundation
OSHA	Occupational Safety and Health Act
PCI	Precast Concrete Institute
SDHPT	Texas State Department of Highways and Public Transportation Commission
SMACNA	Sheet Metal and Air Conditioning National Association
SSPC	Steel Structures Painting Council
TNRCC	Texas Natural Resource Conservation Commission
TPI	Truss Plating Institute
UL	Underwriters Laboratory
USGS	United States Geological Survey
USPHS	United States Public Health Service
WEF	Water Environment Federation
WWEMA	Water and Wastewater Equipment Manufacturers Association
WPCF	Water Pollution Control Federation

### 1.3 ADDITIONAL ABBREVIATIONS

<u>Abbreviation</u>	<u>Definition</u>
HOA	Hand-Off-Auto
SCADA	Supervisory Control and Data Acquisition
RTU	Remote Thermal Unit
BCD	Binary Coded Decimal
EEPROM	Electrically Erasable Read Only Memory
QUICS	Name of a Company
BCH	Bose Chaudri Code
BAUD	Unit of Data Transmission Speed
MODOM	Modulator Demodulator Device
AC	Alternating Current
DC	Direct Current
mA	Milli Amp
Hz	Hertz/Cycles
LED	Light Emitting Diode
RTD	Remote Terminal Data
UPS	Uninterrupted Power Supply
SIP	Station Instrument Panel
SCP	Station Control Panel
KVA	Kilo-Volt Amp
V	Volts
A	Amperes
MCC	Motor Control Center
RMS	Rate Means Square
NO	Normally Open
NC	Normally Closed
SPDT	Single Pole Double Throw
UV	Ultraviolet

### 1.4 LEGEND

B. Legends of symbols used are shown on the Drawings, and in general, use of symbols is confined to the Drawings.

**2.00 PRODUCTS**

**3.00 EXECUTION [NOT USED]**

**END OF SECTION**

**01 45 00      QUALITY CONTROL**

**1.0      GENERAL**

**1.1      SCOPE**

A. The Contractor is responsible for quality control throughout the construction project.

**1.2      RECORDS**

A. Throughout construction, daily records shall be maintained of all aspects of the work and all tests performed. All tests performed shall be numbered. One copy of these shall be maintained at the job site and submitted to the Owner at the close-out of the project.

**1.3      SCHEDULE**

A. A specific plan and checklist shall be made between the Contractor and the Owner for observation and inspection to assure that all facility requirements have been met.

**1.4      RECORD AVAILABILITY**

A. All records of the work and all tests performed shall be available at the job site for the Owner's use at any time.

**1.5      QUALIFICATIONS OF PERSONNEL**

A. All operations shall be under the control of the Contractor, or the Contractor's General Superintendent. The General Superintendent shall be experienced in all aspects of the project.

**2.00      PRODUCTS      [NOT USED]**

**3.00      EXECUTION      [NOT USED]**

**END OF SECTION**

## **01 45 01      QUALITY ASSURANCE**

### **1.0      GENERAL**

#### **1.1      SCOPE**

- A. This section summarizes the duties, responsibilities, and limitations of the authority of the Observer in connection with his observation and quality assurance of the work.

#### **1.2      AUTHORITY**

- A. On this project, RJN Group, INC, assumes the function of the quality assurance during construction.

#### **1.3      DEFINITIONS**

- A. INSPECTOR: A representative of the owner who will be assigned authority to observe the work.
- B. Working Day: Per Lewisville General Contract Documents and General Specifications for the City of Lewisville.

#### **1.4      LIMITS ON WORKING HOURS**

- A. Normal working hours are from 7:00 am to 6:00 pm. Contractor may not work on a Saturday, Sunday, or official City holiday; more than eleven hours in a calendar day, or forty-five hours in a calendar week without the specific written consent of the Owner. All requests for extra working hours must be made to the owner in writing 72 hours in advance.
- B. Contractor will be responsible for quality assurance hours by the Engineer beyond normal working hours.

#### **1.5      UNINSPECTED WORK**

- A. Any work performed without benefit of an inspection may require removal and replacement if so, directed by the owner. This removal and replacement will be completed by the Contractor at no additional cost to the Owner or the Owner's Representative.

### **2.00      PRODUCTS      [NOT USED]**

### **3.0      EXECUTION**

#### **3.1      AUTHORITY OF THE OWNER'S REPRESENTATIVE**

- A. The owner's representative personnel shall observe the work in progress and promptly notify the Contractor of any deficiencies. Representatives are not authorized to accept work not in conformance with the plans and specifications, nor are they authorized to change the requirements of the contract documents.

### **3.2 RESPONSIBILITIES OF THE CONTRACTOR**

- A. The Contractor shall provide safe access to the work in order to observe its progress and quality. The Contractor shall also assist the inspector in obtaining samples and performing tests, as necessary.
- B. The Contractor will be responsible for extended services service beyond completion date at a rate of \$400.00 per calendar day.

**END OF SECTION**

**01 50 00      TEMPORARY FACILITIES AND CONTROLS**

**1.0      GENERAL**

**1.1      SUMMARY**

A. Section Includes:

1. Provide temporary facilities and controls needed for the Work including, but not necessarily limited to:
  - a. Temporary utilities
  - b. Sanitary facilities
  - c. Storage Sheds and Buildings
  - d. Dust control
  - e. Temporary fencing of the construction site

B. Related Specification Sections include, but are not necessarily limited to:

1. Division 0 – Bidding Requirements, Contract Forms and Conditions of the Contract
2. Division 1 – General Requirements

**1.2      PRICE AND PAYMENT PROCEDURES**

A. Measurement and Payment

1. Work associated with this Item is considered subsidiary to the various Items bid. No separate payment will be allowed for this Item.

**1.3      REFERENCES      [NOT USED]**

**1.4      ADMINISTRATIVE REQUIREMENTS**

A. Temporary Utilities

1. Obtaining Temporary Service
  - a. Make arrangements with utility service companies for temporary services.
  - b. Abide by rules and regulations of utility service companies or authorities having jurisdiction.
  - c. Be responsible for utility service costs until Work is approved for Final Acceptance.
    - 1) Included are fuel, power, light, heat, and other utility services necessary for execution, completion, testing and initial operation of Work.
2. Water
  - a. Contractor to provide water required for and in connection with Work to be performed and for specified tests of piping, equipment, devices, or other use as required for the completion of the Work.



- b. Provide and maintain adequate supply of potable water for domestic consumption by Contractor personnel and City's Project Representatives.
  - c. Coordination
    - 1) Contact City 1 week before water for construction is desired
  - d. Contractor Payment for Construction Water
    - 1) Obtain construction water meter from City for payment as billed by City's established rates.
- 3. Electricity and Lighting
  - a. Provide and pay for electric powered service as required for Work, including testing of Work.
    - 1) Provide power for lighting, operation of equipment, or other use.
  - b. Electric power service includes temporary power service or generator to maintain operations during scheduled shutdown.
- 4. Telephone
  - a. Provide emergency telephone service at Site for use by Contractor personnel and others performing work or furnishing services at Site.
- 5. Temporary Heat and Ventilation
  - a. Provide temporary heat as necessary for protection or completion of Work.
  - b. Provide temporary heat and ventilation to assure safe working conditions.
- C. Sanitary Facilities
  - 1. Provide and maintain sanitary facilities for persons on Site.
    - a. Comply with regulations of State and local departments of health.
  - 2. Enforce use of sanitary facilities by construction personnel at job site.
    - a. Enclose and anchor sanitary facilities.
    - b. No discharge will be allowed from these facilities.
    - c. Collect and store sewage and waste so as not to cause nuisance or health problem.
    - d. Haul sewage and waste off-site at no less than weekly intervals and properly dispose in accordance with applicable regulation.
  - 3. Locate facilities near Work Site and keep clean and maintained throughout Project.
  - 4. Remove facilities at completion of Project
- D. Storage Sheds and Buildings
  - 1. Provide adequately ventilated, watertight, weatherproof storage facilities with floor above ground level for materials and equipment susceptible to weather damage.
  - 2. Storage of materials not susceptible to weather damage may be on blocks off ground.

3. Store materials in a neat and orderly manner.
4. Place materials and equipment to permit easy access for identification, inspection, and inventory.
5. Equip building with lockable doors and lighting and provide electrical service for equipment space heaters and heating or ventilation as necessary to provide storage environments acceptable to specified manufacturers.
6. Fill and grade site for temporary structures to provide drainage away from temporary and existing buildings.
7. Remove building from site prior to Final Acceptance.

E. Temporary Fencing

1. Provide and maintain for the duration of construction when required in contract documents

F. Dust Control

1. Contractor is responsible for maintaining dust control through the duration of the project.
  - a. Contractor remains on-call at all times
  - b. Must respond in a timely manner

G. Temporary Protection of Construction

1. Contractor or subcontractors are responsible for protecting Work from damage due to weather.

**1.5** SUBMITTALS [NOT USED]

**1.6** ACTION SUBMITTALS/INFORMATIONAL SUBMITTALS [NOT USED]

**1.7** CLOSEOUT SUBMITTALS [NOT USED]

**1.8** MAINTENANCE MATERIAL SUBMITTALS [NOT USED]

**1.9** QUALITY ASSURANCE [NOT USED]

**1.10** DELIVERY, STORAGE, AND HANDLING [NOT USED]

**1.11** FIELD [SITE] CONDITIONS [NOT USED]

**1.12** WARRANTY [NOT USED]

**2.00** PRODUCTS [NOT USED]

**3.0** EXECUTION [NOT USED]

**3.1** INSTALLERS [NOT USED]

**3.2** EXAMINATION [NOT USED]

**3.3** PREPARATION [NOT USED]

**3.4** INSTALLATION

A. Temporary Facilities

1. Maintain all temporary facilities for duration of construction activities as needed.

**3.5** [REPAIR]/[RESTORATION] [NOT USED]

**3.6** RE-INSTALLATION [NOT USED]

**3.7** FIELD [OR] SITE QUALITY CONTROL [NOT USED]

**3.8** SYSTEM STARTUP [NOT USED]

**3.9** ADJUSTING [NOT USED]

**3.10** CLEANING [NOT USED]

**3.11** CLOSEOUT ACTIVITIES

A. Temporary Facilities

1. Remove all temporary facilities and restore area after completion of the Work, to a condition equal to or better than prior to start of Work.

**3.12** PROTECTION [NOT USED]

**3.13** MAINTENACNCE [NOT USED]

**3.14** ATTACHMENTS [NOT USED]

**END OF SECTION**

**PART 1 - GENERAL**

**1.1 SUMMARY**

- A. Section Includes:
  - 1. Procedures for Storm Water Pollution Prevention Plans
- B. Deviations from this City of Lewisville Standard Specification
  - 1. None.
- C. Related Specification Sections include, but are not necessarily limited to:
  - 1. Division 0 – Bidding Requirements, Contract Forms and Conditions of the Contract
  - 2. Division 1 – General Requirements
  - 3. Section 31 25 00 – Erosion and Sediment Control

**1.2 PRICE AND PAYMENT PROCEDURES**

- A. Measurement and Payment
  - 1. Construction Activities resulting in less than 1 acre of disturbance
    - a. Work associated with this Item is considered subsidiary to the various Items bid. No separate payment will be allowed for this Item.
  - 2. Construction Activities resulting in greater than 1 acre of disturbance
    - b. Measurement and Payment shall be in accordance with Section 31 25 00.

**1.3 REFERENCES**

- A. Abbreviations and Acronyms
  - 1. Notice of Intent: NOI
  - 2. Notice of Termination: NOT
  - 3. Storm Water Pollution Prevention Plan: SWPPP
  - 4. Texas Commission on Environmental Quality: TCEQ
  - 5. Notice of Change: NOC
- B. Reference Standards
  - 1. Reference standards cited in this Specification refer to the current reference standard published at the time of the latest revision date logged at the end of this Specification unless a date is specifically cited.
  - 2. Integrated Storm Management (ISWM) Technical Manual for Construction Controls

## 1.4 ADMINISTRATIVE REQUIREMENTS

### A. General

1. Contractor is responsible for resolution and payment of any fines issued associated with compliance to Stormwater Pollution Prevention Plan.

### B. Construction Activities resulting in:

1. Less than 1 acre of disturbance
  - a. Provide erosion and sediment control in accordance with Section 31 25 00 and Drawings.
2. 1 to less than 5 acres of disturbance
  - a. Texas Pollutant Discharge Elimination System (TPDES) General Construction Permit is required
  - b. Complete SWPPP in accordance with TCEQ requirements
    - 1) TCEQ Small Construction Site Notice Required under general permit TXR150000
      - a) Sign and post at job site
      - b) Prior to Preconstruction Meeting, send 1 copy to City Department of Transportation and Public Works, Environmental Division, (817) 392-6088.
    - 2) Provide erosion and sediment control in accordance with:
      - a) Section 31 25 00
      - b) The Drawings
      - c) TXR150000 General Permit
      - d) SWPPP
      - e) TCEQ requirements
3. 5 acres or more of Disturbance
  - a. Texas Pollutant Discharge Elimination System (TPDES) General Construction Permit is required
  - b. Complete SWPPP in accordance with TCEQ requirements
    - 1) Prepare a TCEQ NOI form and submit to TCEQ along with required fee
      - a) Sign and post at job site
      - b) Send copy to City Department of Transportation and Public Works, Environmental Division, (817) 392-6088.
    - 2) TCEQ Notice of Change required if making changes or updates to NOI
    - 3) Provide erosion and sediment control in accordance with:
      - a) Section 31 25 00

- b) The Drawings
  - c) TXR150000 General Permit
  - d) SWPPP
  - e) TCEQ requirements
- 4) Once the project has been completed and all the closeout requirements of TCEQ have been met a TCEQ Notice of Termination can be submitted.
- a) Send copy to City Department of Transportation and Public Works, Environmental Division, (817) 392-6088.

**1.5 SUBMITTALS**

**A. SWPPP**

- 1. Submit in accordance with Section 01 33 00, except as stated herein.
  - a. Prior to the Preconstruction Meeting, submit a draft copy of SWPPP to the City as follows:
    - 1) 1 copy to the City Project Manager
      - a) City Project Manager will forward to the City Department of Transportation and Public Works, Environmental Division for review

**B. Modified SWPPP**

- 1. If the SWPPP is revised during construction, resubmit modified SWPPP to the City in accordance with Section 01 33 00.

**1.6 ACTION SUBMITTALS/INFORMATIONAL SUBMITTALS [NOT USED]**

**1.7 CLOSEOUT SUBMITTALS [NOT USED]**

**1.8 MAINTENANCE MATERIAL SUBMITTALS [NOT USED]**

**1.9 QUALITY ASSURANCE [NOT USED]**

**1.10 DELIVERY, STORAGE, AND HANDLING [NOT USED]**

**1.11 FIELD [SITE] CONDITIONS [NOT USED]**

**1.12 WARRANTY [NOT USED]**

**PART 2- PRODUCTS [NOT USED]**

**PART 3- EXECUTION [NOT USED]**

**END OF SECTION**

**01 60 00          PRODUCT REQUIREMENTS**

**1.0          GENERAL**

**1.1          SUMMARY**

A. Section Includes:

1. Referenced for Product Requirements and City Standard Product List

B. Deviations from this City of Lewisville Standard Specification:

1. None.

C. Related Specification Sections include, but not necessarily limited to:

1. Division 0 – Bidding Requirements, Contract Forms and Conditions of the Contract
2. Division 1 – General Requirements

**1.2          PRICE AND PAYMENT PROCEDURES [NOT USED]**

**1.3          REFERENCES [NOT USED]**

**1.4          ADMINISTRATIVE REQUIREMENTS**

A. Only products specifically included on City's Standard Product List in these Contract Documents shall be allowed for use on the Project.

1. Any subsequently approved products will only be allowed for use upon specific approval by the City.

B. Any specific product requirements in the Contract Documents supersede similar products included on the City's Standard Product List.

1. The City reserves the right to not allow products to be used for certain projects even though the product is listed on the City's Standard Product List.

C. Although a specific product is included on City's Standard Product List, not all products from that manufacturer are approved for use, including but not limited to, that manufacturer's standard product.

D. See Section 01 33 00 for submittal requirements of Product Data included on City's Standard Product List.

**1.5          SUBMITTALS [NOT USED]**

**1.6          ACTION SUBMITTALS/INFORMATIONAL SUBMITTALS [NOT USED]**

**1.7          CLOSEOUT SUBMITTALS [NOT USED]**

**1.8          MAINTENANCE MATERIAL SUBMITTALS [NOT USED]**

**1.9          QUALITY ASSURANCE [NOT USED]**

**1.10        DELIVERY, STORAGE, AND HANDLING [NOT USED]**

**1.11** FIELD [SITE] CONDITIONS [NOT USED]

**1.12** WARRANTY [NOT USED]

**2.00** PRODUCTS [NOT USED]

**3.00** EXECUTION [NOT USED]

**END OF SECTION**



**01 77 19      CONTRACT CLOSEOUT**

**1.0      GENERAL**

**1.1      FINAL INSPECTION**

- A. When the Contractor considers the work complete, he shall submit written certification that all contract documents have been reviewed and all work has been completed and is in compliance with contract documents. He shall also certify that all facilities are operational, and all work is completed and ready for final inspections.
- B. The Owner will make an inspection to verify the status of completion. Should the Owner consider the work incomplete or defective, he will promptly notify the Contractor in writing, listing the incomplete or defective work. The Contractor shall take immediate steps to remedy the stated deficiencies and send a second written certification to Owner that the work is complete.
- C. If the Owner finds the work acceptable under the contract documents, he shall request the Contractor to provide all required close-out submittals.

**1.2      CLOSE-OUT SUBMITTALS**

- A. The following close-out submittal data shall be provided by the Contractor:
  - 1. Project Record Documents
  - 2. Evidence of Payment and Release of Liens. Submit the following in such form as approved by Owner.
    - a. Contractor's affidavit of payment of debts and claims.
    - b. Contractor's affidavit of release of liens.
    - c. Consent of surety to make final payment.
    - d. Releases or waivers of liens from all subcontractors and others with lien rights against property of Owner.
  - 3. As-built shop drawings, in 24" x 36" (D size) Mylar format, and in electronic CAD (DXF) format.

**1.3      FINAL PAYMENT REQUEST**

- A. The Contractor shall submit a payment request to the Engineer. The statement shall reflect all adjustments to the contract and shall include, but not be limited to, the following:
  - 1. Original contract sum
  - 2. Additions and deductions resulting from:
    - a. Change orders
    - b. Retainages withheld to date
    - c. Deductions for uncorrected work and unused quantities
    - d. Deductions for liquidated damages

- e. Total contract sum, as adjusted
- f. Previous payments
- g. Sum remaining due

B. The Contractor shall submit the final application for payment in accordance with procedures and requirements stated in the contract documents.

**2.00 PRODUCTS**

**3.00 EXECUTION [NOT USED]**

**END OF SECTION**

**01 78 23            OPERATION AND MAINTENANCE DATA**

**1.0        GENERAL**

**1.1        SUMMARY**

A. Section Includes:

1. Product data and related information appropriate for City's maintenance and operation of products furnished under Contract
2. Such products may include, but are not limited to:
  - a. Traffic Controllers
  - b. Irrigation Controllers (to be operated by the City)
  - c. Butterfly Valves

B. Related Specification Sections include, but are not necessarily limited to:

1. Division 0 – Bidding Requirements, Contract Forms and Conditions of the Contract
2. Division 1 – General Requirements

**1.2        PRICE AND PAYMENT PROCEDURES**

A. Measurement and Payment

1. Work associated with this Item is considered subsidiary to the various Items bid. No separate payment will be allowed for this Item.

**1.3        REFERENCES [NOT USED]**

**1.4        ADMINISTRATIVE REQUIREMENTS**

A. Schedule

1. Submit manuals in final form to the City within 30 calendar days of product shipment to the project site.

**1.5        SUBMITTALS**

- A. Submittals shall be in accordance with Section 01 33 00. All submittals shall be approved by the City prior to delivery.

**1.6        INFORMATIONAL SUBMITTALS**

A. Submittal Form

1. Prepare data in form of an instructional manual for use by City personnel.
2. Format
  - a. Size: 8 ½ inches x 11 inches
  - b. Paper
    - 1) 40 pound minimum, white, for typed pages

- 2) Holes reinforced with plastic, cloth or metal
- c. Text: Manufacturer's printed data, or neatly typewritten
- d. Drawings
  - 1) Provide reinforced punched binder tab, bind in with text
  - 2) Reduce larger drawings and fold to size of text pages.
- e. Provide fly-leaf for each separate product, or each piece of operating equipment.
  - 1) Provide typed description of product, and major component parts of equipment.
  - 2) Provide indexed tabs.
- f. Cover
  - 1) Identify each volume with typed or printed title "OPERATING AND MAINTENANCE INSTRUCTIONS".
  - 2) List:
    - a) Title of Project
    - b) Identity of separate structure as applicable
    - c) Identity of general subject matter covered in the manual

### 3. Binders

- a. Commercial quality 3-ring binders with durable and cleanable plastic covers
- b. When multiple binders are used, correlate the data into related consistent groupings.

4. If available, provide an electronic form of the O&M Manual.

## B. Manual Content

1. Neatly typewritten table of contents for each volume, arranged in systematic order
  - a. Contractor, name of responsible principal, address and telephone number
  - b. A list of each product required to be included, indexed to content of the volume
  - c. List, with each product:
    - 1) The name, address and telephone number of the subcontractor or installer
    - 2) A list of each product required to be included, indexed to content of the volume
    - 3) Identify area of responsibility of each
    - 4) Local source of supply for parts and replacement
  - d. Identify each product by product name and other identifying symbols as set forth in Contract Documents.
2. Product Data
  - a. Include only those sheets which are pertinent to the specific product.
  - b. Annotate each sheet to:

- 1) Clearly identify specific product or part installed
  - 2) Clearly identify data applicable to installation
  - 3) Delete references to inapplicable information
3. Drawings
    - a. Supplement product data with drawings as necessary to clearly illustrate:
      - 1) Relations of component parts of equipment and systems
      - 2) Control and flow diagrams
    - b. Coordinate drawings with information in Project Record Documents to assure correct illustration of completed installation.
    - c. Do not use Project Record Drawings as maintenance drawings.
  4. Written text, as required to supplement product data for the particular installation:
    - a. Organize in consistent format under separate headings for different procedures.
    - b. Provide logical sequence of instructions of each procedure.
  5. Copy of each warranty, bond and service contract issued
    - a. Provide information sheet for City personnel giving:
      - 1) Proper procedures in event of failure
      - 2) Instances which might affect validity of warranties or bonds
- C. Manual for Materials and Finishes
1. Submit 5 copies of complete manual in final form.
  2. Content, for architectural products, applied materials and finishes:
    - a. Manufacturer's data, giving full information on products
      - 1) Catalog number, size, composition
      - 2) Color and texture designations
      - 3) Information required for reordering special manufactured products
    - b. Instructions for care and maintenance
      - 1) Manufacturer's recommendation for types of cleaning agents and methods
      - 2) Cautions against cleaning agents and methods which are detrimental to product
      - 3) Recommended schedule for cleaning and maintenance
  3. Content, for moisture protection and weather exposure products:
    - a. Manufacturer's data, giving full information on products
      - 1) Applicable standards
      - 2) Chemical composition

- 3) Details of installation
- b. Instructions for inspection, maintenance and repair
- D. Manual for Equipment and Systems
  - 1. Submit 5 copies of complete manual in final form.
  - 2. Content, for each unit of equipment and system, as appropriate:
    - a. Description of unit and component parts
      - 1) Function, normal operating characteristics and limiting conditions
      - 2) Performance curves, engineering data and tests
      - 3) Complete nomenclature and commercial number of replaceable parts
    - b. Operating procedures
      - 1) Start-up, break-in, routine and normal operating instructions
      - 2) Regulation, control, stopping, shut-down and emergency instructions
      - 3) Summer and winter operating instructions
      - 4) Special operating instructions
    - c. Maintenance procedures
      - 1) Routine operations
      - 2) Guide to "trouble shooting"
      - 3) Disassembly, repair and reassembly
      - 4) Alignment, adjusting and checking
    - d. Servicing and lubrication schedule
      - 1) List of lubricants required
    - e. Manufacturer's printed operating and maintenance instructions
    - f. Description of sequence of operation by control manufacturer
      - 1) Predicted life of parts subject to wear
      - 2) Items recommended to be stocked as spare parts
    - g. As installed control diagrams by controls manufacturer
    - h. Each contractor's coordination drawings
      - 1) As installed color coded piping diagrams
    - i. Charts of valve tag numbers, with location and function of each valve
    - j. List of original manufacturer's spare parts, manufacturer's current prices, and recommended quantities to be maintained in storage
    - k. Other data as required under pertinent Sections of Specifications

3. Content, for each electric and electronic system, as appropriate:
  - a. Description of system and component parts
    - 1) Function, normal operating characteristics, and limiting conditions
    - 2) Performance curves, engineering data and tests
    - 3) Complete nomenclature and commercial number of replaceable parts
  - b. Circuit directories of panelboards
    - 1) Electrical service
    - 2) Controls
    - 3) Communications
  - c. As installed color coded wiring diagrams
  - d. Operating procedures
    - 1) Routine and normal operating instructions
    - 2) Sequences required
    - 3) Special operating instructions
  - e. Maintenance procedures
    - 1) Routine operations
    - 2) Guide to "trouble shooting"
    - 3) Disassembly, repair and reassembly
    - 4) Adjustment and checking
  - f. Manufacturer's printed operating and maintenance instructions
  - g. List of original manufacturer's spare parts, manufacturer's current prices, and recommended quantities to be maintained in storage
  - h. Other data as required under pertinent Sections of Specifications
4. Prepare and include additional data when the need for such data becomes apparent during instruction of City's personnel.

**1.7 CLOSEOUT SUBMITTALS [NOT USED]**

**1.8 MAINTENANCE MATERIAL SUBMITTALS [NOT USED]**

**1.9 QUALITY ASSURANCE**

- A. Provide operation and maintenance data by personnel with the following criteria:
  1. Trained and experienced in maintenance and operation of described products
  2. Skilled as technical writer to the extent required to communicate essential data
  3. Skilled as draftsman competent to prepare required drawings

**1.10 DELIVERY, STORAGE AND HANDLIGN [NOT USED]**

**1.11 FIELD [SITE] CONDITIONS [NOT USED]**

**1.12 WARRANTY [NOT USED]**

**2.00 PRODUCTS [NOT USED]**

**3.00 EXECUTION [NOT USED]**

**END OF SECTION**



**01 78 39 PROJECT RECORD DOCUMENTS**

**1.0 GENERAL**

**1.1 SUMMARY**

A. Section Includes:

1. Work associated with the documenting the project and recording changes to project documents, including:
  - a. Record Drawings
  - b. Water Meter Service Reports
  - c. Sanitary Sewer Service Reports
  - d. Large Water Meter Reports

B. Related Specification Sections include, but are not necessarily limited to:

1. Division 0 – Bidding Requirements, Contract Forms and Conditions of the Contract
2. Division 1 – General Requirements

**1.2 PRICE AND PAYMENT PROCEDURES**

A. Measurement and Payment

1. Work associated with this Item is considered subsidiary to the various Items bid. No separate payment will be allowed for this Item.

**1.3 REFERENCES [NOT USED]**

**1.4 ADMINISTRATIVE REQUIREMENTS**

**1.5 SUBMITTALS**

- A. Prior to submitting a request for Final Inspection, deliver Project Record Documents to City's Project Representative.

**1.6 ACTION SUBMITTALS/INFORMATIONAL SUBMITTALS [NOT USED]**

**1.7 CLOSEOUT SUBMITTALS [NOT USED]**

**1.8 MAINTENANCE MATERIAL SUBMITTALS [NOT USED]**

**1.9 QUALITY ASSURANCE**

A. Accuracy of Records

1. Thoroughly coordinate changes within the Record Documents, making adequate and proper entries on each page of Specifications and each sheet of Drawings and other Documents where such entry is required to show the change properly.
2. Accuracy of records shall be such that future search for items shown in the Contract Documents may rely reasonably on information obtained from the approved Project Record Documents.

3. To facilitate accuracy of records, make entries within 24 hours after receipt of information that the change has occurred.
4. Provide factual information regarding all aspects of the Work, both concealed and visible, to enable future modification of the Work to proceed without lengthy and expensive site measurement, investigation, and examination.

#### **1.10 STORAGE AND HANDLING**

##### **A. Storage and Handling Requirements**

1. Maintain the job set of Record Documents completely protected from deterioration and from loss and damage until completion of the Work and transfer of all recorded data to the final Project Record Documents.
2. In the event of loss of recorded data, use means necessary to again secure the data to the City's approval.
  - a. In such case, provide replacements to the standards originally required by the Contract Documents.

#### **1.11 FIELD [SITE] CONDITIONS [NOT USED]**

#### **1.12 WARRANTY [NOT USED]**

### **2.0 PRODUCTS**

#### **2.1 OWNER-FURNISHED [OR] OWNER-SUPPLIED PRODUCTS [NOT USED]**

#### **2.2 RECORD DOCUMENTS**

##### **A. Job set**

1. Promptly following receipt of the Notice to Proceed, secure from the City, at no charge to the Contractor, 1 complete set of all Documents comprising the Contract.

##### **B. Final Record Documents**

1. At a time nearing the completion of the Work and prior to Final Inspection, provide the City 1 complete set of all Final Record Drawings in the Contract.

#### **2.3 ACCESSORIES [NOT USED]**

#### **2.4 SOURCE QUALITY CONTROL [NOT USED]**

### **3.0 EXECUTION**

#### **3.1 INSTALLERS [NOT USED]**

#### **3.2 EXAMINATION [NOT USED]**

#### **3.3 PREPARATION [NOT USED]**

#### **3.4 MAINTENANCE DOCUMENTS**

##### **A. Maintenance of Job Set**

1. Immediately upon receipt of the job set, identify each of the Documents with the title, "RECORD DOCUMENTS - JOB SET".
2. Preservation
  - a. Considering the Contract completion time, the probable number of occasions upon which the job set must be taken out for new entries and for examination, and the conditions under which these activities will be performed, devise a suitable method for protecting the job set.
  - b. Do not use the job set for any purpose except entry of new data and for review by the City, until start of transfer of data to final Project Record Documents.
  - c. Maintain the job set at the site of work.
3. Coordination with Construction Survey
  - a. At a minimum, in accordance with the intervals set forth in Section 01 71 23, clearly mark any deviations from Contract Documents associated with installation of the infrastructure.
4. Making entries on Drawings
  - a. Record any deviations from Contract Documents.
  - b. Use an erasable colored pencil (not ink or indelible pencil), clearly describe the change by graphic line and note as required.
  - c. Date all entries.
  - d. Call attention to the entry by a "cloud" drawn around the area or areas affected.
  - e. In the event of overlapping changes, use different colors for the overlapping changes.
5. Conversion of schematic layouts
  - a. In some cases on the Drawings, arrangements of conduits, circuits, piping, ducts, and similar items, are shown schematically and are not intended to portray precise physical layout.
    - 1) Final physical arrangement is determined by the Contractor, subject to the City's approval.
    - 2) However, design of future modifications of the facility may require accurate information as to the final physical layout of items which are shown only schematically on the Drawings.
  - b. Show on the job set of Record Drawings, by dimension accurate to within 1 inch, the centerline of each run of items.
    - 1) Final physical arrangement is determined by the Contractor, subject to the City's approval.
    - 2) Show, by symbol or note, the vertical location of the Item ("under slab", "in ceiling plenum", "exposed", and the like).
    - 3) Make all identification sufficiently descriptive that it may be related reliably to the Specifications.

- c. The City may waive the requirements for conversion of schematic layouts where, in the City's judgment, conversion serves no useful purpose. However, do not rely upon waivers being issued except as specifically issued in writing by the City.

**B. Final Project Record Documents**

**1. Transfer of data to Drawings**

- a. Carefully transfer change data shown on the job set of Record Drawings to the corresponding final documents, coordinating the changes as required.
- b. Clearly indicate at each affected detail and other Drawing a full description of changes made during construction, and the actual location of items.
- c. Call attention to each entry by drawing a "cloud" around the area or areas affected.
- d. Make changes neatly, consistently and with the proper media to assure longevity and clear reproduction.

**2. Transfer of data to other Documents**

- a. If the Documents, other than Drawings, have been kept clean during progress of the Work, and if entries thereon have been orderly to the approval of the City, the job set of those Documents, other than Drawings, will be accepted as final Record Documents.
- b. If any such Document is not so approved by the City, secure a new copy of that Document from the City at the City's usual charge for reproduction and handling, and carefully transfer the change data to the new copy to the approval of the City.

- 3.5 REPAIR/RESTORATION [NOT USED]**
- 3.6 RE-INSTALLATION [NOT USED]**
- 3.7 FIELD [OR] SITE QUALITY CONTROL [NOT USED]**
- 3.8 SYSTEM STARTUP [NOT USED]**
- 3.9 ADJUSTING [NOT USED]**
- 3.10 CLEANING [NOT USED]**
- 3.11 CLOSEOUT ACTIVITIES [NOT USED]**
- 3.12 PROTECTION [NOT USED]**
- 3.13 MAINTENANCE [NOT USED]**
- 3.14 ATTACHMENTS [NOT USED]**

**END OF SECTION**

**DIVISION 02**  
**DEMOLITION**



**PART 1 - GENERAL**

**1.1 SUMMARY**

- A. Section Includes:
  - 1. Removing sidewalks and steps
  - 2. Removing ADA ramps and landings
  - 3. Removing driveways
  - 4. Removing fences
  - 5. Removing guardrail
  - 6. Removing retaining walls (less than 4 feet tall)
  - 7. Removing mailboxes
  - 8. Removing rip rap
  - 9. Removing miscellaneous concrete structures including porches and foundations
  - 10. Disposal of removed materials
- B. Deviations this from Standard Specification
  - 1. None.
- C. Related Specification Sections include, but are not necessarily limited to:
  - 1. Division 0 – Bidding Requirements, Contract Forms, and Conditions of the Contract
  - 2. Division 1 – General Requirements
  - 3. Section 31 23 23 – Borrow

**1.2 PRICE AND PAYMENT PROCEDURES**

- A. Measurement and Payment
  - 1. Measurement
    - a. Remove Sidewalk: Measure by square foot.
    - b. Remove Steps: measure by the square foot as seen in the plan view only.
    - c. Remove ADA Ramp: measure by each.
    - d. Remove Driveway: measure by the square foot by type.
    - e. Remove Fence: measure by the linear foot.
    - f. Remove Guardrail: measure by the linear foot along the face of the rail in place including metal beam guard fence transitions and single guard rail terminal sections from the center of end posts.
    - g. Remove Retaining Wall (less than 4 feet tall): measure by the linear foot
    - h. Remove Mailbox: measure by each.
    - i. Remove Rip Rap: measure by the square foot.
    - j. Remove Miscellaneous Concrete Structure: measure by the lump sum.
  - 2. Payment
    - a. Remove Sidewalk: full compensation for saw cutting, removal, hauling, disposal, tools, equipment, labor, and incidentals needed to execute work. Sidewalk adjacent to or attached to retaining wall (including sidewalk that acts as a wall footing) shall be paid as sidewalk removal. For utility projects, this Item shall be considered subsidiary to the trench and no other compensation will be allowed.
    - b. Remove Steps: full compensation for saw cutting, removal, hauling, disposal, tools, equipment, labor, and incidentals needed to execute work. For utility projects, this Item shall be considered subsidiary to the trench and no other

- compensation will be allowed.
- c. Remove ADA Ramp and landing: full compensation for saw cutting, removal, hauling, disposal, tools, equipment, labor, and incidentals needed to execute work. Work includes ramp landing removal. For utility projects, this Item shall be considered subsidiary to the trench and no other compensation will be allowed.
  - d. Remove Driveway: full compensation for saw cutting, removal, hauling, disposal, tools, equipment, labor, and incidentals needed to remove improved driveway by type. For utility projects, this Item shall be considered subsidiary to the trench and no other compensation will be allowed.
  - e. Remove Fence: full compensation for removal, hauling, disposal, tools, equipment, labor, and incidentals needed to remove fence. For utility projects, this Item shall be considered subsidiary to the trench and no other compensation will be allowed.
  - f. Remove Guardrail: full compensation for removing materials, loading, hauling, unloading, and storing or disposal; furnishing backfill material; backfilling the postholes; and equipment, labor, tools, and incidentals. For utility projects, this Item shall be considered subsidiary to the trench and no other compensation will be allowed.
  - g. Remove Retaining Wall (less than 4 feet tall): full compensation for saw cutting, removal, hauling, disposal, tools, equipment, labor and incidentals needed to execute work. Sidewalk adjacent to or attached to retaining wall (including sidewalk that acts as a wall footing) shall be paid as sidewalk removal. For utility projects, this Item shall be considered subsidiary to the trench and no other compensation will be allowed.
  - h. Remove Mailbox: full compensation for removal, hauling, disposal, tools, equipment, labor, and incidentals needed to execute work. For utility projects, this Item shall be considered subsidiary to the trench and no other compensation will be allowed.
  - i. Remove Rip Rap: full compensation for saw cutting, removal, hauling, disposal, tools, equipment, labor, and incidentals needed to execute work. For utility projects, this Item shall be considered subsidiary to the trench and no other compensation will be allowed.
  - j. Remove Miscellaneous Concrete Structure: full compensation for saw cutting, removal, hauling, disposal, tools, equipment, labor, and incidentals needed to execute work. For utility projects, this Item shall be considered subsidiary to the trench and no other compensation will be allowed.

### **1.3 REFERENCES**

#### **A. Definitions**

1. Improved Driveway: Driveway constructed of concrete, asphalt paving or brick unit pavers.

### **1.4 ADMINISTRATIVE REQUIREMENTS [NOT USED]**

### **1.5 SUBMITTALS [NOT USED]**

### **1.6 ACTION SUBMITTALS/INFORMATIONAL SUBMITTALS [NOT USED]**

### **1.7 CLOSEOUT SUBMITTALS [NOT USED]**

### **1.8 MAINTENANCE MATERIAL SUBMITTALS [NOT USED]**

### **1.9 QUALITY ASSURANCE [NOT USED]**

### **1.10 DELIVERY, STORAGE, AND HANDLING [NOT USED]**

### **1.11 FIELD [SITE] CONDITIONS [NOT USED]**

### **1.12 WARRANTY [NOT USED]**



## **PART 2 - PRODUCTS**

### **2.1 OWNER-FURNISHED PRODUCTS [NOT USED]**

### **2.2 MATERIALS**

A. Fill Material: See Section 31 23 23.

### **2.3 ACCESSORIES [NOT USED]**

### **2.4 SOURCE QUALITY CONTROL [NOT USED]**

## **PART 3 - EXECUTION**

### **3.1 INSTALLERS [NOT USED]**

### **3.2 EXAMINATION [NOT USED]**

### **3.3 PREPARATION [NOT USED]**

### **3.4 REMOVAL**

#### **A. Remove Sidewalk**

1. Remove sidewalk to nearest existing dummy, expansion, or construction joint.
2. Sawcut when removing to nearest joint is not practical. See 3.4.K.

#### **B. Remove Steps**

1. Remove step to nearest existing dummy, expansion, or construction joint.
2. Sawcut when removing to nearest joint is not practical. See 3.4.K.

#### **C. Remove ADA Ramp**

1. Sawcut existing curb and gutter and pavement prior to wheelchair ramp removal. See 3.4.K.
2. Remove ramp to nearest existing dummy, expansion, or construction joint on existing sidewalk.

#### **D. Remove Driveway**

1. Sawcut existing drive, curb and gutter and pavement prior to drive removal. See 3.4.K.
2. Remove drive to nearest existing dummy, expansion, or construction joint.
3. Sawcut when removing to nearest joint is not practical. See 3.4.K.
4. Remove adjacent sidewalk to nearest existing dummy, expansion, or construction joint on existing sidewalk.

#### **E. Remove Fence**

1. Remove all fence components above and below ground and backfill with acceptable fill material.
2. Use caution in removing and salvaging fence materials.
3. Salvaged materials may be used to reconstruct fence as approved by City or as shown on Drawings.
4. Contractor responsible for keeping animals (livestock, pets, etc.) within the fenced areas during construction operation and while removing fences.

#### **F. Remove Guardrail**

1. Remove rail elements in original lengths.
2. Remove fittings from the posts and the metal rail and then pull the posts.
3. Do not mar or damage salvageable materials during removal.
4. Completely remove posts and any concrete surrounding the posts.
5. Furnish backfill material and backfill the hole with material equal in composition

and density to the surrounding soil unless otherwise directed.

6. Cut off or bend down eyebolts anchored to the dead man to an elevation at least 1- foot below the new subgrade elevation and leave in place along with the dead man.
- G. Remove Retaining Wall (less than 4 feet tall)
1. Remove wall to nearest existing joint.
  2. Sawcut when removing to nearest joint is not practical. See 3.4.K.
  3. Removal includes all components of the retaining wall including footings.
  4. Sidewalk adjacent to or attached to retaining wall: See 3.4.A
- H. Remove Mailbox
1. Salvage existing materials for reuse. Mailbox materials may need to be used for reconstruction.
- I. Remove Rip Rap
1. Remove rip rap to nearest existing dummy, expansion, or construction joint.
  2. Sawcut when removing to nearest joint is not practical. See 3.4.K.
- J. Remove Miscellaneous Concrete Structure
1. Remove portions of miscellaneous concrete structures including foundations and slabs that do not interfere with proposed construction to 2 feet below the finished ground line.
  2. Cut reinforcement close to the portion of the concrete to remain in place.
  3. Break or perforate the bottom of structures to remain to prevent the entrapment of water.
- K. Sawcut
1. Sawing Equipment
    - a. Power-driven
    - b. Manufactured for the purpose of sawing pavement
    - c. In good operating condition
    - d. Shall not spall or fracture the pavement to the removal area
  2. Sawcut perpendicular to the surface completely through existing pavement.

**3.5 REPAIR [NOT USED]**

**3.6 RE-INSTALLATION [NOT USED]**

**3.7 SITE QUALITY CONTROL [NOT USED]**

**3.8 SYSTEM STARTUP [NOT USED]**

**3.9 ADJUSTING [NOT USED]**

**3.10 CLEANING [NOT USED]**

**3.11 CLOSEOUT ACTIVITIES [NOT USED]**

**3.12 PROTECTION [NOT USED]**

**3.13 MAINTENANCE [NOT USED]**

**3.14 ATTACHMENTS [NOT USED]**

**END OF SECTION**

**PART 1 - GENERAL**

**1.1 SUMMARY**

- A. Section Includes:
  - 1. Direction for the removal, abandonment or salvaging of the following utilities:
    - a. Cathodic Protection Test Stations
    - b. Water Lines
    - c. Gate Valves
    - d. Water Valves
    - e. Fire Hydrants
    - f. Water Meters and Meter Box
    - g. Water Sampling Station
    - h. Concrete Water Vaults
    - i. Sanitary Sewer Lines
    - j. Sanitary Sewer Manholes
    - k. Sanitary Sewer Junction Boxes
    - l. Storm Sewer Lines
    - m. Storm Sewer Manhole Risers
    - n. Storm Sewer Junction Boxes
    - o. Storm Sewer Inlets
    - p. Box Culverts
    - q. Headwalls and Safety End Treatments
    - r. Trench Drains
- B. Deviations from this Standard Specification
  - 1. None.
- C. Related Specification Sections include, but are not necessarily limited to:
  - 1. Division 0 – Bidding Requirements, Contract Forms and Conditions of the Contract
  - 2. Division 1 – General Requirements
  - 3. Section 03 34 13 – Controlled Low Strength Material (CLSM)
  - 4. Section 33 05 10 – Utility Trench Excavation, Embedment and Backfill
  - 5. Section 33 05 24 – Installation of Carrier Pipe in Casing or Tunnel Liner Plate
  - 6. Section 33 11 11 – Ductile Iron Fittings
  - 7. Section 33 11 13 – Concrete Pressure Pipe, Bar-wrapped, Steel Cylinder Type
  - 8. Section 33 11 14 – Buried Steel Pipe and Fittings
  - 9. Section 33 12 25 – Connection to Existing Water Mains

**1.2 PRICE AND PAYMENT PROCEDURES**

- A. Utility Lines
  - 1. Abandonment of Utility Line by Grouting
    - a. Measurement

- 1) Measurement for this Item shall be per cubic yard of existing utility line to be grouted. Measure by tickets showing cubic yards of grout applied.
  - b. Payment
    - 1) The work performed and materials furnished in accordance with this Item and measured as provided under "Measurement" shall be paid for at the unit price per cubic yard of "Line Grouting" for:
      - a) Various types of utility line
  - c. The price bid shall include:
    - 1) Low density cellular grout or CLSM
    - 2) Water
    - 3) Pavement removal
    - 4) Excavation
    - 5) Hauling
    - 6) Disposal of excess materials
    - 7) Furnishing, placement and compaction of backfill
    - 8) Clean-up
2. Utility Line Removal, Separate Trench
- a. Measurement
    - 1) Measurement for this Item shall be per linear foot of existing utility line to be removed.
  - b. Payment
    - 1) The work performed and materials furnished in accordance with this Item and measured as provided under "Measurement" shall be paid for at the unit price bid per linear foot of "Remove Line" for:
      - a) Various types of existing utility line
      - b) Various sizes
  - c. The price bid shall include:
    - 1) Removal and disposal of existing utility pipe
    - 2) Pavement removal
    - 3) Excavation
    - 4) Hauling
    - 5) Disposal of excess materials
    - 6) Furnishing, placement and compaction of backfill
    - 7) Clean-up
3. Utility Line Removal, Same Trench
- a. Measurement
    - 1) This Item is considered subsidiary the proposed utility line being installed.
  - b. Payment
    - 1) The work performed and materials furnished in accordance with this Item are subsidiary to the installation of proposed utility pipe and shall be subsidiary to the unit price bid per linear foot of pipe complete in place, and no other compensation will be allowed.
4. Manhole Abandonment
- a. Measurement
    - 1) Measurement for this Item will be per each manhole to be abandoned.
  - b. Payment
    - 1) The work performed and materials furnished in accordance with this Item and measured as provided under "Measurement" shall be paid for at the unit price bid per each "Abandon Manhole" for:

- a) Various diameters
      - b) Various types
    - c. The price bid shall include:
      - 1) Removal and disposal of manhole cone
      - 2) Removal, salvage and delivery of frame and cover to City, if applicable
      - 3) Cutting and plugging of existing sewer lines
      - 4) Concrete
      - 5) Acceptable material for backfilling manhole void
      - 6) Pavement removal
      - 7) Excavation
      - 8) Hauling
      - 9) Disposal of excess materials
      - 10) Furnishing, placement and compaction of backfill
      - 11) Surface restoration
      - 12) Clean-up
  - 5. Cathodic Test Station Abandonment
    - a. Measurement
      - 1) Measurement for this Item will be per each cathodic test station to be abandoned.
    - b. Payment
      - 1) The work performed and materials furnished in accordance with this Item and measured as provided under "Measurement" shall be paid for at the unit price bid per each "Abandon Cathodic Test Station".
    - c. The price bid shall include:
      - 1) Abandon cathodic test station
      - 2) CLSM
      - 3) Pavement removal
      - 4) Excavation
      - 5) Hauling
      - 6) Disposal of excess materials
      - 7) Furnishing, placement and compaction of backfill
      - 8) Clean-up
- B. Water Lines and Appurtenances
- 1. Installation of a Water Line Pressure Plug
    - a. Measurement
      - 1) Measurement for this Item shall be per each pressure plug to be installed.
    - b. Payment
      - 1) The work performed and materials furnished in accordance with this Item and measured as provided under "Measurement" shall be paid for at the unit price bid for each "Pressure Plug" installed for:
        - a) Various sizes
    - c. The price bid shall include:
      - 1) Furnishing and installing pressure plug
      - 2) Pavement removal
      - 3) Excavation
      - 4) Hauling
      - 5) Disposal of excess material
      - 6) Gaskets
      - 7) Bolts and Nuts

- 8) Furnishing, placement and compaction of embedment
  - 9) Furnishing, placement and compaction of backfill
  - 10) Disinfection
  - 11) Testing
  - 12) Clean-up
2. Abandonment of Water Line by Cut and installation of Abandonment Plug
- a. Measurement
    - 1) Measurement for this Item shall be per each cut and abandonment plug installed.
  - b. Payment
    - 1) The work performed and materials furnished in accordance with this Item and measured as provided under "Measurement" shall be paid for at the unit price bid for each "Water Abandonment Plug" installed for:
      - a) Various sizes
  - c. The price bid shall include:
    - 1) Furnishing and installing abandonment plug
    - 2) Pavement removal
    - 3) Excavation
    - 4) Hauling
    - 5) CLSM
    - 6) Disposal of excess material
    - 7) Furnishing, placement and compaction of backfill
    - 8) Clean-up
3. Water Valve Removal
- a. Measurement
    - 1) Measurement for this Item will be per each water valve to be removed.
  - b. Payment
    - 1) The work performed and materials furnished in accordance with this Item and measured as provided under "Measurement" shall be paid for at the unit price bid per each "Remove Water Valve" for:
      - a) Various sizes
  - c. The price bid shall include:
    - 1) Removal and disposal of valve
    - 2) CLSM
    - 3) Pavement removal
    - 4) Excavation
    - 5) Hauling
    - 6) Disposal of excess materials
    - 7) Furnishing, placement and compaction of backfill
    - 8) Clean-up
4. Water Valve Removal and Salvage
- a. Measurement
    - 1) Measurement for this Item will be per each water valve to be removed and salvaged.
  - b. Payment
    - 1) The work performed and materials furnished in accordance with this Item and measured as provided under "Measurement" shall be paid for at the unit price bid per each "Salvage Water Valve" for:
      - a) Various sizes

- c. The price bid shall include:
  - 1) Removal and Salvage of valve
  - 2) CLSM
  - 3) Delivery to City
  - 4) Pavement removal
  - 5) Excavation
  - 6) Hauling
  - 7) Disposal of excess materials
  - 8) Furnishing, placement and compaction of backfill
  - 9) Clean-up
- 5. Water Valve Abandonment
  - a. Measurement
    - 1) Measurement for this Item will be per each water valve to be abandoned.
  - b. Payment
    - 1) The work performed and materials furnished in accordance with this Item and measured as provided under "Measurement" shall be paid for at the unit price bid per each "Abandon Water Valve" for:
      - a) Various Sizes
  - c. The price bid shall include:
    - 1) Abandonment of valve
    - 2) CLSM
    - 3) Pavement removal
    - 4) Excavation
    - 5) Hauling
    - 6) Disposal of excess materials
    - 7) Furnishing, placement and compaction of backfill
    - 8) Clean-up
- 6. Fire Hydrant Removal and Salvage
  - a. Measurement
    - 1) Measurement for this Item will be per each fire hydrant to be removed.
  - b. Payment
    - 1) The work performed and materials furnished in accordance with this Item and measured as provided under "Measurement" shall be paid for at the unit price bid per each "Salvage Fire Hydrant".
  - c. The price bid shall include:
    - 1) Removal and salvage of fire hydrant
    - 2) Delivery to City
    - 3) Pavement removal
    - 4) Excavation
    - 5) Hauling
    - 6) Disposal of excess materials
    - 7) Furnishing, placement and compaction of backfill
    - 8) Clean-up
- 7. Water Meter Removal and Salvage
  - a. Measurement
    - 1) Measurement for this Item will be per each water meter to be removed and salvaged.
  - b. Payment
    - 1) The work performed and materials furnished in accordance with this Item

- and measured as provided under "Measurement" shall be paid for at the unit price bid per each "Salvage Water Meter" for:
- a) Various sizes
  - 2) If a "Water Meter Service Relocate" is performed in accordance with Section 33 12 10, removal and salvage or disposal of the existing (2-inch or smaller) water meter shall be subsidiary to the cost of the "Water Meter Service Relocate", no other compensation will be allowed.
- c. The price bid shall include:
- 1) Removal and salvage of water meter
  - 2) Delivery to City
  - 3) Pavement removal
  - 4) Excavation
  - 5) Hauling
  - 6) Disposal of excess materials
  - 7) Furnishing, placement and compaction of backfill
  - 8) Clean-up
8. Water Sampling Station Removal and Salvage
- a. Measurement
    - 1) Measurement for this Item will be per each water sampling station to be removed.
  - b. Payment
    - 1) The work performed and materials furnished in accordance with this Item and measured as provided under "Measurement" shall be paid for at the unit price bid per each "Salvage Water Sampling Station".
  - c. The price bid shall include:
    - 1) Removal and salvage of water sampling station
    - 2) Delivery to City
    - 3) Pavement removal
    - 4) Excavation
    - 5) Hauling
    - 6) Disposal of excess materials
    - 7) Furnishing, placement and compaction of backfill
    - 8) Clean-up
9. Concrete Water Vault Removal
- a. Measurement
    - 1) Measurement for this Item will be per each concrete water vault to be removed.
  - b. Payment
    - 1) The work performed and materials furnished in accordance with this Item and measured as provided under "Measurement" shall be paid for at the unit price bid per each "Remove Concrete Water Vault".
  - c. The price bid shall include:
    - 1) Removal and disposal of concrete water vault
    - 2) Removal, salvage and delivery of frame and cover to City, if applicable
    - 3) Removal, salvage, and delivery of any valves to City, if applicable
    - 4) Removal, salvage, and delivery of any water meters to City, if applicable
    - 5) Pavement removal
    - 6) Excavation
    - 7) Hauling
    - 8) Disposal of excess material
    - 9) Furnishing, placement and compaction of backfill



10) Clean-up

C. Sanitary Sewer Lines and Appurtenances

1. Abandonment of Sanitary Sewer Line by Cut and installation of Abandonment Plug

a. Measurement

- 1) Measurement for this Item shall be per each cut and abandonment plug installed.

b. Payment

- 1) The work performed and materials furnished in accordance with this Item and measured as provided under "Measurement" shall be paid for at the unit price bid for each "Sewer Abandonment Plug" for:
  - a) Various sizes

c. The price bid shall include:

- 1) Furnishing and installing abandonment plug
- 2) Pavement removal
- 3) Excavation
- 4) Hauling
- 5) CLSM
- 6) Disposal of excess material
- 7) Furnishing, placement and compaction of backfill
- 8) Clean-up

2. Sanitary Sewer Manhole Removal

a. Measurement

- 1) Measurement for this Item will be per each sanitary sewer manhole to be removed.

b. Payment

- 1) The work performed and materials furnished in accordance with this Item and measured as provided under "Measurement" shall be paid for at the unit price bid per each "Remove Sewer Manhole" for:
  - a) Various diameters

c. The price bid shall include:

- 1) Removal and disposal of manhole
- 2) Removal, salvage and delivery of frame and cover to City, if applicable
- 3) Cutting and plugging of existing sewer lines
- 4) Pavement removal
- 5) Excavation
- 6) Hauling
- 7) Disposal of excess materials
- 8) Furnishing, placement and compaction of backfill
- 9) Clean-up

3. Sanitary Sewer Junction Structure Removal

a. Measurement

- 1) Measurement for this Item will be per each sanitary sewer junction structure being removed.

b. Payment

- 1) The work performed and materials furnished in accordance with this Item and measured as provided under "Measurement" shall be paid for at the lump sum bid per each "Remove Sewer Junction Box" location.

c. The price bid shall include:

- 1) Removal and disposal of junction box

- 2) Removal, salvage and delivery of frame and cover to City.
- 3) Pavement removal
- 4) Excavation
- 5) Hauling
- 6) Disposal of excess materials
- 7) Furnishing, placement and compaction of backfill
- 8) Clean-up

D. Storm Sewer Lines and Appurtenances

1. Abandonment of Storm Sewer Line by Cut and installation of Abandonment Plug
  - a. Measurement
    - 1) Measurement for this Item shall be per each cut and abandonment plug to be installed.
  - b. Payment
    - 1) The work performed and materials furnished in accordance with this Item and measured as provided under "Measurement" shall be paid for at the unit price bid for each "Storm Abandonment Plug" installed for:
      - a) Various sizes
  - c. The price bid shall include:
    - 1) Furnishing and installing abandonment plug
    - 2) Pavement removal
    - 3) Excavation
    - 4) Hauling
    - 5) CLSM
    - 6) Disposal of excess material
    - 7) Furnishing, placement and compaction of backfill
    - 8) Clean-up
2. Storm Sewer Manhole Removal
  - a. Measurement
    - 1) Measurement for this Item will be per each storm sewer manhole to be removed.
  - b. Payment
    - 1) The work performed and materials furnished in accordance with this Item and measured as provided under "Measurement" shall be paid for at the unit price bid per each "Remove Manhole Riser" for:
      - a) Various sizes
  - c. The price bid shall include:
    - 1) Removal and disposal of manhole
    - 2) Removal, salvage and delivery of frame and cover to City, if applicable
    - 3) Pavement removal
    - 4) Excavation
    - 5) Hauling
    - 6) Disposal of excess materials
    - 7) Furnishing, placement and compaction of backfill
    - 8) Clean-up
3. Storm Sewer Junction Box Removal
  - a. Measurement
    - 1) Measurement for this Item will be per each storm sewer junction structure to be removed.
  - b. Payment

- 1) The work performed and materials furnished in accordance with this Item and measured as provided under "Measurement" shall be paid for at the unit price bid per each "Remove Storm Junction Box" for:
    - a) Various sizes
  - c. The price bid shall include:
    - 1) Removal and disposal of junction box
    - 2) Removal, salvage and delivery of frame and cover to City, if applicable
    - 3) Pavement removal
    - 4) Excavation
    - 5) Hauling
    - 6) Disposal of excess materials
    - 7) Furnishing, placement and compaction of backfill
    - 8) Clean-up
4. Storm Sewer Junction Structure Removal
- a. Measurement
    - 1) Measurement for this Item will be per each storm sewer junction structure being removed.
  - b. Payment
    - 1) The work performed and materials furnished in accordance with this Item and measured as provided under "Measurement" shall be paid for at the lump sum bid per each "Remove Storm Junction Structure" location.
  - c. The price bid shall include:
    - 1) Removal and disposal of junction structure
    - 2) Removal, salvage and delivery of frame and cover to City, if applicable
    - 3) Pavement removal
    - 4) Excavation
    - 5) Hauling
    - 6) Disposal of excess materials
    - 7) Furnishing, placement and compaction of backfill
    - 8) Clean-up
5. Storm Sewer Inlet Removal
- a. Measurement
    - 1) Measurement for this Item will be per each storm sewer inlet to be removed.
  - b. Payment
    - 1) The work performed and materials furnished in accordance with this Item and measured as provided under "Measurement" shall be paid for at the unit price bid per each "Remove Storm Inlet" for:
      - a) Various types
      - b) Various sizes
  - c. The price bid shall include:
    - 1) Removal and disposal of inlet
    - 2) Pavement removal
    - 3) Excavation
6. Storm Sewer Junction Box Removal
- a. Measurement
    - 1) Measurement for this Item shall be per linear foot of existing storm sewer box to be removed.
  - b. Payment
    - 1) The work performed and materials furnished in accordance with this Item

and measured as provided under "Measurement" shall be paid for at the unit price bid per linear foot of "Remove Storm Junction Box" for all sizes.

- c. The price bid shall include:
  - 1) Removal and disposal of Storm Sewer Box
  - 2) Pavement removal
  - 3) Excavation
  - 4) Hauling
  - 5) Disposal of excess materials
  - 6) Furnishing, placement and compaction of backfill
  - 7) Clean-up
- 7. Headwall/SET Removal
  - a. Measurement
    - 1) Measurement for this Item will be per each headwall or safety end treatment (SET) to be removed.
  - b. Payment
    - 1) The work performed and materials furnished in accordance with this Item and measured as provided under "Measurement" shall be paid for at the unit price bid per each "Remove Headwall/SET".
  - c. The price bid shall include:
    - 1) Removal and disposal of Headwall/SET
    - 2) Pavement removal
    - 3) Excavation
    - 4) Hauling
    - 5) Disposal of excess materials
    - 6) Furnishing, placement and compaction of backfill
    - 7) Clean-up
- 8. Trench Drain Removal
  - a. Measurement
    - 1) Measurement for this Item shall be per linear foot of storm sewer trench drain to be removed.
  - b. Payment
    - 1) The work performed and materials furnished in accordance with this Item and measured as provided under "Measurement" shall be paid for at the unit price bid per linear foot of "Remove Trench Drain" for:
      - a) Various sizes
  - c. The price bid shall include:
    - 1) Removal and disposal of storm sewer line
    - 2) Pavement removal
    - 3) Excavation

### **1.3 REFERENCES [NOT USED]**

### **1.4 ADMINISTRATIVE REQUIREMENTS**

#### **A. Coordination**

- 1. Contact Inspector and the Water Department Field Operation Storage Yard for coordination of salvage material return.

### **1.5 SUBMITTALS [NOT USED]**

### **1.6 ACTION SUBMITTALS/INFORMATIONAL SUBMITTALS [NOT USED]**

**1.7 CLOSEOUT SUBMITTALS [NOT USED]**

**1.8 MAINTENANCE MATERIAL SUBMITTALS [NOT USED]**

**1.9 QUALITY ASSURANCE [NOT USED]**

**1.10 DELIVERY, STORAGE, AND HANDLING**

A. Storage and Handling Requirements

1. Protect and salvage all materials such that no damage occurs during delivery to the City.

**1.11 FIELD [SITE] CONDITIONS [NOT USED]**

**1.12 WARRANTY [NOT USED]**

**PART 2 - PRODUCTS**

**2.1 OWNER-FURNISHED [OR] OWNER-SUPPLIED PRODUCTS [NOT USED]**

**2.2 MATERIALS**

**2.3 ACCESSORIES [NOT USED]**

**2.4 SOURCE QUALITY CONTROL [NOT USED]**

**PART 3 - EXECUTION**

**3.1 INSTALLERS [NOT USED]**

**3.2 EXAMINATION [NOT USED]**

**3.3 PREPARATION [NOT USED]**

**3.4 REMOVAL, SALVAGE, AND ABANDONMENT**

A. General

1. Manhole Abandonment

- a. All manholes that are to be taken out of service are to be removed unless specifically requested and/or approved by City.
- b. Excavate and backfill in accordance with Section 33 05 10.
- c. Remove and salvage manhole frame and cover as coordinated with City.
- d. Deliver salvaged material to the City.
- e. Cut and plug sewer lines to be abandoned.
- f. Backfill manhole void in accordance with City Standard Details.

B. Water Lines and Appurtenances

1. Water Line Pressure Plugs

- a. Ductile Iron Water Lines
  - 1) Excavate, embed, and backfill in accordance with Section 33 05 10.
  - 2) Plug with an MJ Plug with mechanical restraint and blocking in accordance with Section 33 11 11.
  - 3) Perform Cut and Plug in accordance with Section 33 12 25.

- b. PVC C900 and C905 Water Lines
    - 1) Excavate, embed, and backfill in accordance with Section 33 05 10.
    - 2) Plug with an MJ Plug with mechanical restraint and blocking in accordance with Section 33 11 11.
    - 3) Perform Cut and Plug in accordance with Section 33 12 25.
  - c. Concrete Pressure Pipe, Bar Wrapped, Steel Cylinder Type Water Lines
    - 1) Excavate, embed, and backfill in accordance with Section 33 05 10
    - 2) Plug using:
      - a) A fabricated plug restrained by welding or by a Snap Ring in accordance with Section 33 11 13; or
      - b) A blind flange in accordance with Section 33 11 13
    - 3) Perform Cut and Plug in accordance with Section 33 12 25.
  - d. Buried Steel Water Lines
    - 1) Excavate, embed, and backfill in accordance with Section 33 05 10.
    - 2) Plug using:
      - a) A fabricated plug restrained by welding in accordance with Section 33 11 14; or
      - b) A blind flange in accordance with Section 33 11 14
    - 3) Perform Cut and Plug in accordance with Section 33 12 25.
2. Water Line Abandonment Plug
    - a. Excavate and backfill in accordance with Section 33 05 10.
    - b. Plug with CLSM in accordance with Section 03 34 13.
  3. Water Line Abandonment by Grouting
    - a. Excavate and backfill in accordance with Section 33 05 10.
    - b. Dewater from existing line to be grouted.
    - c. Fill line with Low Density Cellular Grout in accordance with Section 33 05 24 or CLSM in accordance with 03 34 13.
    - d. Dispose of any excess material.
  4. Water Line Removal
    - a. Excavate and backfill in accordance with Section 33 05 10.
    - b. Cut existing line from the utility system prior to removal.
    - c. Cut any services prior to removal.
    - d. Remove existing pipeline and properly dispose as approved by City.
  5. Water Valve Removal
    - a. Excavate and backfill in accordance with Section 33 05 10.
    - b. Remove and dispose of valve bonnet, wedge, and stem.
    - c. Fill valve body with CLSM in accordance with Section 03 34 13.
  6. Water Valve Removal and Salvage
    - a. Excavate and backfill in accordance with Section 33 05 10.
    - b. Remove valve bonnet, wedge, and stem.
    - c. Deliver salvaged material to the Water Department Field Operation Storage Yard.
    - d. Protect salvaged materials from damage.
    - e. Fill valve body with CLSM in accordance with Section 03 34 13.
  7. Water Valve Abandonment
    - a. Excavate and backfill in accordance with Section 33 05 10.
    - b. Remove the top 2 feet of the valve stack and any valve extensions.
    - c. Fill the remaining valve stack with CLSM in accordance with Section 03 34 13.
  8. Fire Hydrant Removal and Salvage

- a. Excavate and backfill in accordance with Section 33 05 10.
  - b. Remove Fire Hydrant.
  - c. Place abandonment plug on fire hydrant lead line.
  - d. Deliver salvaged fire hydrant to the Water Department Field Operation Storage Yard.
  - e. Protect salvaged materials from damage.
9. Water Meter Removal and Salvage
- a. Remove and salvage water meter.
  - b. Return salvaged meter to Project Representative.
  - c. City will provide replacement meter for installation.
  - d. Meter Box and Lid
    - 1) Remove and salvage cast iron meter box lid.
    - 2) Remove and dispose of any non-cast iron meter box lid.
    - 3) Return salvaged material to the Water Department Field Operation Storage Yard.
    - 4) Remove and dispose of meter box.
10. Water Sample Station Removal and Salvage
- a. Remove and salvage existing water sample station.
  - b. Deliver salvaged material to the Water Department Field Operation Storage Yard.
11. Concrete Water Vault Removal
- a. Excavate and backfill in accordance with Section 33 05 10.
  - b. Remove and salvage vault lid.
  - c. Remove and salvage valves.
  - d. Remove and salvage meters.
  - e. Deliver salvaged material to the Water Department Field Operation Storage Yard.
  - f. Remove and dispose of any piping or other appurtenances.
  - g. Demolish and remove entire concrete vault.
  - h. Dispose of all excess materials.
12. Cathodic Test Station Abandonment
- a. Excavate and backfill in accordance with Section 33 05 10
  - b. Remove the top 2 feet of the cathodic test station stack and contents.
  - c. Fill any remaining voids with CLSM in accordance with Section 03 34 13.
- C. Sanitary Sewer Lines and Appurtenances
1. Sanitary Sewer Line Abandonment Plug
- a. Excavate and backfill in accordance with Section 33 05 10.
  - b. Remove and dispose of any sewage.
  - c. Plug with CLSM in accordance with Section 03 34 13.
2. Sanitary Sewer Line Abandonment by Grouting
- a. Excavate and backfill in accordance with Section 33 05 10.
  - b. Dewater and dispose of any sewage from the existing line to be grouted.
  - c. Fill line with Low Density Cellular Grout in accordance with Section 33 05 24 or CLSM in accordance with 03 34 13.
  - d. Dispose of any excess material.
3. Sanitary Sewer Line Removal
- a. Excavate and backfill in accordance with Section 33 05 10.
  - b. Cut existing line from the utility system prior to removal.

- c. Cut any services prior to removal.
  - d. Remove existing pipeline and properly dispose as approved by City.
4. Sanitary Sewer Manholes Removal
    - a. All sanitary sewer manholes that are to be taken out of service are to be removed unless specifically requested and/or approved by City.
    - b. Excavate and backfill in accordance with Section 33 05 10.
    - c. Remove and salvage manhole frame and cover.
    - d. Deliver salvaged material to the Water Department Field Operation Storage.
    - e. Demolish and remove entire concrete manhole.
    - f. Cut and plug sewer lines to be abandoned.
  5. Sanitary Sewer Junction Structure Removal
    - a. Excavate and backfill in accordance with Section 33 05 10.
    - b. Remove and salvage manhole frame and cover.
    - c. Deliver salvaged material to the Water Department Field Operation Storage.
    - d. Demolish and remove entire concrete manhole.
    - e. Cut and plug sewer lines to be abandoned.
- D. Storm Sewer Lines and Appurtenances
1. Storm Sewer Abandonment Plug
    - a. Excavate and backfill in accordance with Section 33 05 10.
    - b. Dewater line.
    - c. Plug with CLSM in accordance with Section 03 34 13.
  2. Storm Sewer Line Abandonment by Grouting
    - a. Excavate and backfill in accordance with Section 33 05 10.
    - b. Dewater the existing line to be grouted.
    - c. Fill line with Low Density Cellular Grout in accordance with Section 33 05 24 or CLSM in accordance with 03 34 13.
    - d. Dispose of any excess material.
  3. Storm Sewer Line Removal
    - a. Excavate and backfill in accordance with Section 33 05 10.
    - b. Remove existing pipeline and properly dispose as approved by City.
    - c. Storm Sewer Manhole Removal. All storm sewer manholes that are to be taken out of service are to be removed unless specifically requested and/or approved by City.
    - d. Excavate and backfill in accordance with Section 33 05 10.
    - e. Demolish and remove entire concrete manhole.
    - f. Cut and plug storm sewer lines to be abandoned.
  4. Storm Sewer Junction Box and/or Junction Structure Removal
    - a. Excavate and backfill in accordance with Section 33 05 10.
    - b. Demolish and remove entire concrete structure.
    - c. Cut and plug storm sewer lines to be abandoned.
  5. Storm Sewer Inlet Removal
    - a. Excavate and backfill in accordance with Section 33 05 10.
    - b. Demolish and remove entire concrete inlet.
    - c. Cut and plug storm sewer lines to be abandoned.
  6. Storm Sewer Box Removal
    - a. Excavate and backfill in accordance with Section 33 05 10.
    - b. Cut existing line from the utility system prior to removal.
    - c. Cut any services prior to removal.



- d. Remove existing pipeline and properly dispose as approved by City.
- 7. Headwall/SET Removal
  - a. Excavate and backfill in accordance with Section 33 05 10.
  - b. Demolish and remove entire concrete inlet.
  - c. Cut and plug storm sewer lines to be abandoned.
- 8. Storm Sewer Trench Drain Removal
  - a. Excavate and backfill in accordance with Section 33 05 10.
  - b. Remove existing pipeline and dispose as approved by City.

**3.5 REPAIR / RESTORATION [NOT USED]**

**3.6 RE-INSTALLATION [NOT USED]**

**3.7 FIELD [OR] SITE QUALITY CONTROL**

**3.8 SYSTEM STARTUP [NOT USED]**

**3.9 ADJUSTING [NOT USED]**

**3.10 CLEANING [NOT USED]**

**3.11 CLOSEOUT ACTIVITIES [NOT USED]**

**3.12 PROTECTION [NOT USED]**

**3.13 MAINTENANCE [NOT USED]**

**3.14 ATTACHMENTS [NOT USED]**

**END OF SECTION**

**PART 1 - GENERAL**

**1.1 SUMMARY**

- A. Section Includes:
  - 1. Removing concrete paving, asphalt paving and brickpaving
  - 2. Removing concrete curb and gutter
  - 3. Removing concrete valley gutter
  - 4. Milling roadway paving
  - 5. Pulverization of existing pavement
  - 6. Disposal of removed materials
- B. Deviations from this Standard Specification
  - 1. None.
- C. Related Specification Sections include, but are not necessarily limited to:
  - 1. Division 0 - Bidding Requirements, Contract Forms, and Conditions of the Contract
  - 2. Division 1 - General Requirements
  - 3. Section 32 11 33 - Cement Treated Base Courses

**1.2 PRICE AND PAYMENT PROCEDURES**

- A. Measurement and Payment
  - 1. Measurement
    - a. Remove Concrete Paving: measure by the square yard from back-to-back of curbs.
    - b. Remove Asphalt Paving: measure by the square yard between the lips of gutters.
    - c. Remove Brick Paving: measure by the square yard.
    - d. Remove Concrete Curb and Gutter: measure by the linear foot.
    - e. Remove Concrete Valley Gutter: measure by the square yard
    - f. Wedge Milling: measure by the square yard for varying thickness.
    - g. Surface Milling: measure by the square yard for varying thickness.
    - h. Butt Milling: measured by the linear foot.
    - i. Pavement Pulverization: measure by the square yard.
    - j. Remove Speed Cushion: measure by each.
  - 2. Payment
    - a. Remove Concrete Paving: full compensation for saw cutting, removal, hauling, disposal, tools, equipment, labor, and incidentals needed to execute work. For utility projects, this Item shall be considered subsidiary to the trench and no other compensation will be allowed.
    - b. Remove Asphalt Paving: full compensation for saw cutting, removal, hauling, disposal, tools, equipment, labor, and incidentals needed to execute work. For utility projects, this Item shall be considered subsidiary to the trench and no other compensation will be allowed.

- c. Remove Brick Paving: full compensation for saw cutting, removal, salvaging, cleaning, hauling, disposal, tools, equipment, labor, and incidentals needed to execute work. For utility projects, this Item shall be considered subsidiary to the trench and no other compensation will be allowed.
- d. Remove Concrete Curb and Gutter: full compensation for saw cutting, removal, hauling, disposal, tools, equipment, labor, and incidentals needed to execute work. For utility projects, this Item shall be considered subsidiary to the trench and no other compensation will be allowed.
- e. Remove Concrete Valley Gutter: full compensation for saw cutting, removal, hauling, disposal, tools, equipment, labor, and incidentals needed to execute work.
- f. Wedge Milling: full compensation for all milling, hauling milled material to salvage stockpile or disposal, tools, labor, equipment, and incidentals necessary to execute the work.
- g. Surface Milling: full compensation for all milling, hauling milled material to salvage stockpile or disposal, tools, labor, equipment, and incidentals necessary to execute the work.
- h. Butt Milling: full compensation for all milling, hauling milled material to salvage stockpile or disposal, tools, labor, equipment, and incidentals necessary to execute the work.
- i. Pavement Pulverization: full compensation for all labor, material, equipment, tools, and incidentals necessary to pulverize, remove and store the pulverized material, undercut the base, mixing, compaction, haul off, sweep, and dispose of the undercut material.
- j. Remove speed cushion: full compensation for removal, hauling, disposal, tools, equipment, labor, and incidentals needed to execute the work. For utility projects, this Item shall be considered subsidiary to the trench and no other compensation will be allowed.
- k. No payment for saw cutting of pavement or curbs and gutters will be made under this section. Include cost of such work in unit prices for items listed in bid form requiring saw cutting.
- l. No payment will be made for work outside maximum payment limits indicated on plans, or for pavements or structures removed for CONTRACTOR's convenience.

**1.3 REFERENCES**

- A. ASTM International (ASTM):
  - a. D698, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Efp (12 400 ft-lbf/ft<sup>3</sup> (600 kN-m/m<sup>3</sup>))

**1.4 ADMINISTRATIVE REQUIREMENTS [NOT USED]**

**1.5 SUBMITTALS [NOT USED]**

**1.6 ACTION SUBMITTALS/INFORMATIONAL SUBMITTALS [NOT USED]**

**1.7 CLOSEOUT SUBMITTALS [NOT USED]**

**1.8 MAINTENANCE MATERIAL SUBMITTALS [NOT USED]**

**1.9 QUALITY ASSURANCE [NOT USED]**

**1.10 DELIVERY, STORAGE, AND HANDLING [NOT USED]**

**1.11 FIELD CONDITIONS [NOT USED]**

**1.12 WARRANTY [NOT USED]**

## **PART 2 - PRODUCTS**

### **2.1 OWNER-FURNISHED PRODUCTS [NOT USED]**

### **2.2 EQUIPMENT [NOT USED]**

### **2.3 ACCESSORIES [NOT USED]**

### **2.4 SOURCE QUALITY CONTROL [NOT USED]**

## **PART 3 - EXECUTION**

### **3.1 EXAMINATION [NOT USED]**

### **3.2 INSTALLERS [NOT USED]**

### **3.3 PREPARATION**

#### A. General:

1. Mark paving removal limits for City approval prior to beginning removal.
2. Identify known utilities below grade - Stake and flag locations.

### **3.4 PAVEMENT REMOVAL**

#### A. General.

1. Exercise caution to minimize damage to underground utilities.
2. Minimize amount of earth removed.
3. Remove paving to neatly sawed joints.
4. Use care to prevent fracturing adjacent, existing pavement.

#### B. Sawing

1. Sawing Equipment.
  - a. Power-driven.
  - b. Manufactured for the purpose of sawing pavement.
  - c. In good operating condition.
  - d. Shall not spall or fracture the pavement structure adjacent to the removal area.
2. Sawcut perpendicular to the surface to full pavement depth, parallel and perpendicular to existing joint.
3. Sawcut parallel to the original sawcut in square or rectangular fashion.
4. If a sawcut falls within 5 feet of an existing dummy joint, construction joint, saw joint, cold joint, expansion joint, edge of paving or gutter lip, remove paving to that joint, edge, or lip.
5. If a pavement edge of a cut is damaged subsequent to saw cutting, saw to a new, neat, straight line for the purpose of removing the damaged area.

#### C. Remove Concrete Paving and Concrete Valley Gutter

1. Sawcut: See 3.4.B.
2. Remove concrete to the nearest expansion joint or vertical saw cut.

#### D. Remove Concrete Curb and Gutter

1. Sawcut: See 3.4.B.
2. Minimum limits of removal: 30 inches in length.

#### E. Remove Asphalt Paving

1. Sawcut: See 3.4.B.
2. Remove pavement without disturbing the base material.
3. When shown on the plans or as directed, stockpile materials designated as salvageable at designated sites.
4. Prepare stockpile area by removing vegetation and trash and by providing for proper drainage.

#### F. Milling

1. General
  - a. Mill surfaces to the depth shown in the plans or as directed.
  - b. Do not damage or disfigure adjacent work or existing surface improvements.
  - c. If milling exposes smooth underlying pavement surfaces, mill the smooth surface to make rough.
  - d. Provide safe temporary transition where vehicles or pedestrians must pass over the milled edges.
  - e. Remove excess material and clean milled surfaces.
  - f. Stockpiling of planed material will not be permitted within the right of way unless approved by the City.
  - g. If the existing base is brick and cannot be milled, remove a 5-foot width of the existing brick base. See 3.3.G. for brick paving removal.
2. Milling Equipment
  - a. Power operated milling machine capable of removing, in one pass or two passes, the necessary pavement thickness in a five-foot minimum width.
  - b. Self-propelled with sufficient power, traction, and stability to maintain accurate depth of cut and slope.
  - c. Equipped with an integral loading and reclaiming means to immediately remove material cut from the surface of the roadway and discharge the cuttings into a truck, all in one operation.
  - d. Equipped with means to control dust created by the cutting action.
  - e. Equipped with a manual system providing for uniformly varying the depth of cut while the machine is in motion making it possible to cut flush to all inlets, manholes, or other obstructions within the paved area.
  - f. Variable Speed in order to leave the specified grid pattern.
  - g. Equipped to minimize air pollution.
3. Wedge Milling and Surface Milling
  - a. Wedge Mill existing asphalt, concrete, or brick pavement from the lip of gutter at a depth of 2 inches and transitioning to match the existing pavement (0-inch cut) at a minimum width of 5 feet.
  - b. Surface Mill existing asphalt pavement to the depth specified,
  - c. Provide a milled surface that provides a uniform surface free from gouges, ridges, oil film, and other imperfections of workmanship with a uniform textured appearance.
  - d. In all situations where the existing H.M.A.C. surface contacts the curb face, the wedge milling includes the removal of the existing asphalt covering the gutter up to and along the face of curb.
  - e. Perform wedge or surface milling operation in a continuous manner along both sides of the street or as directed.
4. Butt Joint Milling
  - a. Mill butt joints into the existing surface, in association with the wedge milling operation.

- b. Butt joint will provide a full width transition section and a constant depth at the point where the new overlay is terminated.
  - c. Typical locations for butt joints are at all beginning and ending points of streets where paving material is removed. Prior to the milling of the butt joints, consult with the City for proper location and limits of these joints.
  - d. Butt Milled joints are required on both sides of all railroad tracks and concrete valley gutters, bridge decks and culverts and all other items which transverse the street and end the continuity of the asphalt surface.
  - e. Make each butt joint 20 feet long and milled out across the full width of the street section to a tapered depth of 2 inch.
  - f. Taper the milled area within the 20-feet to a depth from 0-inch to 2-inch at a line adjacent to the beginning and ending points or intermediate transverse items.
  - g. Provide a temporary wedge of asphalt at all butt joints to provide a smooth ride over the bump.
- G. Remove Brick Paving
- 1. Remove masonry paving units to the limits specified in the plans or as directed by the City.
  - 2. Salvage existing bricks for re-use, clean, palletize, and deliver to the City Stockpile yard at 3300 Yuma Street or as directed.
- H. Pavement Pulverization
- 1. Pulverization
    - a. Pulverize the existing pavement to depth of 8 inches. See Section 32 11 33.
    - b. Temporarily remove and store the 8-inch-deep pulverized material, then cut the base 2 inches.
    - c. Start 2-inch base cut at a depth of 8 inches from the existing pulverized surface.
  - 2. Cement Application
    - a. Use 3.5% Portland cement.
    - b. See Section 32 11 33.
  - 3. Mixing: see Section 32 11 33.
  - 4. Compaction: see Section 32 11 33.
  - 5. Finishing: see Section 32 11 33.
  - 6. Curing: see Section 32 11 33.
  - 7. If the existing pavement has a combination of 10 inches of H.M.A.C. and crushed stone/gravel:
    - a. Undercut not required
    - b. Pulverize 10 inches deep.
    - c. Remove 2-inch the total pulverized amount.
- I. Remove speed cushion
- 1. Scrape or sawcut speed cushion from existing pavement without damaging existing pavement.

**3.5 REPAIR [NOT USED]**

**3.6 RE-INSTALLATION [NOT USED]**

**3.7 FIELD QUALITY CONTROL [NOT USED]**

**3.8 SYSTEM STARTUP [NOT USED]**

- 3.9 ADJUSTING [NOT USED]**
- 3.10 CLEANING [NOT USED]**
- 3.11 CLOSEOUT ACTIVITIES [NOT USED]**
- 3.12 PROTECTION [NOT USED]**
- 3.13 MAINTENANCE [NOT USED]**
- 3.14 ATTACHMENTS [NOT USED]**

**END OF SECTION**

**REMOVAL, HANDLING, CUTTING, DISTURBANCE AND DISPOSAL OF ASBESTOS CEMENT PIPE**

**PART 1: GENERAL**

**1.1 Scope of Work**

This item shall govern the removal, handling, disturbance, cutting, and disposal of asbestos cement (AC) pipe and other asbestos containing materials (ACM) related to the AC pipe work. AC pipe is also known as transite pipe. Any buried pipe typically containing approximately 15 to 20 percent chrysotile and crocidolite asbestos, is considered to be ACM. The material is classified as non-friable unless broken, at which time its classification changes to friable ACM. The removal and/or disturbance of this material is governed by the National Emissions Standards for Hazardous Air Pollutants (NESHAP) and the Occupational Safety and Health Administration (OSHA).

**1.2 Description:**

This item shall consist of the removal, handling, cutting, disturbance, and disposal of AC water pipe, joints, wrappings, and other ACM. To comply with NESHAP and OSHA regulations, this project requires workers with specialized training using wet work procedures to cut and remove AC pipe, AC pipe joints, valves (any type) containing ACM, and surrounding soils containing ACM. A Texas Department of Health (TDH) licensed Asbestos Consultant shall develop the asbestos work practices and the monitoring in the Contractor's Health and Safety Plan to be reviewed by the Owner's Representative. It is the Contractor's responsibility to obtain the services of a licensed Asbestos Consultant authorized in the State of Texas; this work shall be considered subsidiary to this item.

To meet and/or exceed NESHAP and OSHA guidelines, the Contractor shall subcontract the AC water pipe handling to an Environmental Protection Agency (EPA) accredited and TDH licensed Asbestos Abatement Contractor, and TDH Licensed Asbestos Consultant.

NESHAP guidelines apply to projects when at least 260 linear feet or 35 cubic feet or 160 square feet of AC pipe becomes or will become "regulated asbestos containing material" or RACM. If the threshold limits are exceeded, the Contractor shall be responsible for the TDH administrative fee. The Asbestos Consultant shall also be

responsible for submitting the TDH notification and copying the Owner's Representative.

During the disjoining operation of AC pipe removal, if the debris caused by the disjoining operation is cleaned up so that it does not contaminate a greater length of pipe, only the portion that has become RACM shall be counted toward the threshold amount. However, if the generated AC pipe debris is not properly cleaned up, then the entire pipe shall be considered contaminated and the whole length shall be treated as asbestos containing waste material (ACWM). If the scope of this project involves a threshold amount, then a Demolition/Renovation Notification Form shall be sent to TDH by the Contractor. This form shall be post-marked no later than 11 working days prior to the start of any asbestos disturbance.

All AC pipe projects require that NESHAP and OSHA guidelines be met and/or exceeded in areas where AC pipe is to be disturbed. Thus, all AC pipe disturbances require a third party TDH licensed Asbestos Consultant and an Asbestos Contractor on-site during AC pipe disturbance. An asbestos abatement work plan shall be provided to the Owner's Representative by both the licensed Asbestos Consultant and the Asbestos Contractor. Upon completion of the AC pipe project, an air monitoring abatement report shall be prepared by the



Contractor's Asbestos Consultant. Copies of the final abatement report shall be provided to the Owner's Representative by the Contractor's consultant. OSHA requires that during any ACM disturbance, regardless of amount, the asbestos worker(s) shall be properly protected during potential asbestos exposure, 29 CFR, Subpart Z, 1910.1101.

### 1.3 Definitions:

The following terms are defined for the nature of this work:

- **Air Monitoring:**  
The process of measuring the fiber concentration of a known volume of air collected during a specific period of time. The analysis procedure utilized for asbestos is the NIOSH Standard Analytical Method for Asbestos in Air, Method 7400. Transmission electron microscopy (TEM) may be utilized for lower detection limits and/or specific fiber identification.
- **Air Monitoring Technician:**  
The person licensed by TDH to conduct air monitoring for an asbestos abatement project or related activity. The air monitoring technician may only obtain air samples and may only perform analysis of air samples with an upgraded Air Monitoring Technician License, which includes completion of the NIOSH-582 equivalent course.

The air-monitoring technician shall be an employee of a licensed asbestos laboratory or a licensed asbestos consultant agency.

- **Amended Water:**  
Water to which a surfactant has been added.
- **Asbestos:**  
The asbestiform varieties of serpentines and amphiboles. Specifically: chrysotile, crocidolite, grunerite, amosite, anthophyllite, actinolite, and tremolite.
- **Asbestos Containing Material (ACM):**  
Material or products that contain more than 1.0 percent of any kind of asbestos.
- **Asbestos Containing Waste Material (ACWM):**  
Asbestos containing material or asbestos contaminated objects requiring disposal.
- **Authorized Personnel:**  
Any person authorized by the Contractor and required by work duties to be present in the work area or other regulated areas.

- **Authorized Visitor:**  
Owner's representatives and any representative of a regulatory or other agency having jurisdiction over the project.
  
- **Asbestos Consultant:**  
That person licensed by TDH to perform the following asbestos related functions:
  - Project design
  - Asbestos surveys and condition assessment of ACM
  - Asbestos Management Planning
  - The collection of bulk material samples and airborne substance samples, and the planning of sampling strategies
  - Owner-representative services for asbestos abatement projects or O&M programs, including air monitoring and project management
  - Consultation regarding regulatory compliance, and all aspects of technical specifications and contract documents.
  - The selection, fit testing, and appropriate use of personal protective equipment, and the development of asbestos related engineering controls.
  
- **Abatement Contractor:**  
The company, agency, or entity licensed by TDH that has been retained by the Contractor to perform asbestos abatement and other associated functions.
  
- **Class II Asbestos Work (OSHA Standard):**  
Activities involving the removal of ACM that is not thermal system insulation or surfacing material. This includes, but is not limited to, the removal of AC pipe and appurtenances.
  
- **Competent Person:**  
One who is capable of identifying existing asbestos hazards in the workplace and selecting the appropriate control strategy for asbestos exposure, and who has the authority to take prompt corrective measures to eliminate them.
  
- **Encapsulant:**  
A specific adhesive designed to lock down and minimize the fiber release of ACM and asbestos-contaminated materials.
  
- **Friable Asbestos:**  
ACM, which can be crumbled to dust, when dry, under hand pressure, and includes previously non-friable material after such previously non-friable material becomes damaged to the extent that, when dry, it may be crumbled, pulverized, or reduced to powder by hand pressure.

- **HEPA Filter:**  
A high efficiency particulate air filter capable of removing particles >0.3 microns in diameter with 99.97 percent efficiency.
  
- **NESHAP:**  
The National Emission Standards for Hazardous Air Pollutants (40 CFR Part 61)
  
- **NIOSH:**  
The National Institute for Occupational Safety and Health
  
- **OSHA:**  
The Occupational Safety and Health Administration
  
- **PEL:**  
Permissible exposure level
  
- **Regulated Area:**  
An area established by the Contractor to demarcate areas where asbestos work is conducted, and any adjoining area where debris and waste from such asbestos work accumulate; and a work area within which airborne concentrations of asbestos exceed, or there is a reasonable possibility they may exceed, the PEL.
  
- **Regulated Asbestos Containing Material (RACM):**
  - Friable asbestos material
  - Category I non-friable ACM that has become friable.
  - Category I non-friable ACM that will be or has been subjected to sanding, grinding, cutting, or abrading.
  - Category II non-friable ACM that has a high probability of becoming or has become crumbled, pulverized, or reduced to powder by forces expected to act on the material in the course of the demolition or renovation operations regulated by 40 CFR Part 61, Subpart M.
  
- **Staging Area:**  
A pre-selected area where containerized ACWM will be placed prior to removal from the project site.
  
- **Surfactant:**  
A chemical wetting agent added to water to improve penetration.
  
- **TWA:**

- Time weighted average

## **PART 2: QUALITY ASSURANCE**

### **2.1 Reference Standards**

All work under these specifications shall be done in strict accordance with all applicable Federal, State, and local regulations, standards, and codes governing asbestos abatement, and any other trade work done in conjunction with the asbestos abatement. Work activities shall also comply with these and other City Specifications related to health and safety.

The most recent edition of any relevant regulation, standard, or code shall be in effect. Where a conflict exists between the regulations, standards, codes, or these specifications, the most stringent requirements shall be utilized.

The Contractor shall comply with, at minimum, the following specific regulations:

#### **2.1.1 OSHA including but not limited to:**

- Title 29 Code of Federal Regulations Section 1910.1001 - General Industry Standard for Asbestos
- Title 29 Code of Federal Regulations Section 1910.134 - General Industry Standard for Respiratory Protection
- Title 29 Code of Federal Regulations Section 1926 - Construction Industry
- Title 29 Code of Federal Regulations Section 1910.2 - Access to Employee Exposure and Medical Records
- Title 29 Code of Federal Regulations Section 1910.1200 - Hazard Communication

#### **2.1.2 EPA including but not limited to:**

- Title 40 Code of Federal Regulations Part 61 Subpart M - National Emission Standard for Asbestos

#### **2.1.3 TDH including but not limited to:**

- Texas Administrative Code, Title 25, Chapter 295, Subchapter C - Texas Asbestos Health Protection
- Texas Administrative Code, Title 25, Chapter 325 Texas Solid Waste Regulations
- Texas Civil Statutes, Article 4477- A, Section 12, General Provisions 295.31 to 295.73

#### **2.1.4 American National Standards Institute (ANSI)**

#### **2.1.5 American Society for Testing and Materials (ASTM)**

#### **2.1.6 Department of Transportation - HM 181**

## 2.2 Submittals

2.2.1 At the Pre-construction Meeting, all training records, certifications, medical records, and laboratory qualifications shall be submitted for review to Owner's Representative as well as the following:

- The Contractor shall be responsible for developing and implementing an asbestos removal work plan in accordance with NESHAP, OSHA, these specifications, and State requirements. The Contractor must have a TDH licensed Asbestos Consultant to provide detailed asbestos specific safety and work plans for ensuring worker and community protection. Plans submitted by the Asbestos Consultant shall include the person's or firm's name, address, phone number and TDH certification. Health and safety plans for working with ACM shall address the requirements in these specifications. However, these specifications are not intended to be and do not constitute asbestos abatement project design as described under TAC 25, Chapter 295.47, TDH asbestos regulations.
- The Contractor shall submit documentation satisfactory to Owner's Representative that an Initial and/or Negative Exposure Assessment in accordance with OSHA Standard 29 CFR 1911 has or will be performed (as applicable).
- The Contractor shall submit documentation satisfactory to Owner's representative that the Contractor's employees, including foremen, supervisors, and any other company personnel or agents, who may be exposed to airborne asbestos fibers or who may be responsible for any aspect of asbestos disturbance activities, have received adequate training in compliance with applicable rules and regulations.
- The Contractor shall submit documentation to Owner's Representative of a respiratory protection program for affected employees as per OSHA Standard 29CFR 1910.134.
- The Contractor shall submit documentation to Owner's Representative from a physician that all personnel, who may be required to wear a respirator, are medically monitored to determine whether they are physically capable of working while wearing the required respiratory protection without suffering adverse health effects. In addition, the Contractor shall submit document that personnel have received medical monitoring as is required in compliance with applicable rules and regulations.
- The Contractor shall submit to Owner's Representative documentation of respirator fit testing for all Contractor's employees and agents, who must enter the work area. This fit testing shall be in accordance with qualitative procedures as detailed in the OSHA Standard 29 CFR 1910.134.
- The Contractor shall submit the name of the OSHA monitoring consultant/lab. The Contractor shall be responsible for air monitoring as required to meet OSHA requirements.
- The Contractor shall submit proof satisfactory to Owner's Representative that required permits, site location, and arrangements for transport and disposal of ACWM have been made.

2.2.2 During Asbestos Disturbance Activities:

- Submit copies to Owner's Representative of all transport manifests, trip tickets, and disposal receipts for all ACWM removed from the work area during the project. The Contractor shall sign manifests as the generator of the ACWM and provide copies to Owner's Representative.

- Upon completion of the AC pipe project, an abatement report shall be prepared by the Contractors' Asbestos Consultant. Copies of the final abatement report shall be provided to the Owner.

## **PART 3: EXECUTION**

### **3.1 Delivery, Storage and Handling**

#### **3.1.1 Construction Requirements:**

- The Work includes all work specified herein, to include mobilization and demobilization, labor, materials, overhead, profit, taxes, transportation, disposal fees, administrative fees, incidental cost, etc. Estimating areas, quantities, weight, etc., are the sole responsibility of the Contractor.
- The Contractor shall remove, seal, transport and dispose of all impacted ACM in compliance with all current Federal, State, and local regulations, laws, ordinances, rules, standards, and regulatory agency requirements. Asbestos disturbance and/or removal activities shall be conducted by properly trained, accredited, and licensed personnel using proper personal protective equipment.
- The Contractor shall notify Owner's Representative at least 72 hours in advance prior to beginning removal and/or disturbance of AC pipe.
- Time is of the essence in removing ACM from the project area. All work must be completed within the time period specified.
- All required notifications to State regulatory agencies shall be made by the Contractor with copies provided to Owner's Representative, including but not limited to the TDH Demolition/Renovation Notification Form. If 260 linear feet or greater of AC pipe is crushed, crumbled, or pulverized, then the project is subject to NESHAP regulations and a Demolition/Renovation Notification Form shall be sent to TDH by the Contractor. This form shall be post-marked no later than 11 working days prior to the start of any asbestos disturbance.
- The Contractor shall have an on-site supervisor, who is an OSHA Competent Person, present on the job site at all times the work is in progress. This supervisor shall be thoroughly familiar and experienced with asbestos disturbance and other related work and shall be familiar with and shall enforce the use of all safety procedures and equipment. The supervisor shall be knowledgeable of all applicable EPA, OSHA, NIOSH and TDH requirements and guidelines.
- Prior to commencing any preparation of the work areas for asbestos disturbance, the Contractor shall post all required documents, warning signs, and as necessary, erect physical barriers to secure the work area.
- The Contractor has sole and primary responsibility for the "means and/or methods" of the work, for the inspection of the work at all stages, and for the supervision of the performance of the work.
- The Contractor shall be responsible for site safety and for taking all necessary precautions to protect the Contractor's workers, City personnel, and the public from asbestos exposure

and/or injury. The Contractor shall be responsible for maintaining the integrity of the work area.

- The Contractor shall confine operations at the site to the area requiring disturbance of AC pipe and the general site area associated with the proximity of the project. Portions of the site beyond areas, in which the indicated work is required, are not to be disturbed. The Contractor shall not unreasonably encumber the site with materials or equipment. If ACWM is required to be stored overnight, it shall be properly labeled, secured, and containerized to preclude unauthorized disturbance of the waste materials.
- The Contractor shall be responsible for the transport and disposal of ACWM to a duly licensed landfill facility permitted to accept asbestos waste. The Contractor shall be responsible for obtaining and coordinating waste disposal authorization from a TCEQ licensed landfill. Waste manifests shall be used to transport the AC pipe from the project site to the final landfill disposal site. The Contractor shall sign manifests as the generator of the AC pipe and shall provide copies to the Owner's Representative for final payment.

### 3.1.2 Site Security:

- The Contractor shall demarcate the area of AC pipe disturbance ("regulated area") with barrier tape and warning signs, as per OSHA regulation 29 CFR 1926.1101. Access to the regulated area shall be limited only to authorized personnel. Authorized personnel shall have asbestos awareness training, respiratory training, etc., including City personnel.
- Entry into the work area by unauthorized individuals shall be reported immediately to the Owner's Representatives by the Contractor.
- A logbook shall be maintained immediately outside the regulated area. Anyone who enters the regulated area must record name, affiliation, time in, and time out for each entry.

### 3.1.3 Personal Protective Equipment:

#### 3.1.3.1 *General:*

All work which will or may disturb ACM shall be accomplished utilizing, as a minimum, disposal suits with protective head cover, gloves, boots, eye protection, proper respiratory protection, decontamination by HEPA vacuuming and/or wet methods, and wet wiping all equipment. The Contractor shall provide hard hats and/or other protection as required for job conditions or by applicable safety regulations. Disposal suits consisting of material impenetrable by asbestos fibers shall be provided to all workers and authorized visitors in sizes adequate to accommodate movement without tearing. Workers shall be provided protective clothing from the time of first disturbance of ACM until final cleanup is completed.

#### 3.1.3.2 *Respiratory Protection:*

The Contractor shall use removal techniques, methods and equipment that will not permit the fiber count to exceed the OSHA Permissible Exposure Level (PEL) of 0.1 fibers per cubic centimeter (f/cc) of air as detected by personal air sampling methods. Any remedial measures taken by the Contractor to meet this requirement shall be at the Contractor's expense.

- The Contractor's Competent Person shall ensure use of the appropriate respiratory protection for the work being performed. For minimum legal respiratory requirements, see OSHA Standards 29 CFR 1910.134, 29 CFR 1910.1001, and 29 CFR 1926.1101. All

respiratory equipment, such as respirators, filters, etc., shall be certified by NIOSH for use in asbestos contaminated atmospheres.

- The Contractor's Competent Person shall perform an Initial and/or Negative Exposure Assessment, which shall be performed on employees who have been trained in compliance with the OSHA regulations. Employee's exposures shall be collected using objective data that is to demonstrate whether the materials specified for removal can release airborne fibers in concentration levels exceeding 0.1 f/cc during an 8-hour time weighted average (TWA) and the excursion limit of 1.0 f/cc. For the purpose of the assessment, the work conditions shall be those having the greatest potential for releasing asbestos fibers. Removal methods using conventional hand tools shall be performed in an area that requires a minimum of a 7-hour work shift with employees performing functions normally required for a total project. Removal, for the purposes of the assessment, shall be performed with methods most likely to release fibers and that do not render the ACM friable. Properly trained employees shall wear proper protective clothing and respirators during the assessment. Initial and/or Negative Exposure Assessments shall be performed in accordance with OSHA Standard 29 CFR 1926.1101.
- The development of the Health and Safety Plan by the Contractor's TDH licensed Asbestos Consultant shall include determining the adequacy of the Contractor's air monitoring data (which must be performed within the previous 12 months of the project start date) for the Initial and/or Negative Exposure Assessment, based in part on site-specific factors such as changes in personnel or work methods used during AC pipe removal. If the type of air monitoring data needs to be reviewed during the course of a project, the Contractor's Asbestos Consultant shall review the data in order to determine adequacy. Any downgrade in personal protective equipment related to asbestos exposure shall be requested in writing to the Owner's Representative and approved by a TDH licensed Asbestos Consultant. This request may be granted only when all regulations and pertinent sections of this specification for respiratory protection are met.
- The Contractor shall begin AC pipe removal operations (i.e., breaking, sawing, cutting, or repairing the pipe) in powered air purifying respirators (PAPRs) equipped with dual HEPA filters. PAPRs shall be utilized until such time that air monitoring results indicate half-face respirators may be used. Any changes (downgrade or upgrade) in respiratory protection shall be based upon an 8-hour TWA of fiber concentrations in the regulated area. For personal samples, the 8-hour TWA's shall be calculated daily by the Contractor's OSHA monitoring firm. The highest calculated 8-hour TWA shall be used to determine the type of respirator to be worn. The type of respirators worn shall be selected in accordance with 29 CFR 1926.1101 (h)(3).

The Contractor may request a respiratory protection downgrade, approved by a TDH licensed Asbestos Consultant, in writing to the Owner's Representative when all regulations and pertinent sections of this specification for respiratory protection are met.

- Workers shall be provided with personally issued, individually identified respirators.
- No one wearing a beard shall be permitted to wear a respirator.

#### 3.1.4 Air Monitoring:

- Personal Air Monitoring: The Contractor shall provide personal air sampling as required by OSHA regulations. The OSHA TWA PEL for asbestos (0.1 f/cc) shall not be exceeded. Personal air samples shall be obtained by a TDH licensed Asbestos Air Monitoring Technician and analyzed by an accredited, independent TDH licensed Phase Contrast



Microscopy (PCM) laboratory. OSHA monitoring results shall be posted at the project site and made available to all affected Contractor personnel on a daily basis.

- The Contractor shall provide, as a minimum, personal air monitoring on each worker who is cutting, (wet) sawing, breaking, or repairing AC pipe.
- Area Air Monitoring: At any time that visible airborne fibers are generated or that wet work procedures are not used, all work shall immediately cease until air monitoring by a TDH licensed Asbestos Consultant Agency has started. The Contractor's on-site Competent Person shall be responsible for making this determination; however, periodic, random site visits by the Owner's representative will field-verify the objectivity of the Competent Person in these matters. Once initiated, the sampling and frequency of the area air monitoring shall be dependent upon on the specific work practices being used by the workers at that time. However, the area air monitoring shall include, as a minimum,

samples collected inside the regulated area, and upwind and downwind of the regulated area. The TDH licensed Asbestos Consultant Agency hired by the Contractor shall determine the need for additional samples and shall amend the Health and Safety Plan to include sampling protocols. A copy shall be provided to the Owner's Representative.

- Area air monitoring shall be conducted in accordance with applicable Federal, State, and local requirements. The cost of area air monitoring due to failure to use adequate wet work procedures shall be borne by the Contractor. Copies of all results shall be provided to the Owner's Representative.
- Area air sampling shall be mandatory in high density areas such as schools, residential areas, and certain other locations as determined by the Owner's Representative and dictated by the bid documents/plans.

### 3.1.5 Employee Training:

- Training shall be provided by the Contractor to all employees or agents who may be required to disturb ACM for AC pipe handling and auxiliary purposes, and to all supervisory personnel who may be involved in the planning, execution, or inspection of such projects. The training shall be in accordance with OSHA Standard 29 CFR 192.1101 for "Class II asbestos work".
- At a minimum, Contractor's employees who will be potentially exposed to asbestos shall have completed within the last 12 months, an 8-hour Asbestos Awareness training course taught by a TDH licensed Asbestos Training Provider. The training course shall cover topics including, but not be limited to: the health effects of asbestos and work practices related to the handling of AC pipe.
- The Contractor's Competent Person shall have completed within the last 12 months, a 40-hour Asbestos Contractor Supervisor training course taught by a TDH licensed Asbestos Training Provider. The training course shall cover topics including, but not be limited to: the health effects of asbestos, employee personal protective equipment, medical monitoring requirements for workers, air monitoring procedures and requirements for workers, work practices for asbestos abatement, personal hygiene procedures, special safety hazards that may be encountered, and other topics as required.

3.1.6 AC Pipe Handling:

3.1.6.1 *General:*

The Contractor shall properly remove, handle, transport and dispose all AC pipe specified in the bid documents/plans for this project. All work involving AC pipe and other ACM products shall be addressed in the Health and Safety Plan documents submitted to the Owner's Representative. The Contractor shall hire a TDH licensed Asbestos Consultant to provide detailed asbestos specific safety and work plans for ensuring worker and community protection. Health and Safety Plan documents are to include provisions for the discipline of any worker failing to use wet work procedures or failing to use designated personnel protective equipment.

The Contractor shall remove ACM with wet methods or by other controlled techniques approved by the TDH, EPA and OSHA, and in accordance with these specifications and the Contractor-provided Health and Safety Plan. Alternative removal methods will be considered at the time of the Contractor's submittals. The Contractor shall take special care to prevent damage to structures and materials not requiring demolition to access the ACM.

The Contractor shall limit work to the area indicated. Access to the work area shall be controlled by the Contractor. All electrical equipment, etc., shall have ground limit circuit interrupter (GFCI) protection. The Contractor shall properly demarcate, barricade, and contain the work and/or regulated areas.

The AC pipe work consists of providing GFCI protection, using approved equipment with engineering controls, sufficiently wetting the ACM using a surfactant or lock-down encapsulant, removing the ACM, HEPA vacuuming the work area, wet wiping the work area, double-bagging/double-wrapping the waste, and removing carefully as indicated herein and in accordance with the Contractor-provided Health and Safety Plan.

3.1.6.2. *Equipment:*

Equipment used to cut, break, or otherwise disturb AC pipe and associated ACM may include, but are not limited to: wet-cutting saws, saws equipped with point of cut ventilator (saw equipped with a water mister) or enclosures with HEPA filtered exhaust air, snap cutters, manual field lathes, and pressure and non-pressure tapping devices.

Equipment used to control visible emissions of fibers, contain the work area, or facilitate the clean-up of debris may include, but are not limited to: airless spray equipment, pump-up sprayers, surfactant, lock-down encapsulant, HEPA vacuums, brushes, brooms, shovels, disposable rags, polyethylene sheeting of 6-mil thickness, moisture resistant duct tape, asbestos warning signs, notices, and barrier tape. Alternative dismantling equipment may be substituted for the materials indicated herein but must be approved by the Owner's Representative.

3.1.6.3 *Prohibited Work Practices and Engineering Controls:*

The following work practices and engineering controls shall not be used for work related to asbestos or for work that disturbs ACM, regardless of asbestos exposure or the results of Initial Exposure Assessments:

- High-speed abrasive disc saws that are not equipped with point of cut ventilator or enclosures with HEPA filtered exhaust air.
- Other high-speed abrasive tools, such as disk sanders
- Carbide-tipped cutting blades

- Electrical drills, chisels, and rasps used to make field connections in AC pipe.
- Shell cutters used to cut entry holes in AC pipe.
- A hammer and chisel used to remove couplings or collars on AC pipe.
- Compressed air used to remove asbestos or ACM, unless the compressed air is used in conjunction with an enclosed ventilation system designed to capture the dust cloud generated by the compressed air.
- Dry sweeping, dry shoveling, or other dry clean-up of dust and debris containing ACM.
- Employee rotation as a means of reducing employee exposure to asbestos.

3.1.6.4 *General Removal Work Practices:*

AC pipe has been identified as a non-friable ACM with the potential to become friable ACM. The material is classified as non-friable unless broken, at which time its classification changes to friable. NESHAP guidelines apply to projects when at least 260 linear feet or 35 cubic feet or 160 square feet of AC pipe becomes or will become “regulated asbestos containing material” or RACM. Therefore, if at least 260 linear feet of AC pipe is crushed, crumbled, or pulverized, then the project is subject to NESHAP. During the disjoining operation of AC pipe removal, only the portion that has become RACM shall be counted toward the threshold amount, if the debris caused by the disjoining operation is cleaned up so that it does not contaminate a greater length of pipe. If the generated AC pipe debris is not properly cleaned up, however, then the AC pipe shall be considered contaminated and the whole length is treated as ACM. If the scope of this project involves the threshold amount (260 linear feet or greater), then a Demolition/Renovation Notification Form shall be sent to TDH by the Contractor. This form shall be post-marked no later than 11 working days prior to the start of any asbestos disturbance.

All AC pipe projects require that NESHAP and OSHA guidelines be met and/or exceeded in areas where AC pipe is to be disturbed. Therefore, all AC pipe disturbances require a third party TDH licensed Asbestos Consultant and Asbestos Contractor on-site during AC pipe disturbance. An asbestos abatement work plan shall be provided to the Owner’s Representative by both the licensed Asbestos Consultant and the Asbestos Contractor. Upon completion of the AC pipe project, an air monitoring abatement report shall be prepared by the Contractor’s Asbestos Consultant. Copies of the final abatement report shall be submitted to the Owner’s Representative by the Contractor’s consultant. During any ACM disturbance, OSHA requires that, regardless of amount, the asbestos worker(s) be properly protected during potential asbestos exposure, 29 CFR, Subpart Z, 1910.1101.

The Contractor shall be responsible for developing and implementing an asbestos removal work plan in accordance with NESHAP, OSHA, and State requirements. As such, Contractors submitting bids for the project shall have a TDH licensed Asbestos Consultant provide detailed asbestos specific safety and work plans for ensuring worker and community protection. Health and Safety Plans for working with ACM shall address the requirements of these specifications.

3.1.6.5 A sufficient supply of disposable rags for work area decontamination shall be available.

3.1.6.6 Disposal bags for RACM shall be of true 6-mil polyethylene, pre-printed with labels as required by EPA regulation 40 CFR 61.152 (b)(i)(iv) or OSHA requirement 29 CFR 1926.1101 (k)(8).

3.1.6.7 Stick-on labels identifying the Generator's name and address, and the project site location shall be applied to any asbestos waste bags that contain RACM, as per EPA or OSHA and Department of Transportation HM 181 requirements.

3.1.6.8 *Work Area Preparation:*

The Contractor shall post warning signs and barrier tape meeting the specification of OSHA 29 CFR 1910.1001 and 40 CFR 61 at any location and approaches to a location where airborne concentrations of asbestos may exceed the PEL. Signs shall be posted at a distance sufficiently far from the work area to permit an employee to read the sign and to take the necessary protective measures to avoid exposure. The Contractor shall maintain constant security against unauthorized entry past warning signs and barrier tape. Signs shall be post in both English and Spanish at the site.

3.1.6.9 *Personnel Exit Procedures*

- Before leaving the work area, all personnel shall remove gross contamination from the outside of respirators and protective clothing by brushing and/or wet wiping procedures. Small HEPA vacuums with brush attachments may be utilized for this purpose. Adequate washing facilities shall be provided and utilized on-site.
- Upon completion of the work, contaminated gloves shall be disposed as ACWM. Disposable cloth gloves may be substituted for leather gloves, at the Contractor's discretion. Rubber boots shall be decontaminated at the completion of the project.

3.1.6.10 *Specific Removal Work Practice Requirements*

- The Contractor has sole and primary responsibility for the "means and/or methods" of the work, for inspection of the work at all stages, and for supervision of the performance of the work.
- The Contractor shall isolate the regulated area with barrier tape and asbestos warning signs.
- The Contractor shall lay and secure 6-mil polyethylene sheeting on the ground on both sides of the AC pipe for the length of the work area.
- Working within the regulated area and using wet removal methods, the Contractor shall thoroughly soak each section of AC pipe to be disturbed, prior to any removal activity, with a surfactant or lock-down encapsulant. The Contractor shall use equipment capable of producing a "mist" application to reduce the potential for release of fibers. The Contractor shall take care to use as much encapsulant or surfactant as needed to lockdown possible fallout debris from edges and joints during removal. Continuous wetting of the materials throughout the entire removal process shall be provided. The Contractor shall take care to limit the breakage of ACM and to remove these materials as intact as possible.
- Any AC pipe debris on adjacent surfaces shall be removed. The Contractor shall promptly clean up asbestos wastes and debris following AC pipe disturbance. All visible accumulations of ACM and asbestos contaminated debris shall be removed and containerized by hand. Asbestos debris mixed with soil shall be picked up with shovels. The contaminated soil shall be containerized as a regulated ACWM. Clean-up activities may also involve vacuum cleaners equipped with HEPA filtration or wet-wiping surfaces with disposable rags. Contaminated rags shall be containerized as regulated ACWM.

- After disturbance and clean-up activities but prior to removal of the AC pipe from the regulated area, the Contractor shall encapsulate damaged and exposed areas and ends of the AC pipe with a lock-down encapsulant.
- The Contractor shall then remove the Category II non-friable ACM “that is not in poor condition and is not friable,” as defined in NESHAP regulations. The Contractor shall remove all AC pipe “intact” and in whole complete sections by carefully lifting the AC pipe to the disposal container using approved equipment. The Category II non-friable AC pipe shall not be made “friable” (crumbled, pulverized, or reduced to a powder). The Contractor shall not drop, break and/or otherwise make the AC pipe susceptible to releasing asbestos fibers. If these procedures are followed and debris is cleaned up properly, then the Category II non-friable AC pipe shall be disposed as non-regulated ACM.
- Pieces of AC pipe debris shall be handled as RACM waste. The debris shall be placed in two 6-mil asbestos bags or double wrapped, with proper labeling.

3.1.6.11 Abandonment of AC water mains/pipes: The Contractor shall be responsible for isolating the existing mains to remain in service by capping, plugging, and blocking, as necessary. The opening of an abandoned AC water main and all other openings or holes shall be blocked off by manually forcing cement grout or concrete, into and around the openings, in sufficient quantity to provide a permanent watertight seal. Abandonment of old, existing AC water mains shall be considered subsidiary to the required work and no direct payment shall be made.

3.1.6.12 Abandonment of valves that contain ACM: Valves to be abandoned in the execution of the work shall have the valve box and extension packed with sand to within 8-inches of the street surface. The remaining 8-inches shall be filled with 2,500 psi concrete or an equivalent sand-cement mix, and finished flush with the adjacent pavement or ground surface. The valves cover shall be salvaged and return to the City. The abandonment of valves containing ACM shall be considered subsidiary to the required work and no direct payment shall be made.

3.1.6.13 Verification of Removal & Clean-up Procedures: The Contractor’s on-site Competent Person shall inspect the work area and ensure that all surfaces are free of AC pipe dust and debris.

3.1.6.14 *Disposal Procedures*

- If a dumpster/trailer is used for temporary storage, it shall be secured and closed at all times except when loading. It shall be properly marked, and critical barrier tape shall be in place.
- AC pipe debris and asbestos-contaminated items shall be properly double bagged; labeled; loaded in a fully enclosed, lined, locked, placard-identified transport container; transported; and disposed in compliance with all regulatory requirements as RACM.
- After being removed from the regulated area, Category II non-friable AC pipe shall be transferred to a polyethylene-lined container. The Contractor shall remove all containers as soon as practical, but no later than the end of the work shift.
- When a dumpsters/trailer is full, it shall be hauled away to the closest EPA approved landfill for proper disposal. The Contractor may dispose of Category II non-friable AC pipe waste material as non-regulated waste in a municipal solid waste landfill, as defined in the NESHAP and TCEQ Rule (Type I Landfill). Prior to disposal, written approval to transport and to accept the Category II non-friable material shall be obtained from a pre-approved transporter and landfill and shall be submitted to the Owner’s Representative.

- The Contractor shall submit copies of all transport manifests, trip tickets, and disposal receipts for all ACWM removed from the work area during the project to the Owner's Representative. The Contractor shall sign manifests as the generator of the AC pipe and provide copies to Owner's Representative for final payment.

**PART 5: METHOD OF MEASUREMENT AND PAYMENT**

Method of Measurement and Payment for the work included in this section will be in accordance with the payment schedule in the Bid Proposal.

**\*\*END OF SECTION\*\***

**PART 1- GENERAL**

**1.1 SUMMARY**

- A. This section covers the trench and excavation safety system required for constructing improvements that necessitate open excavations on the project. All work under this item shall be in accordance with the current edition of the OSHA Standard for Excavation and Trench Safety Systems, 29 CFR 1926 Subpart P.
- B. Related Sections
  - 1. Section 01 33 00 – Submittals
  - 2. Section 33 05 10 – Utility Trench Excavation, Embedment, and Backfill

**1.2 SUBMITTALS**

- A. Trench Safety System shall be designed by a Professional Engineer licensed in the state of Texas.

**1.3 REFERENCE STANDARDS**

- A. 29 CFR 1296 Subpart P -Occupational Safety and Health Standards – Excavations.
- B. 29 CFR 1296 Subpart U -Occupational Safety and Health Standards – Blasting and Use of Explosives.

**1.4 NOTIFICATION REQUIRED**

- A. The Contractor, before beginning any excavation, shall notify the State Department of Labor (Safety Division) that work is commencing on a project which has excavations five feet deep or deeper. The Contractor shall provide written documentation of the notification to the Authority.
- B. The Contractor shall notify all utility companies and owners in accordance with the OSHA requirements given in 29 CFR 1926.651(b)(2) for the purpose of locating utilities and underground installations.

**1.5 EXISTING STRUCTURES AND UTILITIES**

- A. Where the trench or excavation endangers the stability of a building, wall, street, highway, utilities, or other installation the Contractor shall provide support systems such as shoring, bracing, or underpinning to ensure the stability of such structure or utility.
- B. The Contractor may elect to remove and replace or relocate such structures or utilities with the written approval of the Utility and the Authority.

**PART 2 – PRODUCTS (Not Applicable)**

**PART 3 – EXECUTION (Not Applicable)**

**PART 4 – MEASUREMENT AND PAYMENT**

**4.1** Trench safety shall be considered subsidiary to the work required to complete the contract.

**END OF SECTION**



**DIVISION 03**  
**CONCRETE**



## 03 10 00 SUPPLEMENTAL CONCRETE FORMWORK

### PART 1 GENERAL

#### 1.1 DESCRIPTION

- A. Scope:
1. CONTRACTOR shall provide all labor, materials, equipment and incidentals as shown, specified and required to furnish and install concrete formwork. The Work also includes:
    - a. Providing openings in formwork to accommodate the Work under this and other Sections and building into the formwork all items such as sleeves, anchor bolts, inserts and all other items to be embedded in concrete for which placement is not specifically provided under other Sections.
- B. Coordination:
1. Review installation procedures under other Sections and coordinate the installation of items that must be installed with the formwork.
  2. Coordinate formwork specifications herein with the requirements for finished surfaces specified in Section 03 30 00, Cast-In-Place Concrete.
- C. Related Sections:
1. Section 03 20 00 Supplemental Concrete Reinforcement.
  2. Section 03 25 01 Concrete Joints.
  3. Section 03 30 00 Cast-In-Place Concrete.

#### 1.2 QUALITY ASSURANCE

- A. CONTRACTOR shall examine the substratum and the conditions under which concrete formwork is to be performed, and notify the ENGINEER, in writing, of unsatisfactory conditions. Do not proceed with the Work until unsatisfactory conditions have been corrected in a manner acceptable to the ENGINEER.
- B. Reference Standards: Comply with applicable provisions and recommendations of the following, except as otherwise shown or specified. Where conflicts may occur between the reference standards, the more restrictive provisions shall apply.
1. ACI 117, Standard Tolerances for Concrete Construction and Materials.
  2. ACI 301, Standard Specifications for Structural Concrete.
  3. ACI 318/318R, Building Code Requirements for Reinforced Concrete.
  4. ACI 347, Guide for Concrete Formwork.
  5. ASTM C 805, Test Method for Rebound Number of Hardened Concrete.
  6. US Product Standard, PS-1-83 for Construction and Industrial Plywood.
- C. Allowable Tolerances:
1. Construct formwork to provide completed concrete surfaces complying with tolerances specified in ACI 347, Chapter 3, except as otherwise specified.
  2. Construct formwork to provide completed concrete surfaces complying with the following tolerances:
    - a. Vertical alignment:
      - 1) Lines, surfaces and arises less than 100 feet in height - maximum 1 inch not to exceed a 1/2" in any 10-feet.
      - 2) Outside corner of exposed corner columns and control joints in concrete exposed to view less than 100 feet in height - 1/2 inch.
      - 3) Lines, surfaces, and arises greater than 100 feet in height - 1/1000 times the height but not more than six (6) inches.

- b. Lateral alignment:
    - 1) Members - 1 inch.
    - 2) Centerline of openings 12 inches or smaller and edge location of larger openings in slabs - 1/2 inch.
    - 3) Saw cuts, joints, and weakened plane embedment(s) in slabs - 3/4 inch.
  - c. Level alignment:
    - 1) Elevation of slabs-on-grade - maximum 3/4 inch not to exceed 3/8-inch in any 10-feet.
    - 2) Elevation of top surfaces of formed slabs before removal of shores - 3/4 inch.
    - 3) Elevation of formed surfaces before removal of shores - 3/4 inch.
    - 4) Lintels, sills, parapets, horizontal grooves, and other lines exposed to view - 1/2 inch.
  - d. Cross-sectional dimensions: Overall dimensions of beams, joists, and columns and thickness of walls and slabs.
    - 1) 12-inch dimension or less - plus 3/8 inch to minus 1/4 inch.
    - 2) Greater than 12 inch to 3 foot dimension - plus 1/2 inch to minus 3/8 inch.
    - 3) Greater than 3 foot dimension - plus 1 inch to minus 3/4 inch.
  - e. Relative alignment:
    - 1) Stairs:
      - (a) Difference in width between adjacent risers - 1/8 inch.
      - (b) Difference in width between adjacent treads - 1/4 inch.
      - (c) Maximum difference in height between risers in a flight of stairs - 3/8 inch.
      - (d) Maximum difference in width between treads in a flight of stairs - 3/8 inch.
    - 2) Grooves:
      - (a) Specified width 2 inches or less - 1/8 inch.
      - (b) Specified width between 2 inches and 12 inches - 1/4 inch
    - 3) Vertical alignment of outside corner of exposed corner columns and control joint grooves in concrete exposed to view - 1/4 inch in 10 feet not to exceed 3/4 inch.
    - 4) All other conditions - 3/8 inch in 10 feet.
    - 5) Offsets between pieces of formwork facing material:
      - (a) Class A - Architecturally or prominently exposed surfaces - 1/8 inch gradual or abrupt.
      - (b) Class B - Surfaces to receive plaster or stucco - 1/4 inch gradual or abrupt.
      - (c) Class C - Exposed surfaces in generally unfinished spaces - 1/4 inch abrupt, 1/2-inch gradual.
      - (d) Class D - Concealed surfaces - 1/2 inch gradual or abrupt.
- D. CONTRACTOR shall install all formwork and accessories for all facilities in accordance with manufacturers' instructions.
- E. When high range water reducer (superplasticizer) is used in concrete mix, forms shall be designed for full hydrostatic pressure in accordance with ACI 347.
- F. Make joints in forms watertight.
- G. Limit panel deflection to 1/360<sup>th</sup> of each component span to achieve tolerances specified.

### 1.3 SUBMITTALS

- A. Samples:
  - 1. Form Ties: Proposed method of sealing and water-stopping form tie hole. Coordinate with Drawing details.

- B. Shop Drawings:
  - 1. Submit for approval the following:
    - a. Taper tie installation, removal, and hole repair materials and procedures.
  - 2. Submit for information purposes the following:
    - a. Copies of manufacturer's data and installation instructions for proprietary materials, including form coatings, manufactured form systems, ties, and accessories.

#### **1.4 PRODUCT DELIVERY, STORAGE AND HANDLING**

- A. On delivery to job site, place materials in area protected from weather, in accordance with manufacturers' recommendations.
- B. Store materials above ground on framework or blocking. Cover wood for forms and other accessory materials with protective waterproof covering. Provide for adequate air circulation or ventilation. Store materials in accordance with the manufacturers' recommendations.
- C. Handle materials to prevent damage in accordance with the manufacturers' recommendations.

#### **1.5 QUALIFICATIONS**

- A. Formwork Designer: Formwork, falsework, and shoring design shall be by an engineer licensed in the state of Texas.

### **PART 2 PRODUCTS**

#### **2.1 FORM MATERIALS**

- A. Forms for Smooth Finish Concrete:
  - 1. Unless otherwise shown or specified, construct formwork for smooth concrete surfaces with plywood, metal, metal-framed plywood-faced, or other panel type materials acceptable to ENGINEER, to provide continuous, straight, smooth as-cast surfaces with no wood grain or other surface texture imparted by the formwork. Furnish in largest practical sizes to minimize number of joints and to conform to joint system shown or specified. Provide form material with sufficient thickness to withstand pressure of newly placed concrete without bow or deflection.
- B. Forms for Standard Finish Concrete:
  - 1. Form concrete surfaces designated to have a standard formed finish with plywood, lumber, metal, or other acceptable material. Provide lumber that is dressed on at least two edges and one side.
- C. Cylindrical Columns and Supports:
  - 1. Form round-section members with paper or fiber tubes, constructed of laminated plies using water-resistant type adhesive with wax-impregnated exterior for weather and moisture protection. Provide units with sufficient wall thickness to resist loads imposed by wet concrete without deformation.
    - a. Provide manufacturer's seamless units to minimize spiral gaps or seams.
  - 2. Fiberglass or steel forms may be used for cylindrical columns, if approved by ENGINEER.
- D. Form Ties:
  - 1. Provide factory-fabricated, removable, or snap off metal form ties, designed to prevent form deflection, and to prevent spalling of concrete surfaces upon removal. Materials used for tying forms will be subject to approval of ENGINEER.

2. Unless otherwise shown on the Drawings, provide ties so that portion remaining within concrete after removal of exterior parts is at least 1.5-inch from the outer concrete surface. Provide form ties that will leave a hole no larger than 1-inch diameter in the concrete surface.
  3. Ties for exterior walls, be low grade walls, fluid containment walls, and walls subject to hydrostatic pressure shall have water stops.
  4. All ties shall leave a uniform, circular hole when forms are removed.
  5. Provide stainless steel form ties for planned exposed tie hole locations, where shown on the Drawings. When used, tiebreak back point shall be at least 1-inch from outer concrete surface.
  6. Wire ties are not acceptable.
- E. Form Release Agent:
1. Material: Release agent shall not bond with, stain, or adversely affect concrete surfaces, and shall not impair subsequent treatments of concrete surfaces when applied to forms or form liners. A ready-to-use water-based material formulated to reduce or eliminate surface imperfections, containing no mineral oil or organic solvents. Environmentally safe, meeting local, state, and federal regulations and can be used in potable water facilities (NSF 61 approved).
  2. Manufacturers and Products:
    - a. Master Builders, Inc.; Rheofinish.
    - b. Cresset Chemical Company; Crete-Lease 20-VOC.
    - c. Or Engineer approved equal.

## 2.2 DESIGN OF FORMWORK

- A. Design, erect, support, brace and maintain formwork so that it shall safely support vertical and lateral loads that might be applied, until such loads can be supported by the concrete structure. Carry vertical and lateral loads to ground by formwork system or in-place construction that has attained adequate strength for this purpose. Construct formwork so that concrete members and structures are of correct size, shape, alignment, elevation and position.
- B. Design forms and falsework to include values of live load, dead load, weight of moving equipment operated on formwork, concrete mix, height of concrete drop, vibrator frequency, ambient temperature, foundation pressures, stresses, lateral stability, and other factors pertinent to safety of structure during construction.
- C. Provide shores and struts with positive means of adjustment capable of taking up formwork settlement during concrete placing operations, using wedges or jacks or a combination thereof. Provide trussed supports when adequate foundations for shores and struts cannot be secured.
- D. Support form facing materials by structural members spaced sufficiently close to prevent beyond tolerance deflection, in accordance with ACI 117. Fit forms placed in successive units for continuous surfaces to accurate alignment, free from irregularities and within allowable tolerances. For long span members without intermediate supports, provide camber in formwork as required for anticipated deflections resulting from weight and pressure of fresh concrete and construction loads.
- E. Design formwork to be readily removable without impact, shock or damage to concrete surfaces and adjacent materials.
- F. Provide formwork sufficiently tight to prevent leakage of cement paste during concrete placement. Solidly butt joints and provide backup material at joints as required to prevent leakage and fins.

- G. Omit side forms of footings and place concrete directly against excavation only when formally requested by CONTRACTOR, in writing, and accepted by ENGINEER, in writing. When omission of forms is accepted, provide additional concrete required beyond the minimum design profiles and dimensions of the footings as detailed. No additional compensation will be made to CONTRACTOR for additional concrete required.

## **PART 3 EXECUTION**

### **3.1 INSPECTION**

- A. CONTRACTOR shall examine the substrate and the conditions under which Work is to be performed and notify ENGINEER, in writing, of unsatisfactory conditions. Do not proceed with the Work until unsatisfactory conditions have been corrected in a manner acceptable to ENGINEER.
- B. Formwork that is excessively worn, damaged, rusting or otherwise incapable of producing straight and plumb surfaces will be rejected by the Owner, and new forms acceptable to the Owner will be supplied at the Contractor's expense.

### **3.2 FORM CONSTRUCTION**

- A. Construct forms complying with the requirements of ACI 347, to the exact sizes, shapes, lines and dimensions shown, as required to obtain accurate alignment, location and grades to tolerances specified, and to obtain level and plumb work in finished structures. Provide for openings, offsets, keyways, recesses, moldings, rustications, reglets, chamfers, blocking, screeds, bulkheads, anchorages and inserts, and other features required. Use selected materials to obtain required finishes. Finish shall be as determined by approved mock-up or sample panel, where requested by the Owner and as specified.
- B. Fabricate forms for easy removal without damaging concrete surfaces. Provide crush plates or wrecking plates where stripping may damage cast concrete surfaces. Provide top forms for inclined surfaces where the slope is too steep to place concrete with bottom forms only. Kerf wood inserts for forming keyways, reglets, recesses, and the like, to prevent swelling and assure ease of removal.
- C. Provide temporary openings where interior area of form work is inaccessible for cleanout, for inspection before concrete placement, and for placement of concrete. Brace temporary closures and set tightly to forms to prevent loss of cement paste. Locate temporary openings on forms in locations as inconspicuous as possible, consistent with requirements of the Work. Form intersecting planes of openings to provide true, clean-cut corners, with edge grain of plywood not exposed as form for concrete.
- D. Falsework:
  - 1. Erect falsework and support, brace and maintain it to safely support vertical, lateral and asymmetrical loads applied until such loads can be supported by in-place concrete structures. Construct falsework so that adjustments can be made for take-up and settlement.
  - 2. Provide wedges, jacks, or camber strips to facilitate vertical adjustments. Carefully inspect falsework and formwork during and after concrete placement operations to determine abnormal deflection or signs of failure; make necessary adjustments to produce finished Work of required dimensions.
- E. Forms for Smooth Finish Concrete:
  - 1. Do not use metal cover plates for patching holes or defects in forms.
  - 2. Provide sharp, clean corners at intersecting planes, without visible edges or offsets. Back joints with extra studs or girts to maintain true, square intersections.
  - 3. Use extra studs, walers and bracing to prevent bowing of forms between studs and to

avoid bowed appearance in concrete. Do not use narrow strips of form material that will produce bow. Exposed surfaces that visually exhibit bows in forms will be rejected and replaced where directed by the Engineer.

4. Assemble forms so they may be readily removed without damage to exposed concrete surfaces.
  5. Form molding shapes, recesses, rustication joints and projections with smooth-finish materials, and install in forms with sealed joints to prevent displacement.
- F. Corner Treatment:
1. Form exposed corners of beams, walls, foundations, bases, and columns to produce smooth, solid, unbroken lines, except as otherwise shown. Exposed corners shall be chamfered.
  2. Form chamfers with 3/4-inch by 3/4-inch strips, unless otherwise shown, accurately formed, and surfaced to produce uniformly straight lines and tight edge joints. Use rigid PVC chamfers for all architecturally formed concrete. Extend terminal edges to required limit and miter chamfer strips at changes in direction.
  3. Reentrant and unexposed corners may be formed either square or chamfered.
- G. Joints:
1. Refer to Section 03 25 01 of these Specifications for treatment of joints. Locate as shown on the Drawings and specified.
- H. Openings and Built-In Work:
1. Provide openings in concrete formwork shown or required by other Sections. Refer to Paragraph 1.1.B., above, for the requirements of coordination.
  2. Accurately place and securely support items to be built into forms.
- I. Sealing Formwork:
1. All formwork joints shall be tight fitting or otherwise sealed to prevent loss of cement paste.
  2. All formwork, which rests against concrete surfaces, shall be provided with a compressible gasket material between the concrete and edge of form to fill any irregularities and create a tight seal.
- J. Cleaning and Tightening:
1. Thoroughly clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt or other debris just before concrete is to be placed. Retighten forms immediately after concrete placement, as required to eliminate cement paste leaks.

### **3.3 FORM COATINGS**

- A. Coat forms contact surfaces with a non-staining form-coating compound before reinforcement is placed. Do not allow excess form coating material to accumulate in the forms or to come into contact with surfaces which will be bonded to fresh concrete. Apply in compliance with manufacturer's instructions.
- B. Coat steel forms with a non-staining, rust-preventative form oil or otherwise protect against rusting. Rust-stained steel formwork is not acceptable and shall be replaced by the Contractor where directed by the Owner.

### **3.4 INSTALLATION OF EMBEDDED ITEMS**

- A. Set and build into the formwork, anchorage devices and other embedded items, shown, specified, or required by other Sections. Refer to Paragraph 1.1.B., above, for the requirements of coordination. Use necessary setting drawings, diagrams, instructions, and directions.



- B. Edge Forms and Screeds Strips for Slabs:
  - 1. Set edge forms or bulkheads and intermediate screed strips for slabs to obtain required elevations and contours in the finished slab surface. Provide and secure units to support screeds.

**3.5 FIELD QUALITY CONTROL**

- A. Before concrete placement, CONTRACTOR shall check the formwork, including tolerances, lines, ties, tie cones, and form coatings. CONTRACTOR shall make corrections and adjustments to ensure proper size and location of concrete members and stability of forming systems.
- B. During concrete placement CONTRACTOR shall check formwork and related supports to ensure that forms are not displaced, and that completed Work shall be within specified tolerances.
- C. If CONTRACTOR finds that forms are unsatisfactory in any way, either before or during placing of concrete, placement of concrete shall be postponed or stopped until the defects have been corrected and reviewed by ENGINEER.

**3.6 REMOVAL OF FORMS**

- A. Conform to the requirements of ACI 301, Section 2 and ACI 347, Chapter 3.7, except as specified below.

	<u>Ambient Temperature (F)</u>				
	70°F - 95°F	60°F - 70°F	50°F - 60°F		Below 50°F
a. Walls <sup>1</sup>	2 days	2 days	3 days		Do not remove
b. Columns <sup>1</sup>	2 days	3 days	4 days		forms until site -
c. Beam/Soffits <sup>1</sup>	4 days	5 days	6 days		cured test cylinder
d. Slabs 5 in. thick or less	5 days	6 days	7 days		Develops 75% of
e. Slabs over 5 in. thick	5 days	6 days	7 days		28-day strength.

<sup>1</sup> Formwork not supporting concrete, such as side forms for beams, walls, and columns, may be removed after cumulatively curing at not less than 50 degrees Fahrenheit (10 degrees Celsius) for 12 hours after placing concrete, provided concrete is sufficiently hard to not be damaged by form removal, and provided curing and protection operations are maintained.

- B. Removal of Forms and Supports: Continue curing in accordance with Section 03 30 00, Cast-In-Place Concrete.
- C. When high-early strength concrete is specified, a schedule for removal of forms will be developed in the field from the age/strength relationships established for the materials and proportions used by tests in accordance with ACI 301.
- D. Form facing material shall remain in place a minimum of four days after concrete placement, unless otherwise approved by ENGINEER.
- E. Results of suitable control tests of field-cured specimens may be used as evidence that the concrete has attained sufficient strength and that supporting forms and shoring may be removed prior to the periods indicated herein.

F. The time for removal of all forms will be subject to ENGINEER'S approval.

**3.7 PERMANENT SHORES**

A. Provide permanent shores as defined in ACI 347.

B. Reshores shall not be permitted.

**3.8 RE-USE OF FORMS**

A. Clean and repair surfaces of forms to be re-used in the Work. Split, frayed, delaminated or otherwise damaged form facing material will not be acceptable. Apply new form coating compound material to concrete contact surfaces as specified for new formwork.

B. When forms are extended for successive concrete placement, thoroughly clean surfaces, remove fins and laitance, and tighten forms to close all joints. Align and secure joints to avoid offsets. Do not use "patched" forms. Form surfaces shall be subject to ENGINEER and OWNER approval.

**END OF SECTION**

**PART 1- GENERAL**

**1.1      WORK INCLUDED**

Furnish material and labor to form, tie, brace and support wet concrete, reinforcing steel and embedded items until the concrete has developed sufficient strength to remove forms.

**1.2      QUALITY ASSURANCE**

- A. **DESIGN CRITERIA:** Forms shall be designed for the pressure exerted by a liquid weighing 150 pounds per cubic foot. The rate of placing the concrete, the temperature of the concrete, and all other pertinent factors shall be taken into consideration when determining the depth of the equivalent liquid. An additional design live load of 50 pounds per square foot shall be used on horizontal surfaces.
- B. **ALIGNMENT CONTROL:** True alignment of walls and other vertical surfaces having straight lines or rectangular shapes shall be controlled and checked by the following procedures:
  - 1. Forming shall be arranged with provisions for adjusting the horizontal alignment of a form, after the form has been filled with concrete to grade, using wedges, turn-buckles, or other adjustment methods. Establish a transit line or other reference so that adjustments can be made to an established line while the concrete in the top of the form is still plastic.
  - 2. Adjusting facilities shall be at intervals which permit adjustments to a straight line. Concrete shall not be placed until adequate adjusting facilities are in place.

**1.3      SUBMITTALS**

Submittals shall be in accordance with Section 01 33 00, SUBMITTALS and shall include:

- A. **RECORD DATA**
  - 1. Manufacturers' literature for specified products.
- B. **Notification by Contractor**
  - 1. Submit Notification by Contractor (NBC) for inspection of all forms and reinforcing. NBC shall be submitted prior to installation of outside wall forms so that reinforcing and inside forms may be inspected.

**1.4      STANDARDS**

The applicable provisions of the following standards shall apply as if written here in their entirety:

- A. **American Concrete Institute (ACI) specifications:**
  - ACI 301                      Specifications for Structural Concrete
  - ACI 318                      Building Code Requirements for Structural Concrete
  - ACI 350                      Code Requirements for Environmental Engineering  
Concrete Structures
- B. **American Institute of Steel Construction (AISC) publication:**
  - AISC                          Manual of Steel Construction
- C. **American Iron and Steel Institute (AISI) publication:**
  - AISI                          Cold-Formed Steel Design Manual
- D. **American Plywood Association (APA) standards**

## E. DELIVERY AND STORAGE

Lumber for forms shall be stacked neatly on platforms raised above ground.

## 1.5 JOB CONDITIONS

- A. The Contractor shall notify the Engineer upon completion of various portions of the work required for placing concrete so that compliance with the plans and specifications may be monitored. The Engineer will authorize the Contractor to proceed with the placement after this has been completed and corrections, if required, have been made.
- B. In hot weather, both sides of the face forms may be required to be treated with oil to prevent warping and to secure tight joints.

## 2.0 PRODUCTS

### 2.1 MATERIALS

- A. LUMBER: Properly seasoned and of good quality; free from loose or unsound knots, knot holes, twists, shakes, decay, splits, and other imperfections which would affect its strength or impair the finished surface of the concrete.
- B. FORM OIL: Light, clear oil; shall not discolor or injuriously affect the concrete surface, subsequent coatings, or delay or impair curing operations.

### 2.2 FABRICATIONS

- A. LUMBER: Lumber for facing or sheathing shall be surfaced on at least one (1) side and two (2) edges and sized to uniform thickness. Lumber of nominal 1" thickness or plywood of 3/4" thickness shall be permitted for general use on structures, if backed by a sufficient number of studs and wales.
- B. FORMS
  - 1. Forms shall be built mortar-tight and of material sufficient in strength to prevent bulging between supports.
  - 2. Reused forms or form lumber shall be maintained clean and in good condition as to accuracy, shape, strength, rigidity, tightness, and smoothness of surface.
  - 3. All forms shall be so constructed as to permit removal without damage to the concrete. Exercise special care in framing forms for copings, offsets, railing and ornamental work, so that there will be no damage to the concrete when the forms are removed.
- C. METAL FORMS
  - 1. The specifications for "Forms" regarding design, mortar tightness, filleted corners, beveled projections, bracing, alignment, removal, re-use, oiling, and wetting shall apply equally to metal forms.
  - 2. The metal used for forms shall be of such thickness that the forms will remain true to shape. Bolt and rivet heads on the facing sides shall be countersunk. Clamps, pins, or other connecting devices shall be designed to hold the forms rigidly together and to allow removal without injury to the concrete.
  - 3. Metal forms which do not present a smooth surface or line up properly shall not be used. Exercise special care to keep metal free from rust, grease, or other foreign material that discolors the concrete.

#### D. FORM TIES

1. Metal form ties shall be used to hold forms in place and to provide easy metal removal. The use of wire for ties shall not be permitted.
2. Leave no metal or other material within 2 inches of the surface, when removing form tie assemblies which are used inside the forms to hold the forms in correct alignment. The assembly shall provide cone-shaped depressions in the concrete surface at least 1 inch in diameter and 2 inches deep to allow filling and patching. Such devices, when removed, shall leave a smooth depression in the concrete surface without undue injury to the surface from chipping or spalling.
3. Burning off rods, bolts, or ties shall not be permitted.
4. Metal ties shall be held in place by devices attached to wales. Each device shall be capable of developing the strength of the tie.
5. Metal and wooden spreaders which are separate from the forms shall be wired to top of form and shall be entirely removed as the concrete is placed.
6. In the construction of basement or water bearing walls, the portion of a single rod tie that is to remain in the concrete shall be provided with a tightly fitted washer at midpoint to control seepage. Multi-rod ties do not require washers. The use of form ties which are tapered or encased in paper or other material to allow the removal of complete tie, and which leave a hole through the concrete structure, shall not be permitted.

#### E. FALSEWORK

1. Falsework shall be designed and constructed so that no excessive settlement or deformation occurs. Falsework shall provide necessary rigidity.
2. Timber used in falsework centering shall be sound, in good condition and free from defects which impair its strength.
3. Steel members shall be of adequate strength and shape for the intended purpose.
4. Timber piling used in falsework may be of any wood species which satisfactorily withstands driving and which adequately supports the superimposed load.
5. When sills or timber grillages are used to support falsework columns, unless founded on solid rock, shale, or other hard materials, place them in excavated pits. Backfill to prevent the softening of the supporting material from form drip or from rains that may occur during the construction process. Sills or grillages shall be of ample size to support the superimposed load without settlement.
6. Falsework not founded on a satisfactory spread footing shall be supported on piling, which shall be driven to a bearing capacity to support the superimposed load without settlement.

### 3.0 PART 1- EXECUTION

#### 3.1 PREPARATION

Before placing concrete, insure that embedded items are correctly, firmly, and securely fastened into place. Embedded items shall be thoroughly clean and free of oil and other foreign material. Anchor bolts shall be set to the correct location, alignment, and elevation by the use of suitable anchor bolt templates.

#### 3.2 INSTALLATION

##### A. PRE-PLACEMENT

1. During the elapsed time between building the forms and placing the concrete, maintain the forms to eliminate warping and shrinking.

2. Treat the facing of forms with a suitable form oil before concrete is placed. Apply oil before the reinforcement is placed. Wet form surfaces which will come in contact with the concrete immediately before the concrete is placed.
3. At the time of placing concrete, the forms shall be clean and entirely free from all chips, dirt, sawdust, and other extraneous matter at the time. Forms for slab, beam and girder construction shall not have tie wire cuttings, nails or any other matter which would mar the appearance of the finished construction. Clean forms and keep them free of foreign matter during concrete placement.

**B. PLACEMENT**

1. Set and maintain forms to the lines designated, until the concrete is sufficiently hardened to permit form removal. If, at any stage of the work, the forms show signs of bulging or sagging, immediately remove that portion of the concrete causing this condition. If necessary, reset the forms and securely brace against further movement.
2. Provide adequate cleanout openings where access to the bottom of the forms is not otherwise readily attainable.
3. Carefully and accurately place and support reinforcement in concrete structures.

**C. REMOVAL**

Remove forms so that the underlying concrete surface is not marred or damaged in any way. Forms shall not be removed until the concrete has attained sufficient strength to safely carry the dead load, but in no case less than the number of curing days set forth in the following table:

Forms for concrete of minor structural load carrying importance	1 day
Forms for walls, columns, sides of drilled shafts, massive structural components and other members not resisting a bending moment during curing	1 day
Forms and falsework under slabs, beams, and girders where deflections due to dead load moment may exist (for spans < or = 10 ft.)	7 days
Forms and falsework under slabs, beams, and girders where deflections due to dead load moment may exist (for spans > 10 ft. and < or = 20 ft.)	14 days

**END OF SECTION**

**PART 1- GENERAL**

**1.1 SUMMARY**

- A. Section includes: Hydrophilic rubber waterstop.

**1.2 SUBMITTALS**

- A. General:

1. Submit the following items for each type, style, and size of hydrophilic waterstop to be installed.
2. Product data:
  - a. Manufacturer's product data sheets.
    - 1) Include complete physical dimensions, expansion characteristics, and laboratory test reports indicating that average material properties conform to the requirements specified.
    - 2) Provide data sheets for all materials to be included in the waterstop system.
3. Samples:
  - a. Minimum 6-inch long samples of each type of waterstop to be used if requested by the Engineer.
4. Manufacturer's installation instructions:
  - a. Installation instructions and recommended installation details for the complete waterstop system, and for each component used in that system.

**PART 2- PRODUCTS**

**2.1 HYDROPHILIC RUBBER WATERSTOP**

- A. General:

1. System composed of flexible hydrophilic urethane polymer with preformed strips, adhesives, paste, fasteners, and other accessories required for a complete and watertight installation.
  - a. To ensure compatibility of materials, a single manufacturer shall provide all products and accessories for the hydrophilic waterstop system.
  - b. Products incorporating bentonite are not acceptable under this Section.
  - c. Provide waterstop and accessories resistant to degradation under cyclic wetting and drying and to chemicals typically found in water treatment structures.

- B. Hydrophilic strip waterstop.
  - 1. Pre-formed strips of flexible hydrophilic rubber designed to undergo controlled expansion when exposed to moisture.
    - a. Strips manufactured to limit expansion in directions parallel to the plane of the joint, and to direct expansion against confining material perpendicular to that plane.
  - 2. Provide normal or low-expansion pressure as scheduled and as indicated on the Drawings.
  - 3. Manufacturers. One of the following, or equal.
    - a. Hydrophilic strip.
      - 1) Adeka Ultra Seal USA: MC-2010MN.
      - 2) Greenstreak: Hydrotite CJ1020-2K.
    - b. Low expansion hydrophilic strip.
      - 1) Adeka Ultra Seal USA: KBA-1510FP.
      - 2) Greenstreak: Hydrotite CJ0725-3K.
- C. Hydrophilic paste waterstop.
  - 1. Single-component gun grade paste of hydrophilic rubber designed to undergo controlled expansion when exposed to moisture after initial curing.
  - 2. Manufacturers: One of the following, or equal.
    - a. Adeka Ultra Seal USA: P-201.
    - b. Greenstreak: Leakmaster LV-1

**PART 3- EXECUTION**

**3.1 INSTALLATION**

- A. Install products in accordance with manufacturer's instructions and recommended details.
- B. Prepare concrete joint surfaces:
  - 1. Use wire brushing or scraping to expose an uncontaminated, solid surface.
  - 2. Clean prepared surface with high-pressure air or water to remove residue and debris.
  - 3. Confirm that prepared surfaces conform to manufacturer's recommendations for surface profile and moisture conditions before installing materials.
- C. Provide manufacturer's recommended lap, splice, and corner details for hydrophilic waterstops.



1. Use hydrophilic paste at all corner joints and overlap splices of hydrophilic strips.
- D. Hydrophilic strip waterstop.
1. Install primers and adhesives when recommended by the manufacturer before setting hydrophilic strips.
  2. Keep hydrophilic strip taut during the fastening process.
  3. Secure hydrophilic strip in place with concrete nails, screws, or adhesive.
  4. Provide installation with no gap between the hydrophilic strip and the concrete to which it is attached. At rough or irregular surfaces, set hydrophilic strip waterstop strip in a bead of hydrophilic paste.
    - a. Fill all voids and rough areas under the hydrophilic strip with hydrophilic paste.
    - b. Allow hydrophilic paste to cure in accordance with manufacturer's recommendations before encapsulating paste in fresh concrete.

### 3.2 SCHEDULE

- A. At the following joint locations/conditions, use the hydrophilic strip waterstop configuration noted.
- B. Concrete construction joints:
1. Under all of the following conditions, use hydrophilic strip waterstop set in a bed of hydrophilic paste waterstop, and screw strip waterstop to concrete surface:
    - a. Slab or wall thickness is greater than 10 inches, and
    - b. Waterstop is placed between 2 rows of steel reinforcement, and
    - c. Concrete cover from waterstop to nearest concrete face is at least 4 inches.
  2. Under any one of the following conditions, use low-expansion hydrophilic strip waterstop set in bed of hydrophilic paste waterstop and screw strip to concrete surface:
    - a. Waterstop is placed on 1 side of a single row of steel reinforcement, or
    - b. Concrete cover from waterstop to nearest concrete face is less than 4 inches.
- C. Pipe penetrations through concrete:
1. Pipe diameter less than 4 inches: Not allowed.
  2. Pipe diameter of 4 to 24 inches: Continuous bead of hydrophilic paste waterstop, minimum 1/4 inch high by 1/2 inch wide, encircling pipe.

3. Pipe diameter greater than 24 inches: Continuous hydrophilic strip waterstop around perimeter of pipe, with hydrophilic paste seal at lapped ends of strip.

**END OF SECTION**

## **03 20 00      CONCRETE REINFORCEMENT**

### **PART 1-    GENERAL**

#### **1.1    RELATED DOCUMENTS**

- A. Provisions established within the General and Supplementary General Conditions of the Contract, Division 1- General Requirements, and the Drawings are collectively applicable to this Section.

#### **1.2    SELECTION INCLUDES**

- A. Reinforcing steel bars, and welded steel wire fabric for cast-in-place concrete.
- B. Support chairs, bolsters, and spacers, for supporting reinforcement.

#### **1.3    RELATED SECTIONS**

- A. Section 03 30 00 Cast-In-Place Concrete

#### **1.4    QUALITY ASSURANCE**

- A. References
  - 1. ACI-301-1 Specifications for Structural Concrete for Buildings.
  - 2. ACI 315- Details of Concrete Reinforcement.
  - 3. ACI 318- Building Code Requirements for Reinforced Concrete.
  - 4. ACI SP-66- American Concrete Institute- Detailing Manual.
  - 5. ANSI/ASTM A82- Cold Drawn Steel Wire for Concrete Reinforcement.
  - 6. ANSI/ASTM A185 Welded Steel Wire Fabric for Concrete Reinforcement.
  - 7. ASTM A706-Low Alloy Steel Deformed bars for Concrete Reinforcement.
  - 8. ANSI/AWS D1.4- Structural Welding Code Reinforcing Steel.
  - 9. ASTM-A615-Deformed and Plain Billet- Steel Bars for Concrete Reinforcement.
  - 10. CRSI- Manual of Practice.
  - 11. CRSI 63- Recommended Practice for Placing Reinforcing Bars.
  - 12. CRSI 65- Recommended Practice for Placing Bar Supports, Specifications and Nomenclature.
- B. Perform concrete reinforcement work in accordance with CRSI Manual of Standard Practice, Documents 63 and 65, ACI 318.
- C. Conform to ACI 301 and 315.

#### **1.5    SUBMITTALS**

- A. Submit mill test certificates of supplied concrete reinforcing, indicating physical and chemical analysis as per Section 01 33 00.

## **1.6 DELIVERY AND STORAGE**

- A. Stack reinforcing steel in tiers and mark so that each length, size, shape and location can be readily determined. Exercise care to maintain reinforcement free of dirt, mud paint or rust.
- B. Store materials and accessories on dunnage and under protective sheeting.

## **PART 2- PRODUCTS**

### **2.1 MATERIALS**

- A. REINFORCING STEEL: ASTM A615, grade billet-steel deformed bars, uncrated finish, 60 KSI yield grade for no. 4 bars and larger, Grade 40 for no. 3. bars; ASTM A706, grade 40 weldable for bars welded to steel members.
- B. Welded Steel Wire Fabric: ANSI/ASTM A185 plain type, in flat sheets; uncrated finish.

### **2.2 ACCESSORY MATERIALS**

- A. Tire Wire: Minimum 16 gage annealed type.
- B. Chairs, Bolsters, Bar Supports, and Spacers: Sized and shape for strength and support of reinforcement during installation and placement of concrete including load bearing pad on bottom to prevent vapor barrier puncture.
- C. Chairs, Bolsters, Bar Supports, Spacers Adjacent to Architectural Concrete Surfaces: Plastic coated type, size and shaped as required.

### **2.3 FABRICATION**

- A. Fabricate in accordance with ACI 315, providing concrete cover specified in Section 03300.
- B. Locate reinforcing splices not indicated on Drawings at points of minimum stress.
- C. Weld reinforcing bars in accordance with ANSI/AWS D1.4.
- D. Splicing of reinforcement, where required, shall provide sufficient lap to permit the transfer of the stress in accordance with the requirements of this specification. Splice wall vertical reinforcement at location of horizontal construction joints.
- E. Unless otherwise noted on the drawings to be more, lap reinforcement 36 bar diameters (18 inch minimum) at all splices or have dowels of same bar section and spacing as the bars to be spliced. Lap bars at least 36 diameters at II corners and at abrupt changes in direction of walls.
- F. Detail column/pier splices so as not to interfere with beam steel.

## **PART 3- EXECUTION**

### **3.1 PREPARATION**

- A. Before placing concrete, clean reinforcement of foreign particles or coatings.
- B. Placement:

1. Place reinforcement in accordance with CRSI "Placing Reinforcing Bars" and ACI 318, with provisions of ACI 318 governing.
2. Move bars as necessary to avoid interference with other reinforcing steel, conduits, or embedded items.
3. If bars are moved more than one bar diameter or enough to exceed tolerances, submit resulting arrangement of bars to Owner's Representative for review.
4. Place, support, and secure reinforcement against displacement. Do not deviate from alignment or measurement. Place in accordance with CRSI recommendations. Do not heat, cut or bend bars without Architect's approval. Provide minimum 36 bar diameter lap (18 inches Minimum) at splices unless specifically noted otherwise on drawings. Stagger splices in adjacent bars.
5. Do not displace or damage vapor barrier required by Section 03 30 00.
6. Refer to Section 03 30 00 for minimum coverage of concrete unless noted otherwise on the Drawings.
7. Place reinforcement, at time of concrete placing, free of mud, oil, or other materials that adversely affect or reduce bond.
8. Reinforcement with rust, mill scale, or both shall be considered satisfactory, provided minimum dimension, including height of deformation, and weight of hand-wire-brushed test specimen are not less than ASTM A 615 requirements.
9. Support reinforcement and fasten together to prevent displacement by construction loads of placing concrete. Use No. 16 gauge black annealed wire at all joints.
10. Over formwork, use metal or plastic bar chairs and spacers to support reinforcement.
11. Where concrete surface will be exposed to weather in finished structure, use non-corrosive or corrosion protected accessories within ½- inch of concrete surface.
12. Where successive mats or rolls of reinforcing fabric are continuous, overlap welded wire fabric so that overlap measured between outermost cross wires of each fabric sheet is not less than spacing of cross wires plus 2 inches.
13. Bars having splices not shown on shops drawings will be subject to rejection.
14. Do not bend reinforcement after being embedded in hardened concrete.
15. Do not allow bars to be in contact with dissimilar materials.

**END OF SECTION**

**03 25 01 CONCRETE JOINTS**

**PART 1 GENERAL**

**1.1 DESCRIPTION**

- A. Scope:
  - 1. CONTRACTOR shall provide all labor, materials, equipment, and incidentals as shown, specified, and required to furnish and install concrete joints.
  - 2. The types of concrete joints required include the following:
    - a. Construction joints.
    - b. Expansion joints.
    - c. Control/contraction joints.
    - d. Isolation joints.
    - e. Waterstops.
- B. General: All joints subject to hydrostatic pressure or in contact with soil, except non-water bearing slabs-on-grade, shall be provided with continuous waterstop.
- C. Related Sections:
  - 1. Section 03 10 00 Concrete Formwork.
  - 2. Section 03 20 00 Concrete Reinforcement.  
Section 03 30 00 Cast-In-Place Concrete.

**1.2 QUALITY ASSURANCE**

- A. Regulatory Requirements: Acceptance of pourable joint filler for potable water structures by federal EPA or by state health agency.
  - 1. Pourable Joint Filler: Certified as meeting NSF 61.
- B. Qualifications: Water stop manufacturer shall demonstrate five (5) years, minimum, continuous successful experience in production of specified water stops
- C. Reference Standards: Comply with applicable provisions and recommendations of the following, except as otherwise shown or specified:
  - 1. ACI 301, Standard Specifications for Structural Concrete.
  - 2. ASTM C 920, Standard Specification for Elastomeric Joint Sealants.
  - 3. ASTM D 412, Test Methods for Vulcanized Rubber and Thermoplastic Rubbers and Thermoplastic Elastomers-Tension.
  - 4. ASTM D 624, Test Method for Tear Strength of Conventional Vulcanized Rubber and Thermoplastic Elastomers.
  - 5. ASTM D 1752, Standard Specification for Preformed Sponge Rubber and Cork Expansion Joint Fillers for Concrete Paving and Structural Construction.
  - 6. ASTM D 2240, Test Method for Rubber Property - Durometer Hardness.
  - 7. CRD-C572, U.S. Army Corps of Engineers Specifications for Polyvinyl-Chloride Waterstop.
  - 8. ASTM A 240 - Test Method for Stainless Steel Physical Properties.
  - 9. ANSI/NSF 61, Drinking Water System Components-Health Effects.
  - 10. COE CEGS-03250 July 1995 Guide Specification for Military Construction.
  - 11. EPA Title 40 CFR Section 265.193.
- D. All manufactured items shall be installed in accordance with manufacturer's instructions.

**1.3 SUBMITTALS**

- A. Shop Drawings: Submit for approval the following:
  - 1. Manufacturer's specifications and installation instructions for all materials required.
  - 2. Manufacturer's literature for waterstops include waterstop profiles with dimensions, shop made fittings, field splice joint detailed instructions, MSDS sheets, installation instructions, and certificate of compliance to specified physical properties.

3. Layout of all construction, contraction, and expansion joint locations prior to the submittal of steel reinforcement Shop Drawings.

#### **1.4 PRODUCT DELIVERY, STORAGE AND HANDLING**

- A. All materials used for joints in concrete shall be stored on platforms or in enclosures and covered to prevent contact with the ground and exposure to the weather and direct sunlight. Storage and handling requirements of the manufacturer shall also be followed.

### **PART 2 PRODUCTS**

#### **2.1 WATERSTOPS**

- A. Polyvinyl Chloride:
  1. Material Requirements:
    - a. Waterstops shall be extruded from an elastomeric polyvinyl chloride compound containing the plasticizers, resins, stabilizers, and other materials necessary to meet the requirements of these Specifications and the requirements of CRD-C572. No reclaimed or scrap material shall be used.
    - b. Tensile strength of finished waterstop: 1400 psi, minimum.
    - c. Ultimate elongation of finished waterstop: 280 percent, minimum.
    - d. Minimum thickness shall be 3/8-inch.
    - e. Waterstops shall be centerbulb ribbed type and sized as specified in the Drawings.
  2. Product and Manufacturer: Provide one of the following:
    - a. Greenstreak, Inc.
    - b. Vinylex Corp.

#### **2.2 HYDROPHILIC WATERSTOP MATERIALS**

- A. General Material Properties
  1. Hydrophilic waterstop materials shall be bentonite-free and shall expand by a minimum of 80 percent of dry volume in the presence of water to form a watertight joint seal without damaging the concrete in which it is cast. Provide only where indicated in the Contract Documents.
  2. The material shall be composed of resins and polymers which absorb water and cause an increase in volume in a completely reversible and repeatable process. The waterstop material shall be dimensionally stable after repeated wet-dry cycles with no deterioration of swelling potential.
  3. Select materials which are recommended by the manufacturer for the type of liquid to be contained.
- B. Hydrophilic Rubber Waterstop
  1. The minimum cross-sectional dimensions shall be 3/16-inch by 3/4-inch. Waterstop shall be capable of withstanding hydrostatic head pressures relevant to the Work but not less than 100-feet of head pressure.
  2. Product and Manufacturer: Provide one of the following:
    - a. Duroseal Gasket, by BBZ USA, Inc.
    - b. Adeka Ultraseal MC-2010M, by Asahi Denka Kogyo K.K.
    - c. SikaSwell S by the Sika Corporation.
- C. Hydrophilic Sealant:
  1. The hydrophilic sealant shall adhere firmly to concrete, metal, and PVC in dry or damp condition. When cured it shall be elastic indefinitely.
  2. Product and Manufacturer: Provide one of the following:
    - a. Duroseal Paste, by BBZ USA, Inc.
    - b. Adeka Ultraseal P-201, by Asahi Denka Kogyo K.K.
- D. Hydrophilic Injection Resin
  1. Hydrophilic injection resin shall be acrylate-ester based. The viscosity shall be less than 50 cps. The resin shall be water soluble in its uncured state,

solvent free, and non-water reactive. In the cured state it shall form a solid hydrophilic flexible material which is resistant to permanent water pressure and shall not attack bitumen, joint sealants, or concrete.

2. Product and Manufacturer: Provide one of the following:
  - a. Duroseal Inject 1K/2K, by BBZ USA, Inc.
  - b. Sika Injection 29, by Sika Corporation.

### **2.3 CONCRETE CONSTRUCTION JOINT ROUGHENER**

- A. Provide a water-soluble non-flammable, surface-retardant roughener.
- B. Product and Manufacturer: Provide one of the following:
  1. Rugasol-S, as manufactured by Sika Corporation for horizontal joints only.
  2. Concrete Surface Retarder-Formula S, as manufactured by Euclid Chemical Company, for horizontal joints only.
  3. Concrete Surface Retarder-Formula F, as manufactured by Euclid Chemical Company, for vertical joints only.

### **2.4 EPOXY BONDING AGENT**

- A. Provide a two-component epoxy-resin bonding agent.
- B. Product and Manufacturer: Provide one of the following:
  1. Sikadur 32 Hi-Mod LPL, as manufactured by Sika Corporation.
  2. Eucopoxy LPL, as manufactured by the Euclid Chemical Company.

### **2.5 EPOXY-CEMENT BONDING AGENT**

- A. Provide a three-component epoxy resin-cement blended formulated as a bonding agent.
- B. Product and Manufacturer: Provide one of the following:
  1. Sika Armatec 110 EpoCem, as manufactured by Sika Corporation.
  2. Corr-Bond, as manufactured by the Euclid Chemical Company.

### **2.6 NEOPRENE BEARING PADS**

- A. Product and Manufacturer: Provide one of the following:
  1. 65 Durometer, Sheet Neoprene No. 1200, as manufactured by Williams Products Company.
  2. Or approved equal.

### **2.7 JOINT SEALANT**

- A. Sealant shall be a two-part polyurethane type sealant meeting the requirements of ASTM C 920, Type M, Class 25. The manufacturer's recommended primer must be used with the sealant.
- B. The sealant shall meet the following requirements (measured at 73 degrees F and 50 percent RH):
  1. Ultimate hardness (ASTM D 2240, Type A, Shore): 20 to 45.
  2. Tensile strength (ASTM D 412): 200 psi, minimum.
  3. Ultimate elongation (ASTM D 412): 400 percent, minimum.
  4. Tear strength (ASTM D 624, die C): 75 pounds per inch of thickness, minimum.
  5. Color: light gray.
- C. Product and Manufacturer: Provide one of the following:
  1. Sikaflex-2c, as manufactured by Sika Corporation.
  2. Or approved equivalent.

### **2.8 SEALANT ACCESSORIES**

- A. Backer Rod: Backer rod shall be an extruded closed-cell polyethylene foam rod.



The material shall be compatible with the sealant material used and shall have a tensile strength of not less than 40 psi and a compression deflection of approximately 25 percent at 8 psi. The rod shall be 1/8-inch larger in diameter than the joint width at joints less than 3/4-inch wide and 1/4-inch larger in diameter at joints 3/4-inch and wider.

- B. Bond Breaker Tape: Bond breaker shall be polyethylene or TFE-fluorocarbon self-adhesive tape, as recommended by the manufacturer.

## **PART 3 EXECUTION**

### **3.1 INSPECTION**

- A. CONTRACTOR shall examine the substrate and the conditions under which Work is to be performed and notify ENGINEER, in writing, of unsatisfactory conditions. Do not proceed with the Work until unsatisfactory conditions have been corrected in a manner acceptable to ENGINEER.

### **3.2 CONSTRUCTION JOINTS**

- A. Comply with the requirements of ACI 301 and as specified below.
- B. Locate and install construction joints as shown on the Drawings. Additional construction joints shall be located as follows:
  - 1. In walls locate vertical joints at a spacing of 40 feet maximum and approximately 10 feet from corners or as specified in the Drawings.
  - 2. In foundation slabs and slabs on grade locate joints at a spacing of approximately 40 feet. Place concrete in a strip pattern not to exceed 100 linear feet, unless otherwise indicated on the Drawings, to a maximum of 5000 square feet in any one placement.
  - 3. In mats and structural slabs and beams, at a spacing of approximately 40 feet. Locate joints in compliance with ACI 301, unless otherwise indicated on the Drawings.
  - 4. Provide other additional construction joints as required to satisfactorily complete all Work.
- C. Horizontal Joints:
  - 1. Roughen concrete at the interface of construction joints by abrasive blasting, hydroblasting, or the use of surface retardants and water jets to expose the aggregate and remove accumulated concrete on projecting rebar immediately subsequent to form stripping, unless otherwise approved by ENGINEER. Immediately before placing fresh concrete, thoroughly clean the existing contact surface using a stiff brush or other tools and a stream of water under pressure. The surface shall be clean and wet, but free from pools of water at the moment the fresh concrete is placed.
  - 2. Remove laitance, waste mortar or any other substance which may prevent complete adhesion. Where joint roughening was performed more than seven days prior to concrete placement or where dirt or other bond reducing contaminants are on the surface, additional light abrasive blasting or hydroblasting shall be done to remove laitance and all bond reducing materials just prior to concrete placement.
  - 3. Place a 2-inch-thick coat of mortar, one-part sand and one-part cement with water added to a flowable consistency or a 4-inch layer of Construction Joint Grout, as specified in Section 03 60 01 over the contact surface of the old concrete. Place fresh concrete before the mortar or grout has attained its initial set. If the concrete mix has the slump increased to at least 6- inches by addition of a high range water reducer, the placement of mortar or grout may be omitted.
- D. Vertical Joints:
  - 1. Apply roughener to the form in a thin, even film by brush, spray, or roller in accordance with the manufacturer's instructions. After roughener is dry, concrete may be placed.
  - 2. When concrete has been placed, remove joint surface forms as early as is necessary to allow for removal of the surface retarded concrete. Forms covering member surfaces shall remain in place as required by Section 03 10

00, Concrete Formwork. Wash loosened material off with high-pressure water spray to obtain roughened surface subject to approval by ENGINEER. Alternately, the surface shall be roughened by abrasive blasting or hydroblasting to expose aggregate. The outer 1-inch of each side of the joint face shall be masked and protected from the blasting to avoid damage to the member surface.

### **3.3 EXPANSION JOINTS**

- A. Comply with the requirements of ACI 301 and as specified below.
- B. Locate and install expansion joints as shown on the Drawings. Install joint filler in accordance with manufacturer's instructions. Sealants shall be installed as specified herein.

### **3.4 CONTROL JOINTS**

- A. Control joints shall be provided in non-water bearing slabs on grade and where shown in the drawings. A groove, with a depth of at least 25 percent of the slab thickness, shall be formed or saw-cut in the concrete. This groove shall be filled with joint sealant material.
- B. Where the control joint is formed by sawcutting, the cut shall be made immediately after the concrete has set enough to support the saw and be cut without being damaged or to cause curling. The concrete shall be kept continually moist until the cutting operation.
- C. Control joints may be formed with a tool or by insertion of a joint forming strip. After the concrete has gained its design strength, the upper portion of the joint forming strip shall be removed, and the void filled with sealant.

### **3.5 ISOLATION JOINTS**

- A. Wherever a sidewalk, paving or other slab on grade abuts a concrete structure and is not shown doweled into that structure, an isolation joint shall be provided. Such joint shall be formed by a 1/2-inch joint filler with the upper 1/2-inch of the joint filled with sealant.

### **3.6 WATERSTOPS**

- A. General:
  - 1. Comply with the requirements of ACI 301 and as specified below. All joints shall be made in accordance with manufacturer's instructions.
  - 2. Obtain ENGINEER'S approval for waterstop locations not shown on the Drawings.
  - 3. Provide polyvinyl chloride waterstops in all joints in concrete which are intended to retain liquid or are located below grade up to an elevation at least 12-inches above grade or to an elevation at least 12-inches above overflow liquid level in tanks, whichever is higher, except where otherwise shown on the Drawings.
- B. Polyvinyl Chloride Waterstop:
  - 1. Tie waterstop to reinforcement, at a maximum spacing of 18-inches, so that it is securely and rigidly supported in the proper position during concrete placement. Continuously inspect waterstops during concrete placement to ensure their proper positioning.
  - 2. Splices in waterstops shall be performed by heat sealing the adjacent waterstop sections in accordance with the manufacturer's printed recommendations. It is required that:
    - a. The material shall not be damaged by heat sealing.
    - b. The splices shall have a tensile strength of not less than 60 percent of the unspliced materials tensile strength.
    - c. The continuity of the waterstop ribs and of its tubular center axis shall be maintained.

3. Only prefabricated mitered and beveled type joints of the ends of two identical waterstop sections shall be allowed to be made while the material is in the forms.
  4. All joints with waterstops involving more than two ends to be jointed together, and all joints which involve an angle cut, alignment change, or the joining of two dissimilar waterstop sections shall be prefabricated by CONTRACTOR or manufacturer prior to placement in the forms, allowing not less than 24-inch-long strips of waterstop material beyond the joint. Upon being inspected and approved, such prefabricated waterstop joint assemblies shall be installed in the forms and the ends of the 24-inch strips shall be welded to the straight run portions of waterstop in place in the forms.
  5. Where a centerbulb waterstop intersects and is jointed with a non-centerbulb waterstop, care shall be taken to seal the end of the centerbulb, using additional PVC material, if required.
  6. The symmetrical halves of the waterstops shall be equally divided between the concrete placements at the joints and centered within the joint width, unless shown otherwise. Centerbulb waterstops shall be placed in expansion joints so that the centerbulb is centered on the joint filler material.
  7. When any waterstop is installed in the forms or is embedded in the first concrete placement and the waterstop remains exposed to the atmosphere for more than four days, suitable precautions shall be taken to shade and protect the exposed waterstop from direct rays of the sun during the entire exposure and until the exposed portion of the waterstop is embedded in concrete.
  8. Waterstop placed in joints intended for future concrete placement shall be protected from direct rays of the sun by temporary means until a permanent cover is installed so that the waterstop is not exposed to the direct rays of the sun for more than a total of four days.
- C. Hydrophilic Rubber Waterstop and Sealant
1. Where a hydrophilic rubber waterstop or sealant is called for in the Contract Documents, or here approved by the ENGINEER, it shall be installed with the manufacturer's instructions and recommendations; except, as modified herein.
  2. When requested by the ENGINEER, the manufacturer shall provide technical assistance in the field.
  3. The waterstop or sealant shall be located as near as possible to the center of the joint and it shall be continuous around the entire joint. The minimum distance from the edge of the waterstop to the face of the member shall be 3-inches.
  4. Where a hydrophilic rubber waterstop is used in combination with PVC waterstop, the hydrophilic rubber waterstop shall overlap the PVC waterstop for a minimum of 6-inches. The contact surface between the hydrophilic rubber waterstop the PVC waterstop shall be filled with hydrophilic sealant.
  5. Where wet curing methods are used, hydrophilic rubber waterstop and sealant shall be applied after curing water is removed and just prior to the closing up of the forms for the concrete placement. Hydrophilic rubber waterstop and sealant shall be protected from the direct rays of the sun and from becoming wet prior to concrete placement. If the material does become wet and expands, it shall be allowed to dry until it has returned to its original cross-sectional dimensions before concrete is placed.
  6. The hydrophilic rubber waterstop shall be installed in a bed of hydrophilic sealant, before skinning and curing begins, so that any irregularities in the concrete surface are completely filled and the waterstop is bonded to the sealant. After the sealant has cured, concrete nails, with washers of a diameter equal to the waterstop width, shall be placed to secure the waterstop to the concrete at a maximum spacing of 18-inches.
  7. Prior to installation of hydrophilic sealant, the concrete surface shall be wire brushed or sand blasted to remove any laitance or other materials that may interfere with the bonding. Surfaces of metal or PVC to receive sealant shall be cleaned of paint and any material that may interfere with bond. When sealant alone is shown on the Contract Documents, it shall be placed in a

built-up bead which has a triangular cross section with each side of the triangle at least 3/4- inch in length, unless indicated otherwise. Concrete shall not be placed until the sealant has cured as recommended by the manufacturer.

### **3.7 BONDING AGENT**

- A. Use epoxy bonding agent for bonding of fresh concrete to concrete that has been in place for at least 60 days or to existing concrete.
- B. Use epoxy-cement bonding agent for the following:
  - 1. Bonding toppings and concrete fill to concrete that has been in place for at least 60 days or to existing concrete.
  - 2. For all locations where bonding agent is required and concrete cannot be placed within the open time period of epoxy bonding agent.
- C. Use a cement-water slurry as a bonding agent for toppings and concrete fill to new concrete. The cement water slurry shall be worked into the surface with a stiff bristle broom and concrete shall be placed before the cement-water slurry dries.
- D. Handle and store bonding agent in compliance with the manufacturer's printed instructions, including safety precautions.
- E. Mix the bonding agent in complete accordance with the instructions of the manufacturer.
- F. Before placing fresh concrete, thoroughly roughen surface to 3/16-inch amplitude and clean hardened concrete surfaces and coat with bonding agent not less than 1/16-inch thick. Place fresh concrete while the bonding agent is still tacky (within its open time), without removing the in-place bonding agent coat, and as directed by the manufacturer.

### **3.8 SEALANT INSTALLATION**

- A. Sealants shall be installed according to the manufacturer's recommendations for sealant which is to be subjected to continuous submerged conditions and the following requirements. Prior to sealant installation, CONTRACTOR shall arrange to have a representative of the sealant manufacturer instruct the crew doing the Work as to the proper methods of surface preparation, mixing, and application of the sealant.
- B. Surfaces to receive sealant shall be cleaned of all materials which could interfere with proper bonding. Concrete surfaces shall have all fins or other defects removed or repaired and shall receive a light abrasive blasting prior to priming and sealant application. All surfaces to receive sealant shall be completely dry.
- C. Spaces to receive sealant shall be filled with joint filler as shown. Where not shown, the space shall be filled with joint filler or a backer rod so that the depth of sealant does not exceed the width of the space. Where the bottom of the space to receive sealant is formed by a material other than backer rod, a bond breaker tape shall be placed. The maximum sealant depth, at middle of the joint width, shall be 1/2-inch.
- D. The primer and sealant used shall be supplied by the same manufacturer. No sealant shall be placed without the use of a primer.
- E. Self-leveling sealants shall only be used in joints with a slope less than 0.5 percent and where maximum and minimum sealant depths can be maintained. Non-sag sealant shall be used at all other locations and may be used instead of self-leveling sealant. All non-sag sealant shall be tooled to a uniform concave surface before skinning and curing begins.
- F. Sealant material shall be conditioned to be within the optimum temperature range recommended by the manufacturer for installation for a minimum of 16 hours prior to installation. Installation shall proceed only when the substrate is at a temperature recommended by the manufacturer. Sealant shall not be placed if there is a threat of imminent rainfall. CONTRACTOR shall submit a letter certifying that the applied sealants were installed in accordance with the manufacturer's recommendations, including temperature, relative humidity, etc.
- G. All joints to receive sealant shall be inspected by the OWNER prior to sealant

placement. Provide 24-hour written notice to OWNER representative prior to inspection.

- H. All sealant shall achieve final cure at least seven days before the structure is filled with water.
- I. Any sealant which, after the manufacturer's recommended curing time for the job conditions, fails to fully and properly cure shall be completely removed. The surfaces to receive sealant shall be completely cleaned of all traces of the improperly cured sealant and primer. The specified sealant shall then be reinstalled. All costs of such removal, surface treatment, and reinstallation shall be at the expense of CONTRACTOR.

### **3.9 BEARING PAD INSTALLATION**

- A. Neoprene Bearing Pad: Install with water insensitive adhesive in accordance with manufacturer's instructions.

**END OF SECTION**

## **03 30 00 CAST-IN-PLACE CONCRETE**

### **PART 1 - GENERAL**

#### **1.1 SUMMARY**

##### **A. Section Includes:**

1. Cast-in place concrete, including formwork, reinforcement, concrete materials, mixture design, placement procedures and finishes, for the following:
  - a. Piers
  - b. Footings
  - c. Slabs-on-grade
  - d. Foundation walls
  - e. Retaining walls (non TxDOT)
  - f. Suspended slabs
  - g. Blocking
  - h. Cast-in-place manholes.
  - i. Concrete vaults for meters and valves
  - j. Concrete encasement of utility lines

##### **B. Deviations from this City of Lewisville Standard Specification**

1. None.

##### **C. Related Specification Sections include, but are not necessarily limited to:**

1. Division 0 – Bidding Requirements, Contract Forms and Conditions of the Contract
2. Division 1 – General Requirements

#### **1.2 PRICE AND PAYMENT PROCEDURES**

##### **A. Cast-in-Place Concrete**

1. Measurement
  - a. This Item is considered subsidiary to the structure or Items being placed.
2. Payment
  - a. The work performed and the materials furnished in accordance with this Item are subsidiary to the structure or Items being placed and no other compensation will be allowed.

#### **1.3 REFERENCES**

##### **A. Definitions**

1. Cementitious Materials
  - a. Portland cement alone or in combination with 1 or more of the following:
    - 1) Blended hydraulic cement.
    - 2) Fly ash.
    - 3) Other pozzolans
    - 4) Ground granulated blast-furnace slag.
    - 5) Silica fume
  - b. Subject to compliance with the requirements of this specification

##### **B. Reference Standards**

1. Reference standards cited in this Specification refer to the current reference standard published at the time of the latest revision date logged at the end of this Specification unless a date is specifically cited.
2. American Association of State Highway and Transportation (AASHTO):

- a. M182, Burlap Cloth Made from Jute or Kenaf.
- 3. American Concrete Institute (ACI):
  - a. ACI 117 Specification for Tolerances for Concrete Construction and Materials
  - b. ACI 301 Specifications for Structural Concrete
  - c. ACI 305.1 Specification for Hot Weather Concreting
  - d. ACI 306.1 Standard Specification for Cold Weather Concreting
  - e. ACI 308.1 Standard Specification for Curing Concrete
  - f. ACI 318 Building Code Requirements for Structural Concrete
  - g. ACI 347 Guide to Formwork for Concrete
- 4. American Institute of Steel Construction (AISC):
  - a. 303, Code of Standard Practice for Steel Buildings and Bridges.
- 5. ASTM International (ASTM):
  - a. A36, Standard Specification for Carbon Structural Steel.
  - b. A153, Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
  - c. A193, Standard Specification for Alloy-Steel and Stainless-Steel Bolting Materials for High-Temperature Service and Other Special Purpose Applications.
  - d. A615, Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement.
  - e. A706, Standard Specification for Low-Alloy Steel Deformed and Plain Bars for Concrete Reinforcement.
  - f. C31, Standard Practice for Making and Curing Concrete Test Specimens in the Field.
  - g. C33, Standard Specification for Concrete Aggregates.
  - h. C39, Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens.
  - i. C42, Standard Test Method for Obtaining and Testing Drilled Cores and Sawed Beams of Concrete.
  - j. C94, Standard Specification for Ready-Mixed Concrete.
  - k. C109, Standard Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2-inch or {50-milimeter} Cube Specimens)
  - l. C143, Standard Test Method for Slump of Hydraulic-Cement Concrete.
  - m. C171, Standard Specification for Sheet Materials for Curing Concrete.
  - n. C150, Standard Specification for Portland Cement.
  - o. C172, Standard Practice for Sampling Freshly Mixed Concrete.
  - p. C219, Standard Terminology Relating to Hydraulic Cement.
  - q. C231, Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method.
  - r. C260, Standard Specification for Air-Entraining Admixtures for Concrete.
  - s. C309, Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete.
  - t. C494, Standard Specification for Chemical Admixtures for Concrete.
  - u. C618, Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete.
  - v. C881, Standard Specification for Epoxy-Resin-Base Bonding Systems for Concrete.
  - w. C989, Standard Specification for Ground Granulated Blast-Furnace Slag for Use in Concrete and Mortars.
  - x. C1017, Standard Specification for Chemical Admixtures for Use in Producing Flowing Concrete.
  - y. C1059, Standard Specification for Latex Agents for Bonding Fresh to Hardened Concrete.
  - z. C1064, Standard Test Method for Temperature of Freshly Mixed Hydraulic-Cement Concrete.

- aa. C1240, Standard Specification for Silica Fume Used in Cementitious Mixtures.
- bb. E1155, Standard Test Method for Determining  $F_F$  Floor Flatness and  $F_L$  Floor Levelness Numbers.
- cc. F436, Standard Specification for Hardened Steel Washers.
- 6. American Welding Society (AWS).
  - a. D1.1, Structural Welding Code - Steel.
  - b. D1.4, Structural Welding Code - Reinforcing Steel.
- 7. Concrete Reinforcing Steel Institute (CRSI)
  - a. Manual of Standard Practice
- 8. Texas Department of Transportation
  - a. Standard Specification for Construction and Maintenance of Highways, Streets and Bridges

#### **1.4 ADMINISTRATIVE REQUIREMENTS**

- A. Work Included
  - 1. Design, fabrication, erection and stripping of formwork for cast-in-place concrete including shoring, reshoring, falsework, bracing, proprietary forming systems, prefabricated forms, void forms, permanent metal forms, bulkheads, keys, block outs, sleeves, pockets, and accessories.
    - a. Erection shall include installation in formwork of items furnished by other trades.
  - 2. Furnish all labor and materials required to fabricate, deliver, and install reinforcement and embedded metal assemblies for cast-in-place concrete, including steel bars, welded steel wire fabric, ties, supports and sleeves.
  - 3. Furnish all labor and materials required to perform the following:
    - a. Cast-in-place concrete.
    - b. Concrete mix designs
    - c. Grouting

#### **1.5 SUBMITTALS**

- A. Submittals shall be in accordance with Section 01 33 00.
- B. All submittals shall be approved by the City prior to delivery and/or fabrication for specials.

#### **1.6 ACTION SUBMITTALS/INFORMATIONAL SUBMITTALS**

- A. Product Data
  - 1. Required for each type of product indicated.
- B. Design Mixtures
  - 1. For each concrete mixture submit proposed mix designs in accordance with ACI 318, chapter 5.
  - 2. Submit each proposed mix design with a record of past performance.
  - 3. Submit alternate design mixtures when characteristics of materials, Project conditions, weather, test results or other circumstances warrant adjustments.
  - 4. Indicate amounts of mixing water to be withheld for later addition at Project site.
    - a. Include this quantity on delivery ticket.
- C. Steel Reinforcement Submittals for Information
  - 1. Mill test certificates of supplied concrete reinforcing, indicating physical and chemical analysis.



**1.7 CLOSEOUT SUBMITTALS [NOT USED]**

**1.8 MAINTENANCE MATERIAL SUBMITTALS [NOT USED]**

**1.9 QUALITY ASSURANCE**

A. Manufacturer Qualifications

1. A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C94 requirements for production facilities and equipment.
2. Manufacturer certified according to NRMCA's "Certification of Ready Mixed Concrete Production Facilities."

B. Source Limitations

1. Obtain each type or class of cementitious material of the same brand from the same manufacturer's plant, obtain aggregate from 1 source and obtain admixtures through 1 source from a single manufacturer.

C. ACI Publications

1. Comply with the following unless modified by requirements in the Contract Documents:
  - a. ACI 301 Sections 1 through 5
  - b. ACI 117

D. Concrete Testing Service

1. Engage a qualified independent testing agency to perform material evaluation tests.

**1.10 DELIVERY, STORAGE, AND HANDLING**

A. Steel Reinforcement

1. Deliver, store, and handle steel reinforcement to prevent bending and damage.
2. Avoid damaging coatings on steel reinforcement.

B. Waterstops

1. Store waterstops under cover to protect from moisture, sunlight, dirt, oil, and other contaminants.

**1.11 FIELD CONDITIONS [NOT USED]**

**1.12 WARRANTY [NOT USED]**

**PART 2 - PRODUCTS**

**2.1 OWNER-FURNISHED OR OWNER-SUPPLIED PRODUCTS [NOT USED]**

**2.2 PRODUCT TYPES AND MATERIALS**

A. Manufacturers

1. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
  - a. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, products specified.
  - b. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified.

B. Form-Facing Materials

1. Rough-Formed Finished Concrete
    - a. Plywood, lumber, metal, or another approved material
    - b. Provide lumber dressed on at least 2 edges and 1 side for tight fit.
  2. Chamfer Strips
    - a. Wood, metal, PVC, or rubber strips
    - b. 3/4-inch x 3/4-inch, minimum
  3. Rustication Strips
    - a. Wood, metal, PVC, or rubber strips
    - b. Kerfed for ease of form removal
  4. Form-Release Agent
    - a. Commercially formulated form-release agent that will not bond with, stain, or adversely affect concrete surfaces.
    - b. Shall not impair subsequent treatments of concrete surfaces.
    - c. For steel form-facing materials, formulate with rust inhibitor.
  5. Form Ties
    - a. Factory-fabricated, removable, or snap-off metal or glass-fiber-reinforced plastic form ties designed to resist lateral pressure of fresh concrete on forms and to prevent spalling of concrete on removal.
    - b. Furnish units that will leave no corrodible metal closer than 1 inch to the plane of exposed concrete surface.
    - c. Furnish ties that, when removed, will leave holes no larger than 1 inch in diameter in concrete surface.
    - d. Furnish ties with integral water-barrier plates to walls indicated to receive dampproofing or waterproofing.
- C. Steel Reinforcement
1. Reinforcing Bars
    - a. ASTM A615, Grade 60, deformed
- D. Reinforcement Accessories
1. Smooth Dowel Bars
    - a. ASTM A615, Grade 60, steel bars (smooth)
    - b. Cut bars true to length with ends square and free of burrs.
  2. Bar Supports
    - a. Bolsters, chairs, spacers, and other devices for spacing, supporting and fastening reinforcing bars and welded wire reinforcement in place.
    - b. Manufacture bar supports from steel wire, plastic, or precast concrete according to CRSI's "Manual of Standard Practice," of greater compressive strength than concrete and as follows:
      - 1) For concrete surfaces exposed to view where legs of wire bar support contact forms, use CRSI Class 1 plastic-protected steel wire or CRSI Class 2 stainless-steel bar supports.
      - 2) For slabs-on-grade, provide sand plates, horizontal runners, or precast concrete blocks on bottom where base material will not support chair legs or where vapor barrier has been specified.
- E. Embedded Metal Assemblies
1. Steel Shapes and Plates: ASTM A36
  2. Headed Studs: Heads welded by full-fusion process, as furnished by TRW Nelson Stud Welding Division, or approved equal.
- F. Expansion Anchors
1. Available Products
    - a. Wej-it Bolt, Wej-it Corporation, Tulsa, Oklahoma
    - b. Kwik Bolt II, Hilti Fastening Systems, Tulsa, Oklahoma

- c. Trubolt, Ramset Fastening Systems, Paris, Kentucky
- G. Adhesive Anchors and Dowels
1. Adhesive anchors shall consist of threaded rods anchored with an adhesive system into hardened concrete or grout-filled masonry.
    - a. The adhesive system shall use a 2-component adhesive mix and shall be injected with a static mixing nozzle following manufacturer's instructions.
    - b. The embedment depth of the rod shall provide a minimum allowable bond strength that is equal to the allowable yield capacity of the rod, unless otherwise specified.
  2. Available Products
    - a. Hilti HIT HY 150 Max
    - b. Simpson Acrylic-Tie
    - c. Powers Fasteners AC 100+ Gold
  3. Threaded Rods: ASTM A193
    - a. Nuts: ASTM A563 hex carbon steel
    - b. Washers: ASTM F436 hardened carbon steel
    - c. Finish: Hot-dip zinc coating, ASTM A153, Class C
- H. Inserts
1. Provide metal inserts required for anchorage of materials or equipment to concrete construction where not supplied by other trades:
    - a. In vertical concrete surfaces for transfer of direct shear loads only, provide adjustable wedge inserts of malleable cast iron complete with bolts, nuts, and washers.
      - 1) Provide ¾-inch bolt size, unless otherwise indicated.
    - b. In horizontal concrete surfaces and whenever inserts are subject to tension forces, provide threaded inserts of malleable cast iron furnished with full depth bolts.
      - 1) Provide ¾-inch bolt size, unless otherwise indicated.
- I. Concrete Materials
1. Cementitious Material
    - a. Use the following cementitious materials, of the same type, brand, and source, throughout Project:
      - 1) Portland Cement
        - a) ASTM C150, Type I/II, gray
        - b) Supplement with the following:
          - (1) Fly Ash
            - (a) ASTM C618, Class C or F
          - (2) Ground Granulated Blast-Furnace Slag
            - (a) ASTM C989, Grade 100 or 120.
      - 2) Silica Fume
        - a) ASTM C1240, amorphous silica
      - 3) Normal-Weight Aggregates
        - a) ASTM C33, Class 3S coarse aggregate or better, graded.
        - b) Provide aggregates from a single source.
      - 4) Maximum Coarse-Aggregate Size
        - a) ¾-inch nominal
      - 5) Fine Aggregate
        - a) Free of materials with deleterious reactivity to alkali in cement
      - 6) Water
        - a) ASTM C94 and potable
- J. Admixtures
1. Air-Entraining Admixture

- a. ASTM C260
- 2. Chemical Admixtures
  - a. Provide admixtures certified by manufacturer to be compatible with other admixtures and that will not contribute water-soluble chloride ions exceeding those permitted in hardened concrete.
  - b. Do not use calcium chloride or admixtures containing calcium chloride.
  - c. Water-Reducing Admixture
    - 1) ASTM C494, Type A
  - d. Retarding Admixture
    - 1) ASTM C494, Type B
  - e. Water-Reducing and Retarding Admixture
    - 1) ASTM C494, Type D
  - f. High-Range, Water-Reducing Admixture
    - 1) ASTM C494, Type F
  - g. High-Range, Water-Reducing and Retarding Admixture
    - 1) ASTM C494, Type G
  - h. Plasticizing and Retarding Admixture
    - 1) ASTM C1017, Type II
- K. Waterstops
  - 1. Self-Expanding Butyl Strip Waterstops
    - a. Manufactured rectangular or trapezoidal strip, butyl rubber with sodium bentonite or other hydrophilic polymers, for adhesive bonding to concrete,  $\frac{3}{4}$ -inch x 1-inch.
    - b. Available Products
      - 1) Colloid Environmental Technologies Company; Volclay Waterstop-RX
      - 2) Concrete Sealants Inc.; Conseal CS-231
      - 3) Greenstreak; Swellstop
      - 4) Henry Company, Sealants Division; Hydro-Flex
      - 5) JP Specialties, Inc.; Earthshield Type 20
      - 6) Progress Unlimited, Inc.; Superstop
      - 7) TCMiraDRI; Mirastop
- L. Curing Materials
  - 1. Absorptive Cover
    - a. AASHTO M182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 ounces/square yard when dry.
  - 2. Moisture-Retaining Cover
    - a. ASTM C171, polyethylene film or white burlap-polyethylene sheet
  - 3. Water
    - a. Potable
  - 4. Clear, Waterborne, Membrane-Forming Curing Compound
    - a. ASTM C309, Type 1, Class B, dissipating
    - b. Available Products
      - 1) Anti-Hydro International, Inc.; AH Curing Compound #2 DR WB
      - 2) Burke by Edoco; Aqua Resin Cure
      - 3) ChemMasters; Safe-Cure Clear
      - 4) Conspec Marketing & Manufacturing Co., Inc., a Dayton Superior Company; W.B. Resin Cure
      - 5) Dayton Superior Corporation; Day Chem Rez Cure (J-11-W)
      - 6) Euclid Chemical Company (The); Kurez DR VOX
      - 7) Kaufman Products, Inc.; Thinfilm 420
      - 8) Lambert Corporation; Aqua Kure-Clear
      - 9) L&M Construction Chemicals, Inc.; L&M Cure R
      - 10) Meadows, W. R., Inc.; 1100 Clear

- 11) Nox-Crete Products Group, Kinsman Corporation; Resin Cure E
- 12) Symons Corporation, a Dayton Superior Company; Resi-Chem Clear Cure
- 13) Tamms Industries, Inc.; Horncrete WB 30
- 14) Unitex; Hydro Cure 309
- 15) US Mix Products Company; US Spec Maxcure Resin Clear
- 16) Vexcon Chemicals, Inc.; Certi-Vex Enviocure 100

M. Related Materials

1. Bonding Agent
  - a. ASTM C1059, Type II, non-redispersible, acrylic emulsion or styrene butadiene
2. Epoxy Bonding Adhesive
  - a. ASTM C881, 2-component epoxy resin, capable of humid curing and bonding to damp surfaces, of class suitable for application temperature and of grade to suit requirements, and as follows:
    - 1) Types I and II, non-load bearing
    - 2) IV and V, load bearing, for bonding
    - 3) Hardened or freshly mixed concrete to hardened concrete.
3. Reglets
  - a. Fabricate reglets of not less than 0.0217-inch thick, galvanized steel sheet.
  - b. Temporarily fill or cover face opening of reglet to prevent intrusion of concrete or debris.
4. Sleeves and Blockouts
  - a. Formed with galvanized metal, galvanized pipe, polyvinyl chloride pipe, fiber tubes or wood.
5. Nails, Spikes, Lag Bolts, Through Bolts, Anchorages
  - a. Sized as required.
  - b. Shall be of strength and character to maintain formwork in place while placing concrete.

N. Repair Materials

1. Repair Underlayment
  - a. Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses of 1/8 inch or greater.
    - 1) Do not feather.
  - b. Cement Binder
    - 1) ASTM C150, portland cement or hydraulic or blended hydraulic cement as defined in ASTM C219.
  - c. Primer
    - 1) Product of underlayment manufacturer recommended for substrate, conditions, and application.
  - d. Aggregate
    - 1) Well-graded, washed gravel, 1/8 to 1/4 inch or coarse sand as recommended by underlayment manufacturer.
  - e. Compressive Strength
    - 1) Not less than 4100 psi at 28 days when tested according to ASTM C109/C109M
2. Repair Overlayment
  - a. Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses of 1/8 inch or greater.
    - 1) Do not feather.
  - b. Cement Binder
    - 1) ASTM C150, portland cement or hydraulic or blended hydraulic cement as defined in ASTM C219.
  - c. Primer

- 1) Product of topping manufacturer recommended for substrate, conditions, and application.
  - d. Aggregate
    - 1) Well-graded, washed gravel, 1/8 to 1/4 inch or coarse sand as recommended by topping manufacturer.
  - e. Compressive Strength
    - 1) Not less than 5000 psi at 28 days when tested according to ASTM C109.
- O. Concrete Mixtures, General
1. Prepare design mixtures for each type and strength of concrete, proportioned on the basis of laboratory trial mixture or field test data, or both, according to ACI 301.
    - a. Required average strength above specified strength.
      - 1) Based on a record of past performance
        - a) Determination of required average strength above specified strength shall be based on the standard deviation record of the results of at least 30 consecutive strength tests in accordance with ACI 318, Chapter 5.3 by the larger amount defined by formulas 5-1 and 5-2.
      - 2) Based on laboratory trial mixtures
        - a) Proportions shall be selected on the basis of laboratory trial batches prepared in accordance with ACI 318, Chapter 5.3.3.2 to produce an average strength greater than the specified strength  $f'_c$  by the amount defined in table 5.3.2.2.
      - 3) Proportions of ingredients for concrete mixes shall be determined by an independent testing laboratory or qualified concrete supplier.
      - 4) For each proposed mixture, at least 3 compressive test cylinders shall be made and tested for strength at the specified age.
        - a) Additional cylinders may be made for testing for information at earlier ages.
  2. Cementitious Materials
    - a. Limit percentage, by weight, of cementitious materials other than portland cement in concrete as follows, unless specified otherwise:
      - 1) Fly Ash: 25 percent
      - 2) Combined Fly Ash and Pozzolan: 25 percent
      - 3) Ground Granulated Blast-Furnace Slag: 50 percent
      - 4) Combined Fly Ash or Pozzolan and Ground Granulated Blast-Furnace Slag: 50 percent
      - 5) Portland cement minimum, with fly ash or pozzolan not exceeding 25 percent.
      - 6) Silica Fume: 10 percent
      - 7) Combined Fly Ash, Pozzolans, and Silica Fume: 35 percent with fly ash or pozzolans not exceeding 25 percent and silica fume not exceeding 10 percent.
      - 8) Combined Fly Ash or Pozzolans, Ground Granulated Blast-Furnace Slag, and Silica Fume: 50 percent with fly ash or pozzolans not exceeding 25 percent and silica fume not exceeding 10 percent.
  3. Limit water-soluble, chloride-ion content in hardened concrete to:
    - a. 0.30 percent by weight of cement if concrete will have no exposure to chlorides (typical)
    - b. 0.15 percent by weight if concrete will be exposed to chlorides.
    - c. 1.0 percent by weight if concrete will have no exposure to chlorides and will be continually dry and protected.
  4. Admixtures
    - a. Use admixtures according to manufacturer's written instructions.
    - b. Do not use admixtures which have not been incorporated and tested in accepted mixes.

- c. Use water-reducing high-range water-reducing or plasticizing admixture in concrete, as required, for placement and workability.
- d. Use water-reducing and retarding admixture when required by high temperatures, low humidity, or other adverse placement conditions.
- e. Use water-reducing admixture in pumped concrete, concrete for heavy-use industrial slabs and parking structure slabs, concrete required to be watertight, and concrete with a water-cementitious materials ratio below 0.50.
- f. Use corrosion-inhibiting admixture in concrete mixtures where indicated.

P. Concrete Mixtures

- 1. Refer to TxDOT "Standard Specifications for Construction and Maintenance of Highways, Streets, and Bridges" for:
  - a. Culverts
  - b. Headwalls
  - c. Wingwalls
- 2. Proportion normal-weight concrete mixture as follows:
  - a. Minimum Compressive Strength: 3,000 psi at 28 days
  - b. Maximum Water-Cementitious Materials Ratio: 0.50
  - c. Slump Limit: 5 inches or 8 inches for concrete with verified slump of 2 to 4 inches before adding high-range water-reducing admixture or plasticizing admixture, plus or minus 1 inch.
  - d. Air Content: 6 percent, plus or minus 1.5 percent at point of delivery for 3/4-inch nominal maximum aggregate size

Q. Fabricating Reinforcement

- 1. Fabricate steel reinforcement according to CRSI's "Manual of Standard Practice."

R. Fabrication of Embedded Metal Assemblies

- 1. Fabricate metal assemblies in the shop. Holes shall be made by drilling or punching. Holes shall not be made by or enlarged by burning. Welding shall be in accordance with AWS D1.1.
- 2. Metal assemblies exposed to earth, weather or moisture shall be hot dip galvanized. All other metal assemblies shall be either hot dip galvanized or painted with an epoxy paint. Repair galvanizing after welding with a Cold Galvanizing compound installed in accordance with the manufacturer's instructions. Repair painted assemblies after welding with same type of paint.

S. Concrete Mixing

- 1. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete according to ASTM C94, and furnish batch ticket information.
  - a. When air temperature is between 85 and 90 degrees Fahrenheit, reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 degrees Fahrenheit, reduce mixing and delivery time to 60 minutes.
- 2. Project-Site Mixing: Measure, batch, and mix concrete materials and concrete according to ASTM C94/C94M. Mix concrete materials in appropriate drum-type batch machine mixer.
  - a. For mixer capacity of 1 cubic yard or smaller, continue mixing at least 1-1/2 minutes, but not more than 5 minutes after ingredients are in mixer, before any part of batch is released.
  - b. For mixer capacity larger than 1 cubic yard, increase mixing time by 15 seconds for each additional 1 cubic yard.
  - c. Provide batch ticket for each batch discharged and used in the Work, indicating Project identification name and number, date, mixture type, mixture time, quantity, and amount of water added. Record approximate location of final deposit in structure.

## 2.3 ACCESSORIES [NOT USED]

## 2.4 SOURCE QUALITY CONTROL [NOT USED]

# PART 3 - EXECUTION

## 3.1 INSTALLERS [NOT USED]

## 3.2 EXAMINATION [NOT USED]

## 3.3 PREPARATION [NOT USED]

## 3.4 INSTALLATION

### A. Formwork

1. Design, erect, shore, brace, and maintain formwork, according to ACI 301, to support vertical, lateral, static, and dynamic loads, and construction loads that might be applied, until structure can support such loads.
2. Construct formwork so concrete members and structures are of size, shape, alignment, elevation, and position indicated, within tolerance limits of ACI 117.
  - a. Vertical alignment
    - 1) Lines, surfaces, and arises less than 100 feet in height - 1 inch.
    - 2) Outside corner of exposed corner columns and control joints in concrete exposed to view less than 100 feet in height - 1/2 inch.
    - 3) Lines, surfaces, and arises greater than 100 feet in height - 1/1000times the height but not more than 6 inches.
    - 4) Outside corner of exposed corner columns and control joints in concrete exposed to view greater than 100 feet in height - 1/2000 times the height but not more than 3 inches.
  - b. Lateral alignment
    - 1) Members - 1 inch.
    - 2) Centerline of openings 12 inches or smaller and edge location of larger openings in slabs - 1/2 inch.
    - 3) Sawcuts, joints, and weakened plane embedments in slabs - 3/4 inch.
  - c. Level alignment
    - 1) Elevation of slabs-on-grade - 3/4 inch.
    - 2) Elevation of top surfaces of formed slabs before removal of shores - 3/4 inch.
    - 3) Elevation of formed surfaces before removal of shores - 3/4 inch.
  - d. Cross-sectional dimensions: Overall dimensions of beams, joists, and columns and thickness of walls and slabs.
    - 1) 12-inch dimension or less - plus 1/2 inch to minus 1/4 inch.
    - 2) Greater than 12 inches to 3-foot dimension - plus 1/2 inch to minus 3/8 inch.
    - 3) Greater than 3-foot dimension - plus 1 inch to minus 3/4 inch.
  - e. Relative alignment
    - 1) Stairs
      - a) Difference in height between adjacent risers - 1/8 inch.
      - b) Difference in width between adjacent treads - 1/4 inch.
      - c) Maximum difference in height between risers in a flight of stairs - 3/8 inch.
      - d) Maximum difference in width between treads in a flight of stairs - 3/8 inch.
    - 2) Grooves
      - a) Specified width 2 inches or less - 1/8 inch.
      - b) Specified width between 2 inches and 12 inches - 1/4 inch.



- 3) Vertical alignment of outside corner of exposed corner columns and control joint grooves in concrete exposed to view - 1/4 inch in 10 feet.
  - 4) All other conditions - 3/8 inch in 10 feet.
3. Limit concrete surface irregularities, designated by ACI 347R as abrupt or gradual, as follows:
    - a. Class B, 1/4 inch for smooth-formed finished surfaces.
    - b. Class C, 1/2 inch for rough-formed finished surfaces.
  4. Construct forms tight enough to prevent loss of concrete mortar.
  5. Fabricate forms for easy removal without hammering or prying against concrete surfaces. Provide crush or wrecking plates where stripping may damage cast concrete surfaces. Provide top forms for inclined surfaces steeper than 1.5 horizontal to 1 vertical.
    - a. Install keyways, reglets, recesses, and the like, for easy removal.
    - b. Do not use rust-stained steel form-facing material.
  6. Set edge forms, bulkheads, and intermediate screed strips for slabs to achieve required elevations and slopes in finished concrete surfaces. Provide and secure units to support screed strips; use strike-off templates or compacting-type screeds.
  7. Construct formwork to cambers shown or specified on the Drawings to allow for structural deflection of the hardened concrete. Provide additional elevation or camber in formwork as required for anticipated formwork deflections due to weight and pressures of concrete and construction loads.
  8. Foundation Elements: Form the sides of all below grade portions of beams, pier caps, walls, and columns straight and to the lines and grades specified. Do no earth form foundation elements unless specifically indicated on the Drawings.
  9. Provide temporary openings for cleanouts and inspection ports where interior area of formwork is inaccessible. Close openings with panels tightly fitted to forms and securely braced to prevent loss of concrete mortar. Locate temporary openings in forms at inconspicuous locations.
  10. Chamfer exterior corners and edges of permanently exposed concrete.
  11. Form openings, chases, offsets, sinkages, keyways, reglets, blocking, screeds, and bulkheads required in the Work. Determine sizes and locations from trades providing such items.
  12. Clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, and other debris just before placing concrete.
  13. Retighten forms and bracing before placing concrete, as required, to prevent mortar leaks and maintain proper alignment.
  14. Coat contact surfaces of forms with form-release agent, according to manufacturer's written instructions, before placing reinforcement, anchoring devices, and embedded items.
    - a. Do not apply form release agent where concrete surfaces are scheduled to receive subsequent finishes which may be affected by agent. Soak contact surfaces of untreated forms with clean water. Keep surfaces wet prior to placing concrete.
- B. Embedded Items
1. Place and secure anchorage devices and other embedded items required for adjoining work that is attached to or supported by cast-in-place concrete. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
    - a. Install anchor rods, accurately located, to elevations required and complying with tolerances in AISC 303, Section 7.5.
      - 1) Spacing within a bolt group: 1/8 inch
      - 2) Location of bolt group (center): 1/2 inch

- 3) Rotation of bolt group: 5 degrees
  - 4) Angle off vertical: 5 degrees
  - 5) Bolt projection:  $\pm 3/8$  inch
- b. Install reglets to receive waterproofing and to receive through-wall flashings in outer face of concrete frame at exterior walls, where flashing is shown at lintels, shelf angles, and other conditions.

C. Removing and Reusing Forms

1. Do not backfill prior to concrete attaining 70 percent of its 28-day design compressive strength.
2. General: Formwork for sides of beams, walls, columns, and similar parts of the Work that does not support weight of concrete may be removed after cumulatively curing at not less than 50 degrees Fahrenheit for 24 hours after placing concrete if concrete is hard enough to not be damaged by form-removal operations and curing and protection operations are maintained.
  - a. Leave formwork for beam soffits, joists, slabs, and other structural elements that supports weight of concrete in place until concrete has achieved at least 70 percent of its 28-day design compressive strength.
  - b. Do not remove formwork supporting conventionally reinforced concrete until concrete has attained 70 percent of its specified 28-day compressive strength as established by tests of field cured cylinders. In the absence of cylinder tests, supporting formwork shall remain in place until the concrete has cured at a temperature of at least 50 degrees Fahrenheit for the minimum cumulative time periods given in ACI 347, Section 3.7.2.3. Add the period of time when the surrounding air temperature is below 50 degrees Fahrenheit, to the minimum listed time period. Formwork for 2-way conventionally reinforced slabs shall remain in place for at least the minimum cumulative time periods specified for 1-way slabs of the same maximum span.
  - c. Immediately reshore 2-way conventionally reinforced slabs after formwork removal. Reshores shall remain until the concrete has attained the specified 28-day compressive strength.
  - d. Minimum cumulative curing times may be reduced by the use of high-early strength cement or forming systems which allow form removal without disturbing shores, but only after the Contractor has demonstrated to the satisfaction of the Engineer that the early removal of forms will not cause excessive sag, distortion, or damage to the concrete elements.
  - e. Completely remove wood forms. Provide temporary openings if required.
  - f. Provide adequate methods of curing and thermal protection of exposed concrete if forms are removed prior to completion of specified curing time.
  - g. Reshore areas required to support construction loads in excess of 20 pounds per square foot to properly distribute construction loading. Construction loads up to the rated live load capacity may be placed on unshored construction provided the concrete has attained the specified 28-day compressive strength.
  - h. Obtaining concrete compressive strength tests for the purposes of form removal is the responsibility of the Contractor.
  - i. Remove forms only if shores have been arranged to permit removal of forms without loosening or disturbing shores.
3. Clean and repair surfaces of forms to be reused in the Work. Split, frayed, delaminated, or otherwise damaged form-facing material will not be acceptable for exposed surfaces. Apply new form-release agent.
4. When forms are reused, clean surfaces, remove fins and laitance, and tighten to close joints. Align and secure joints to avoid offsets. Do not use patched forms for exposed concrete surfaces unless approved by Engineer.

D. Shores and Reshores

1. The Contractor is solely responsible for proper shoring and reshoring.

2. Comply with ACI 318 and ACI 301 for design, installation, and removal of shoring and reshoring.
    - a. Do not remove shoring or reshoring until measurement of slab tolerances is complete.
  3. Plan sequence of removal of shores and reshore to avoid damage to concrete. Locate and provide adequate reshoring to support construction without excessive stress or deflection.
- E. Steel Reinforcement
1. General: Comply with CRSI's "Manual of Standard Practice" for placing reinforcement.
    - a. Do not cut or puncture vapor retarder. Repair damage and reseal vapor retarder before placing concrete.
  2. Clean reinforcement of loose rust and mill scale, earth, ice, and other foreign materials that would reduce bond to concrete.
  3. Accurately position, support, and secure reinforcement against displacement. Locate and support reinforcement with bar supports to maintain minimum concrete cover. Do not tack weld crossing reinforcing bars.
    - a. Weld reinforcing bars according to AWS D1.4, where indicated. Only steel conforming to ASTM A706 may be welded.
  4. Installation tolerances
    - a. Top and bottom bars in slabs, girders, beams, and joists:
      - 1) Members 8 inches deep or less:  $\pm 3/8$  inch
      - 2) Members more than 8 inches deep:  $\pm 1/2$  inch
    - b. Concrete Cover to Formed or Finished Surfaces:  $\pm 3/8$  inches for members 8 inches deep or less;  $\pm 1/2$  inches for members over 8 inches deep, except that tolerance for cover shall not exceed 1/3 of the specified cover.
  5. Concrete Cover
    - a. Reinforcing in structural elements deposited against the ground: 3 inches.
    - b. Reinforcing in formed beams, columns, and girders: 1-1/2 inches
    - c. Grade beams and exterior face of formed walls and columns exposed to weather or in contact with the ground: 2 inches.
    - d. Interior faces of walls: 1 inches
    - e. Slabs: 3/4 inches
  6. Splices: Provide standard reinforcement splices by lapping and tying ends. Comply with ACI 318 for minimum lap of spliced bars where not specified on the documents. Do not lap splice no. 14 and 18 bars.
  7. Field Welding of Embedded Metal Assemblies
    - a. Remove all paint and galvanizing in areas to receive field welds.
    - b. Field Prepare all areas where paint or galvanizing has been removed with the specified paint or cold galvanizing compound, respectively.
- F. Joints
1. General: Construct joints true to line with faces perpendicular to surface plane of concrete.
  2. Construction Joints: Install so strength and appearance of concrete are not impaired, at locations indicated or as approved by Engineer.
    - a. Place joints perpendicular to main reinforcement. Continue reinforcement across construction joints, unless otherwise indicated. Do not continue reinforcement through sides of strip placements of floors and slabs.
    - b. Form keyed joints as indicated. Embed keys at least 1-1/2 inches into concrete.

- c. Locate joints for beams, slabs, joists, and girders in the middle third of spans. Offset joints in girders a minimum distance of twice the beam width from a beam-girder intersection.
  - d. Locate horizontal joints in walls and columns at underside of floors, slabs, beams, and girders and at the top of footings or floor slabs.
  - e. Space vertical joints in walls as indicated. Locate joints beside piers integral with walls, near corners, and in concealed locations where possible.
  - f. Use a bonding agent at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.
3. Doweled Joints: Install dowel bars and support assemblies at joints where indicated. Lubricate or asphalt coat 1-1/2 of dowel length to prevent concrete bonding to 1 side of joint.
- G. Waterstops
- 1. Flexible Waterstops: Install in construction joints and at other joints indicated to form a continuous diaphragm. Install in longest lengths practicable. Support and protect exposed waterstops during progress of the Work. Field fabricate joints in waterstops according to manufacturer's written instructions.
  - 2. Self-Expanding Strip Waterstops: Install in construction joints and at other locations indicated, according to manufacturer's written instructions, adhesive bonding, mechanically fastening, and firmly pressing into place. Install in longest lengths practicable.
- H. Adhesive Anchors
- 1. Comply with the manufacturer's installation instructions on the hole diameter and depth required to fully develop the tensile strength of the adhesive anchor or reinforcing bar.
  - 2. Properly clean out the hole utilizing a wire brush and compressed air to remove all loose material from the hole, prior to installing adhesive material.
- I. Concrete Placement
- 1. Before placing concrete, verify that installation of formwork, reinforcement, and embedded items is complete and that required inspections have been performed.
  - 2. Do not add water to concrete during delivery, at Project site, or during placement unless approved by Engineer.
  - 3. Before test sampling and placing concrete, water may be added at Project site, subject to limitations of ACI 301.
    - a. Do not add water to concrete after adding high-range water-reducing admixtures to mixture.
    - b. Do not exceed the maximum specified water/cement ratio for the mix.
  - 4. Deposit concrete continuously in 1 layer or in horizontal layers of such thickness that no new concrete will be placed on concrete that has hardened enough to cause seams or planes of weakness. If a section cannot be placed continuously, provide construction joints as indicated. Deposit concrete to avoid segregation.
    - a. Deposit concrete in horizontal layers of depth to not exceed formwork design pressures, 15 feet maximum and in a manner to avoid inclined construction joints.
    - b. Consolidate placed concrete with mechanical vibrating equipment according to ACI 301.

- c. Do not use vibrators to transport concrete inside forms. Insert and withdraw vibrators vertically at uniformly spaced locations to rapidly penetrate placed layer and at least 6 inches into preceding layer. Do not insert vibrators into lower layers of concrete that have begun to lose plasticity. At each insertion, limit duration of vibration to time necessary to consolidate concrete and complete embedment of reinforcement and other embedded items without causing mixture constituents to segregate.
  - d. Do not permit concrete to drop freely any distance greater than 10 feet for concrete containing a high range water reducing admixture (superplasticizer) or 5 feet for other concrete. Provide chute or tremie to place concrete where longer drops are necessary. Do not place concrete into excavations with standing water. If place of deposit cannot be pumped dry, pour concrete through a tremie with its outlet near the bottom of the place of deposit.
  - e. Discard pump priming grout and do not use in the structure.
5. Deposit and consolidate concrete for floors and slabs in a continuous operation, within limits of construction joints, until placement of a panel or section is complete.
- a. Consolidate concrete during placement operations so concrete is thoroughly worked around reinforcement and other embedded items and into corners.
  - b. Maintain reinforcement in position on chairs during concrete placement.
  - c. Screed slab surfaces with a straightedge and strike off to correct elevations.
  - d. Slope surfaces uniformly to drains where required.
  - e. Begin initial floating using bull floats or darbies to form a uniform and open-textured surface plane, before excess bleedwater appears on the surface. Do not further disturb slab surfaces before starting finishing operations.
6. Cold-Weather Placement: Comply with ACI 306.1 and as follows. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.
- a. When average high and low temperature is expected to fall below 40 degrees Fahrenheit for 3 successive days, maintain delivered concrete mixture temperature within the temperature range required by ACI 301.
  - b. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.
  - c. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in mixture designs.
7. Hot-Weather Placement: Comply with ACI 305.1 and as follows:
- a. Maintain concrete temperature below 95 degrees Fahrenheit at time of placement. Chilled mixing water or chopped ice may be used to control temperature, provided water equivalent of ice is calculated to total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.
  - b. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade uniformly moist without standing water, soft spots, or dry areas.
- J. Finishing Formed Surfaces
- 1. Rough-Formed Finish: As-cast concrete texture imparted by form-facing material with tie holes and defects repaired and patched. Remove fins and other projections that exceed specified limits on formed-surface irregularities.
    - a. Apply to concrete surfaces not exposed to public view.
  - 2. Related Unformed Surfaces: At tops of walls, horizontal offsets, and similar unformed surfaces adjacent to formed surfaces, strike off smooth and finish with a texture matching adjacent formed surfaces. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces, unless otherwise indicated.

K. Miscellaneous Concrete Items

1. Filling In: Fill in holes and openings left in concrete structures, unless otherwise indicated, after work of other trades is in place. Mix, place, and cure concrete, as specified, to blend with in-place construction. Provide other miscellaneous concrete filling indicated or required to complete the Work.
  2. Curbs: Provide monolithic finish to interior curbs by stripping forms while concrete is still green and by steel-troweling surfaces to a hard, dense finish with corners, intersections, and terminations slightly rounded.
  3. Equipment Bases and Foundations: Provide machine and equipment bases and foundations as shown on Drawings. Set anchor bolts for machines and equipment at correct elevations, complying with diagrams or templates from manufacturer furnishing machines and equipment.
    - a. Housekeeping pads: Normal weight concrete (3000 psi), reinforced with #3@16 inches on center set at middepth of pad. Trowel concrete to a dense, smooth finish. Set anchor bolts for securing mechanical or electrical equipment during pouring of concrete fill.
  4. Protective slabs ("Mud slabs"): Normal weight concrete (2500 psi minimum) with a minimum thickness of 3-1/2 inches. Finish slab to a wood float finish.
- L. Concrete Protecting and Curing
1. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with ACI 306.1 for cold-weather protection and ACI 305.1 for hot-weather protection during curing.
  2. Formed Surfaces: Cure formed concrete surfaces, including underside of beams, supported slabs, and other similar surfaces. If forms remain during curing period, moist cure after loosening forms. If removing forms before end of curing period, continue curing for the remainder of the curing period.
  3. Unformed Surfaces: Begin curing immediately after finishing concrete. Cure unformed surfaces, including floors and slabs, concrete floor toppings, and other surfaces.
  4. Cure concrete according to ACI 308.1, by 1 or a combination of the following methods:
    - a. Moisture Curing: Keep surfaces continuously moist for not less than 7 days with the following materials:
      - 1) Water
      - 2) Continuous water-fog spray
      - 3) Absorptive cover, water saturated, and kept continuously wet. Cover concrete surfaces and edges with 12-inch lap over adjacent absorptive covers.
    - b. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches, and sealed by waterproof tape or adhesive. Cure for not less than 7 days. Immediately repair any holes or tears during curing period using cover material and waterproof tape.
      - 1) Moisture cure or use moisture-retaining covers to cure concrete surfaces to receive floor coverings.
      - 2) Moisture cure or use moisture-retaining covers to cure concrete surfaces to receive penetrating liquid floor treatments.
      - 3) Cure concrete surfaces to receive floor coverings with either a moisture-retaining cover or a curing compound that the manufacturer certifies will not interfere with bonding of floor covering used on Project.
    - c. Curing Compound: Apply uniformly in continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within 3 hours after initial application. Maintain continuity of coating and repair damage during curing period.

### 3.5 REPAIR

#### A. Concrete Surface Repairs

1. Defective Concrete: Repair and patch defective areas when approved by Engineer. Remove and replace concrete that cannot be repaired and patched to Engineer's approval.
2. Patching Mortar: Mix dry pack patching mortar, consisting of 1-part portland cement to 2-1/2 parts fine aggregate passing a No. 16 sieve, using only enough water for handling, and placing.
3. Repairing Formed Surfaces: Surface defects include color and texture irregularities, cracks, spalls, air bubbles, honeycombs, rock pockets, fins and other projections on the surface, and stains and other discolorations that cannot be removed by cleaning.
  - a. Immediately after form removal, cut-out honeycombs, rock pockets, and voids more than 1/2 inch in any dimension in solid concrete, but not less than 1 inch in depth. Make edges of cuts perpendicular to concrete surface. Clean, dampen with water, and brush-coat holes and voids with bonding agent. Fill and compact with patching mortar before bonding agent has dried. Fill form-tie voids with patching mortar or cone plugs secured in place with bonding agent.
  - b. Repair defects on surfaces exposed to view by blending white portland cement and standard portland cement so that, when dry, patching mortar will match surrounding color. Patch a test area at inconspicuous locations to verify mixture and color match before proceeding with patching. Compact mortar in place and strike off slightly higher than surrounding surface.
  - c. Repair defects on concealed formed surfaces that affect concrete's durability and structural performance as determined by Engineer.
4. Repairing Unformed Surfaces: Test unformed surfaces, such as floors and slabs, for finish and verify surface tolerances specified for each surface. Correct low and high areas. Test surfaces sloped to drain for trueness of slope and smoothness; use a sloped template.
  - a. Repair finished surfaces containing defects. Surface defects include spalls, pop outs, honeycombs, rock pockets, crazing and cracks in excess of 0.01 inch wide or that penetrate to reinforcement or completely through unreinforced sections regardless of width, and other objectionable conditions.
  - b. After concrete has cured at least 14 days, correct high areas by grinding.
  - c. Correct localized low areas during or immediately after completing surface finishing operations by cutting out low areas and replacing with patching mortar. Finish repaired areas to blend into adjacent concrete.
  - d. Repair defective areas, except random cracks and single holes 1 inch or less in diameter, by cutting out and replacing with fresh concrete. Remove defective areas with clean, square cuts and expose steel reinforcement with at least a 3/4-inch clearance all around. Dampen concrete surfaces in contact with patching concrete and apply bonding agent. Mix patching concrete of same materials and mixture as original concrete except without coarse aggregate. Place, compact, and finish to blend with adjacent finished concrete. Cure in same manner as adjacent concrete.
  - e. Repair random cracks and single holes 1 inch or less in diameter with patching mortar. Groove top of cracks and cut out holes to sound concrete and clean off dust, dirt, and loose particles. Dampen cleaned concrete surfaces and apply bonding agent. Place patching mortar before bonding agent has dried. Compact patching mortar and finish to match adjacent concrete. Keep patched area continuously moist for at least 72 hours.
5. Perform structural repairs of concrete, subject to Engineer's approval, using epoxy adhesive and patching mortar.

6. Repair materials and installation not specified above may be used, subject to Engineer's approval.

### **3.6 RE-INSTALLATION [NOT USED]**

### **3.7 FIELD QUALITY CONTROL**

- A. Testing and Inspecting: City will engage a special inspector and qualified testing and inspecting agency to perform field tests and inspections and prepare test reports.
- B. Inspections
  1. Steel reinforcement placement
  2. Headed bolts and studs.
  3. Verification of use of required design mixture
  4. Concrete placement, including conveying and depositing.
  5. Curing procedures and maintenance of curing temperature
  6. Verification of concrete strength before removal of shores and forms from beams and slabs
- C. Concrete Tests: Perform testing of composite samples of fresh concrete obtained according to ASTM C172 according to the following requirements:
  1. Testing Frequency: Obtain 1 composite sample for each day's pour of each concrete mixture exceeding 5 cubic yard, but less than 25 cubic yard, plus 1 set for each additional 50 cubic yard or fraction thereof.
  2. Slump: ASTM C143; 1 test at point of placement for each composite sample, but not less than 1 test for each day's pour of each concrete mixture. Perform additional tests when concrete consistency appears to change.
  3. Air Content: ASTM C231, pressure method, for normal-weight concrete; 1 test for each composite sample, but not less than 1 test for each day's pour of each concrete mixture.
  4. Concrete Temperature: ASTM C1064; 1 test hourly when air temperature is 40 degrees Fahrenheit and below and when 80 degrees Fahrenheit and above, and 1 test for each composite sample.
  5. Compression Test Specimens: ASTM C31.
    - a. Cast and laboratory cure 4 cylinders for each composite sample.
      - 1) Do not transport field cast cylinders until they have cured for a minimum of 24 hours.
  6. Compressive-Strength Tests: ASTM C39.
    - a. Test 1 cylinder at 7 days.
    - b. Test 2 cylinders at 28 days.
    - c. Hold 1 cylinder for testing at 56 days as needed.
  7. When strength of field-cured cylinders is less than 85 percent of companion laboratory-cured cylinders, evaluate operations and provide corrective procedures for protecting and curing in-place concrete.
  8. Strength of each concrete mixture will be satisfactory if every average of any 3-consecutive compressive-strength tests equals or exceeds specified compressive strength and no compressive-strength test value falls below specified compressive strength by more than 500 psi.
  9. Report test results in writing to Engineer, concrete manufacturer, and Contractor within 48 hours of testing. Reports of compressive-strength tests shall contain Project identification name and number, date of concrete placement, name of concrete testing and inspecting agency, location of concrete batch in Work, design compressive strength at 28 days, concrete mixture proportions and materials, compressive breaking strength, and type of break for both 7- and 28-day tests.



10. Additional Tests: Testing and inspecting agency shall make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by Engineer. Testing and inspecting agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C42 or by other methods as directed by Engineer.
    - a. When the strength level of the concrete for any portion of the structure, as indicated by cylinder tests, falls below the specified requirements, provide improved curing conditions and/or adjustments to the mix design as required to obtain the required strength. If the average strength of the laboratory control cylinders falls so low as to be deemed unacceptable, follow the core test procedure set forth in ACI 301, Chapter 17. Locations of core tests shall be approved by the Engineer. Core sampling and testing shall be at Contractors expense.
    - b. If the results of the core tests indicate that the strength of the structure is inadequate, any replacement, load testing, or strengthening as may be ordered by the Engineer shall be provided by the Contractor without cost to the City.
  11. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
  12. Correct deficiencies in the Work that test reports and inspections indicate does not comply with the Contract Documents.
- D. Measure floor and slab flatness and levelness according to ASTM E1155 within 48 hours of finishing.
- E. Concrete Finish Measurement and Tolerances
1. All floors are subject to measurement for flatness and levelness and comply with the following:
    - a. Slabs shall be flat within a tolerance of 5/16 inches in 10 feet when tested with a 10-foot-long straightedge. Apply straightedge to the slab at 3-foot intervals in both directions, lapping straightedge 3 feet on areas previously checked. Low spots shall not exceed the above dimension anywhere along the straightedge. Flatness shall be checked the next workday after finishing.
    - b. Slabs shall be level within a tolerance of  $\pm 1/4$  inch in 10 feet, not to exceed 3/4 inches total variation, anywhere on the floor, from elevations indicated on the Drawings. Levelness shall be checked on a 10-foot grid using a level after removal of forms.
    - c. Measurement Standard: All floors are subject to measurement for flatness and levelness, according to ASTM E1155.
  2. 2-Tiered Measurement Standard
    - a. Each floor test section and the overall floor area shall conform to the 2-tiered measurement standard as specified herein.
      - 1) Minimum Local Value: The minimum local FF/FL values represent the absolute minimum surface profile that will be acceptable for any 1 test sample (line of measurements) anywhere within the test area.
      - 2) Specified Overall Value: The specified overall FF/FL values represent the minimum values acceptable for individual floor sections as well as the floor as a whole.
  3. Floor Test Sections
    - a. A floor test section is defined as the smaller of the following areas:
      - 1) The area bounded by column and/or wall lines.
      - 2) The area bounded by construction and/or control joint lines.
      - 3) Any combination of column lines and/or control joint lines.
    - b. Test sample measurement lines within each test section shall be multidirectional along 2 orthogonal lines, as defined by ASTM E1155, at a spacing to be determined by the City's testing agency.

- c. The precise layout of each test section shall be determined by the City's testing agency.
- 4. Concrete Floor Finish Tolerance
  - a. The following values apply before removal of shores. Levelness values (FL) do not apply to intentionally sloped or cambered areas, nor to slabs poured on metal deck or precast concrete.
    - 1) Slabs
 

Overall Value	FF45/FL30
Minimum Local Value	FF30/FL20
- 5. Floor Elevation Tolerance Envelope
  - a. The acceptable tolerance envelope for absolute elevation of any point on the slab surface, with respect to the elevation shown on the Drawings, is as follows:
    - 1) Slab-on-Grade Construction:  $\pm \frac{3}{4}$  inch
    - 2) Top surfaces of formed slabs measured prior to removal of supporting shores:  $\pm \frac{3}{4}$  inch.
    - 3) Top surfaces of all other slabs:  $\pm \frac{3}{4}$  inch
    - 4) Slabs specified to slope shall have a tolerance from the specified slope of  $\frac{3}{8}$  inch in 10 feet at any point, up to  $\frac{3}{4}$  inch from theoretical elevation at any point.

**3.8 SYSTEM STARTUP [NOT USED]**

**3.9 ADJUSTING [NOT USED]**

**3.10 CLEANING**

A. Defective Work

- 1. Imperfect or damaged work or any material damaged or determined to be defective before final completion and acceptance of the entire job shall be satisfactorily replaced at the Contractor's expense, and in conformity with all of the requirements of the Drawings and Specifications.
- 2. Perform removal and replacement of concrete work in such manner as not to impair the appearance or strength of the structure in any way.

B. Cleaning

- 1. Upon completion of the work remove from the site all forms, equipment, protective coverings and any rubbish resulting therefrom.
- 2. After sweeping floors, wash floors with clean water.
- 3. Leave finished concrete surfaces in a clean condition, satisfactory to the City.

**3.11 CLOSEOUT ACTIVITIES [NOT USED]**

**3.12 PROTECTION [NOT USED]**

**3.13 MAINTENANCE [NOT USED]**

**3.14 ATTACHMENTS [NOT USED]**

**END OF SECTION**

**SECTION 03 30 00.1 SUPPLEMENTAL CAST-IN-PLACE CONCRETE  
- HIGH STRENGTH CONCRETE**

**1.0 GENERAL**

**1.1 SUMMARY**

- A. Furnish labor, materials, mixing and transporting equipment and incidentals necessary to proportion, mix, transport, place, consolidate, finish, and cure high strength concrete in the structure.
- B. Related sections: 03 30 00 Cast-In-Place Concrete

**1.2 DEFINITIONS**

- A. Cementitious Materials: Portland cement alone or in combination with one or more of the following: blended hydraulic cement, fly ash and other pozzolans, ground granulated blast-furnace slag, and silica fume; subject to compliance with requirements.

**1.3 SUBMITTALS**

Submittals shall be in accordance with Section 01 33 00, SUBMITTALS and shall include:

- A. Shop Drawings for:
  - 1. Mix design: For each concrete mix, complete the form "Concrete Mix Design" and one of the following forms: "Documentation of Required Average Strength – Field Strength Test Record" or "Documentation of Average Strength – Trial Mixtures".
  - 2. Submit a schedule to the Owner's representative which shows the sequence of concrete placements.
- B. Certified Test Reports for:
  - 1. Materials used in the trial mix design.
  - 2. Aggregate, conforming to ASTM C33, including the test reports for soundness and abrasion resistance.
  - 3. Aggregate:
    - a. Verification that aggregate is not "potentially reactive" per ASTM C289.
    - b. Or a cement chemical analysis indicating that the total alkali content is acceptable per section 2.02-A.
  - 4. Seven (7) day and 28-day compressive strength tests results.
    - a. When more than fifteen (15) 28-day compressive tests results are available from the current project for a given class of concrete, include the 15-test running average compressive strength versus the required average compressive strength (based on the previous 15 tests) in graphical form.

**1.4 QUALITY ASSURANCE**

- A. Installer Qualifications: An experienced installer who has completed concrete Work similar in material, design, and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.

- B. **Manufacturer Qualifications:** A firm experienced in manufacturing ready-mixed concrete products complying with ASTM C 94 requirements for production facilities and equipment.
  - 1. Manufacturer must be certified according to the National Ready Mixed Concrete Association's Certification of Ready Mixed Concrete Production Facilities.
- C. **Testing Agency Qualifications:** An independent testing agency, acceptable to authorities having jurisdiction and the Engineer, qualified according to ASTM C 1077 and ASTM E 329 to conduct the testing indicated, as documented according to ASTM E 548.
  - 1. Personnel conducting field tests shall be qualified as ACI Concrete Field-Testing Technician, Grade 1, according to ACI CP-1 or an equivalent certification program.

**2.0 PRODUCTS**

**2.1 MANUFACTURERS**

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
  - 1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, products specified.
  - 2. Products: Subject to compliance with requirements, provide one of the products specified.
  - 3. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified.
  - 4. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

**2.2 CONCRETE MATERIALS**

- A. **Cement; General:** If the fine and/or coarse aggregates test "Potentially Reactive", in accordance with ASTM C289, a low alkali Portland Cement shall be used. The total alkali content calculated as the percentage of sodium oxide (Na<sub>2</sub>O) plus 0.658 times the percentage of potassium oxide (K<sub>2</sub>O) shall not exceed 0.6.
- B. **Cement; Type:**
  - 1. Type I or I/II Portland Cement, conforming to ASTM C150; used for all concrete, unless noted otherwise.
- C. **Fly Ash/Pozzolans:** Conforming to ASTM C618, Class F fly ash; used in all classes of concrete. A supplier's certificate of the analysis and composition of the fly ash shall be supplied.
- D. **Coarse Aggregate**
  - 1. Crushed stone or gravel conforming to ASTM C33, in the gradation size specified.
  - 2. For gradation size number 467, a maximum aggregate size of 1-1/2" is:

Sieve Size	Percent Retained	Percent Passing
2"	0	100
1-1/2"	0 – 5	95 – 100
3/4"	30 – 65	35 – 70

3/8"	70 – 90	10 – 30
No. 4	95 – 100	0 – 5

3. For gradation size number 57, the maximum aggregate size of 1" is:

Sieve Size	Percent Retained	Percent Passing
1-1/2"	0	100
1"	0 – 5	95 – 100
1/2"	40 – 75	25 – 60
No. 4	90 – 100	0 – 10
No. 8	95 – 100	0 - 5

4. For gradation size number 67, the maximum aggregate size of 3/4" is:

Sieve Size	Percent Retained	Percent Passing
1"	0	100
3/4"	0 – 10	90 – 100
3/8"	45 – 80	20 – 55
No. 4	90 – 100	10 – 10
No. 8	95 – 100	0 – 5

5. For gradation size number 8, the maximum aggregate size of 3/8" is:

Sieve Size	Percent Retained	Percent Passing
1"	0	100
3/8"	0 – 15	85 – 100
No. 4	70 – 90	10 – 30
No. 8	90 – 100	0 – 10
No. 16	95 – 100	0 – 5

#### E. Fine Aggregate

1. Washed and screened natural sands or sands manufactured by crushing stones, conforming to ASTM C33. The gradation in ASTM C33 for air entrained concrete is:

Sieve Size	Percent Retained	Percent Passing
3/8"	0	100
#4	0 - 5	95 - 100
#8	0 - 20	80 - 100
#16	15 - 50	50 - 85
#30	40 - 75	25 - 60
#50	70 - 90	10 - 30
#100	90 - 98	2 - 10

2. Fine aggregate shall have not more than 45% retained between any two (2) consecutive sieves. Its fineness modulus, as defined in ASTM C125, shall be not less than 2.3 nor more than 3.1.

#### F. Water

1. Potable and complying with ASTM C 94.

## 2.3 ADMIXTURES

- A. Air-Entraining Admixture: Conforming to ASTM C260. The total average air content shall be in accordance with recommendations of ACI 211.1; 4.5%  $\pm$ 1.5% for 1-1/2" maximum size aggregate.
- B. Water Reducing Admixtures: Conforming to ASTM C494; Types "A" or "D" only; accurately measured and added to the mix according to the manufacturer's recommendations.
- C. Set Retarding Admixtures: Conforming to ASTM C494; Types "B" and "D" only; accurately measured and added to the mix in accordance to the manufacturer's recommendations.
- D. Water Reducing Admixtures - High Range (HRWR): High Range Water Reducer shall comply with ASTM C494, Type F or G. HRWR shall be accurately measured in accordance with the manufacturer's recommendations. HRWR shall be added to the concrete mix at the concrete batch plant. HRWR may not be added at placement site except to redose a batch and only after approval of the HRWR manufacturer. The high range water reducing admixture shall be able to maintain the plasticity range without significant loss of slump or rise in concrete temperature for 2 hours. With the use of these admixtures, slump limit shall be between 7" and 9" unless otherwise authorized by the manufacturer. Other admixtures may only be used with the HRWR if approved by the HRWR manufacturer. A representative of the HRWR manufacturer shall be present during any large placement, placement of slabs, or during times of unusual circumstance which may require changes to the product formulation.
  - 1. Manufacturers:
    - a. Master Builders, Inc.
    - b. W. R. Grace & Co.
    - c. Sika Corporation.

## 2.4 CURING MATERIALS

- A. Sheet Curing Material: Conforming to ASTM C171.
  - 1. Waterproof paper
  - 2. Polyethylene film
  - 3. White burlap - polyethylene film
- B. Membrane Curing Compounds: Membrane curing compound conforming to ASTM C309; having a color to indicate coverage when applied; non-staining; applied according to the manufacturer's recommendations. No curing compound shall be used on walls which are to receive a plaster mix finish. When tested according to ASTM C156, the curing compound shall provide a film which has retained, within the specimen, the following percentages of moisture present when the curing compound was applied:
  - 1. At least 97% at the end 24 hours
  - 2. At least 95% at the end of three (3) days
  - 3. At least 91% at the end of seven (7) days
- C. Concrete Curing and Sealing Compound: Where a sealer is necessary, use a concrete curing and sealing compound. Application of this product shall be in accordance with the manufacturer's recommendations.
  - 1. Sonneborn Kure-N-Seal W, by BASF The Chemical Company.

- D. Finishing Aid: Spraying material designed to form a monomolecular film on fresh concrete that reduces the rate of evaporation of surface moisture prior to finishing; conforming to Confilm, as manufactured by Master Builders, Inc. This material is not a curing compound. Concrete must be cured as specified.

## **2.5 RELATED MATERIALS**

- A. Joint Materials for Non-Water-Retaining Structures: Bituminous-type, preformed, expansion joint filler; conforming to ASTM D994.
- B. Bonding Agents:
  - 1. Install according to the manufacturer's recommendations and written instructions.
  - 2. Bonding agent shall be Sika Armatec 110 EpoCem by Sika Corporation.

## **2.6 REPAIR MATERIALS**

- A. Structural Concrete Repair Material: Non-shrink, non-slump, non-metallic, quick-setting patching mortar as approved by the manufacturer for each application and applied accordance with the manufacturer's recommendations.
  - 1. Products:
    - a. Sikatop 123 by Sika Corporation
    - b. Five Star Structural Concrete by Five Star Products, Inc.

## **2.7 CONCRETE MIXTURES**

- A. Design Criteria
  - 1. Concrete shall be composed of Portland Cement, fine aggregate, coarse aggregate, admixtures, and water, as specified. All Class A and C concrete shall include high range water reducer (HRWR).
  - 2. ACI 211.1 shall be the basis for selecting the proportions for concrete made with aggregates of normal and high density and of workability suitable for usual cast-in-place structures.
  - 3. The design of the concrete shall be consistent with the minimum requirements of strength and proportions stated herein and in accordance with ACI Standard 211.1 "Standard Practice for Selecting Proportions for Normal, Heavyweight, and Mass Concrete," subject to maximum water cement ratio, minimum cement content and minimum strengths specified.
  - 4. The workability of any mix shall be as required for the specific placing conditions and the method of placement. The concrete shall have the ability to be worked readily into corners and around reinforcing steel without the segregation of materials or the collection of free water on the surface. Compliance with specified slump limitations shall not necessarily designate a satisfactory mix.
  - 5. In no case shall the amount of coarse material produce harshness in placing or honeycombing in the structure when forms are removed.
  - 6. The maximum amount of coarse aggregate (dry loose volume) per cubic foot of finished concrete shall not exceed 0.82 cubic feet.
  - 7. The maximum amount of water includes the water in the aggregate, with the aggregates in a saturated, surface-dry condition.

8. The maximum water content shall be the amount added at the mixer, plus the free water in the aggregate, and minus the absorption of the aggregate based on a 30-minute absorption period. No allowance shall be made for the evaporation of water after batching. If additional water is required to obtain the desired slump, a compensating amount of cement shall also be added. In no case shall the maximum water-cement ratio exceed the specified maximum or that of the approved mix design. No additional compensation shall be made for additional cement.
9. If fly ash is to be used in place of cement, no more than 20% percent of the cement may be replaced. The amount of fly ash used in place of the cement shall be 20% percent greater than the amount of cement removed.
10. Concrete of 3000 psi or stronger shall contain air-entraining admixtures with the exception of drilled shafts. However, drilled shafts shall also contain air-entraining admixtures if fly ash is used or if placed underwater.
11. When job conditions dictate, water-reducing and set-controlling admixtures may be used. Only specified admixtures shall be used. Admixtures shall be batched at the batch plant.
12. Concrete shall be capable of developing two thirds of the required 28-day compressive strength in seven days.

**B. Concrete Classifications**

<b>Class</b>	<b>Min. 28-Day Compressive Strength (psi)</b>	<b>Max. Size Aggregate (inches)</b>	<b>Max. Water: Cement Ratio</b>	<b>Max. Slump* (inches)</b>	<b>Min. Sacks of Cement** Per CY</b>
A	4000	1.5*** Size No. 467	0.45	5	5.5
B	5000	1.5 Size No. 467	0.40	4	6.5

**C. Required Average Compressive Strength**

1. All concrete is required to have an average compressive strength greater than the specified strength. The required average compressive strength shall be established according to the requirements of ACI 301, 4.2.3.3.
2. Standard Deviation: If the production facility has records of field tests performed within the past 12 months and spanning a period of not less than 60 calendar days for a class of concrete within 1000 psi of that specified for the work, calculate a standard deviation, and establish the required average strength *f<sub>cr</sub>* in accordance with ACI 301, 4.2.3.2 and 4.2.3.3.a. If field test records are not available, select the required average strength from ACI 301, Table 4.2.3.3.b.

**D. Documentation of Required Average Compressive Strength**

1. Documentation indicating the proposed concrete proportions will produce an average compressive strength equal to or greater than the required average compressive strength, shall consist of field strength records or trial mixture.
2. Field Strength Records
  - a. Document field strength records according to ACI 301, 4.2.3.4.a and including the following.
    - 1) Field test data shall not be older than one year.



- 2) If field test data are available and represent a single group of at least 10 consecutive strength tests for one mixture, using the same materials, under the same conditions, and encompassing a period of not less than 60 days, verify that the average of the field test results equals or exceeds  $f_{cr}'$ . Submit for acceptance the mixture proportions along with the field test data.
  - 3) If the field test data represent two groups of compressive strength tests for two mixtures, plot the average strength of each group versus the water-cementitious materials ratio of the corresponding mixture proportions and interpolate between them to establish the required mixture proportions for  $f_{cr}'$ .
3. Trial Mixtures
- a. Establish trial mixture proportions according to ACI 301, 4.2.3.4.b and including the following.
    - 1) Make at least three trial mixtures complying with performance and design requirements. Each trial mixture shall have a different cementitious material content. Select water-cementitious materials ratios that will produce a range of compressive strengths encompassing the required average compressive strength  $f_{cr}'$ .
    - 2) Submit a plot of a curve showing the relationship between water-cementitious materials ratio and compressive strength.
    - 3) Establish mixture proportions so that the maximum water-cementitious materials ratio is not exceeded when the slump is at the maximum specified.
  - b. Laboratory samples shall be taken in accordance with the trial mix designs for laboratory testing purposes.
  - c. The fresh concrete shall be tested for Slump (ASTM C143) and Air Content (ASTM C173 and ASTM C231). Strength test specimens shall be made, cured, and tested for seven (7) and 28-day strength in accordance with ASTM C192, ASTM C39, and ASTM C293.
  - d. Suitable facilities shall be provided for readily obtaining representative samples of aggregate from each of the weigh batchers for test purposes and for obtaining representative samples of concrete for uniformity tests. The necessary platforms, tools, and equipment for obtaining samples shall be furnished. Aggregates shall be tested in accordance with ASTM C289.
  - e. The cement contents specified are minimum values. If additional quantities are required to obtain the specified strengths, supply the cement at no additional cost to the Owner.
  - f. A trial mix shall be designed by an independent testing laboratory, retained, and paid by the Contractor and approved by the Owner. The testing laboratory shall submit verification that the materials and proportions of the trial concrete mix design meet the specifications.
  - g. From these trial mix tests, the ratios between 7-day and 28-day strengths shall be established. The seven (7) day strength which corresponds to the required 28-day strength shall be determined.
  - h. The final results of the trial mix design shall be submitted to the Engineer at least ten (10) days prior to the scheduled beginning of concrete placement and shall be approved by the Engineer prior to the placement of any concrete.
4. Revisions to concrete mixtures
- a. When less than 15 compressive strength tests result for a given class of concrete are available from the current project:
    - 1) If any of the following criteria are met, take immediate steps to increase average compressive strength of the concrete.
      - a) A 7-day compressive strength test result multiplied by 1.5 falls below the required 28-day compressive strength.

- b) A 28-day compressive strength tests result is deemed not satisfactory.
- b. When at least 15 compressive strength test results for a given class of concrete become available from the current project:
  - 1) Calculate the actual average compressive strength, standard deviation and required average compressive strength using the previous 15 consecutive strength tests. Submit results in graphical form with each 28-day test result for that class of concrete.
  - 2) If any of the following criteria are met, take immediate steps to increase average compressive strength of the concrete.
    - a) A 7-day compressive strength test result multiplied by the average job-to-date ratio of 7-day to 28-day compressive strength falls below the required 28-day compressive strength.
    - b) A 28-day compressive strength tests result is deemed not satisfactory.
    - c) The average compressive strength falls below the required average compressive strength.
- c. When revisions to the mix design are required, notify the Engineer in writing of the corrective actions taken.

## **2.8 OFF SITE BATCH PLANT**

Batch plants shall be an established concrete batching facility meeting the requirements of the Concrete Plant Standards of the Concrete Plant Manufacturers Bureau.

## **2.9 CONCRETE MIXING**

- A. Mixers may be stationary, truck, or paving mixers of approved design. They shall be capable of combining the materials into a uniform mixture and of discharging without mixture segregation. Stationary and paving mixers shall be provided with an acceptable device to lock the discharge mechanism until the required mixing time has elapsed. The mixers or mixing plant shall include a device for automatically counting the total number of batches of concrete mixed. The mixers shall be operated at the drum or mixing blade speed designated by the manufacturer on the name plate.
- B. The mixing time for stationary mixers shall be based upon the mixer's ability to produce uniform concrete throughout the batch and from batch to batch. For guidance purposes, the manufacturer's recommendations, or one (1) minute for one (1) cubic yard plus 1/4 minute for each additional cubic yard may be used. Final mixing time shall be based on mixer performance. Mixers shall not be charged in excess of the capacity specified by the manufacturer.
- C. When a stationary mixer is used for partial mixing of the concrete (shrink mixed), the stationary mixing time may be reduced to the minimum necessary to intermingle the ingredients (about 30 seconds).
- D. When a truck mixer is used, either for complete mixing (transit-mixed) or to finish the partial mixing in a stationary mixer and in the absence of uniformity test data, each batch of concrete shall be mixed not less than 70 nor more than 100 revolutions of the drum, at the rate of rotation designated by the manufacturer of the equipment as mixing speed. If the batch is at least 1/2 cubic yard less than the rated capacity, in the absence of uniformity test data, the number of revolutions at mixing speed may be reduced to no less than 50. Additional mixing shall be performed at the speed designated by the manufacturer of the equipment as agitating speed. When necessary for proper control of the concrete, mixing of transit-mixed concrete shall not be permitted until the truck mixer is at the site of the concrete placement. Truck mixers shall be equipped with accurate revolution counters.

- E. Paving mixers may be either single compartment drum or multiple compartment drum type. A sled or box of suitable size shall be attached to the mixer under the bucket to catch any concrete spillage that may occur when the mixer is discharging concrete into the bucket. Multiple compartment drum paving mixers shall be properly synchronized. The mixing time shall be determined by time required to transfer the concrete between compartments of the drum.
- F. Vehicles used in transporting materials from the batching plant to the paving mixers shall have bodies or compartments of adequate capacity to carry the materials and to deliver each batch, separated and intact, to the mixer. Cement shall be transported from the batching plant to the mixers in separate compartments which are equipped with windproof and rain-proof covers.

### **3.0 EXECUTION**

#### **3.1 PREPARATION**

- A. Notify the Owner's representative upon completion of various portions of the work required for placing concrete, so that inspection may be made as early as possible. Keep the Owner's representative informed of the anticipated concrete placing schedule.
- B. All items, including lines and grades, forms, water stops, reinforcing, inserts, piping, electrical, plumbing and the Contractor's concreting materials and equipment shall be in compliance with the plans and specifications before proceeding.
- C. Do not place any concrete until formwork and the placing reinforcement in that unit is complete. Place no concrete before the completion of all adjacent operations which might prove detrimental to the concrete.
- D. Brilliantly light the work site so that all operations are plainly visible when concrete mixing, placing, and finishing continues after daylight. Whenever possible, concrete finishing shall be completed in daylight hours.
- E. When placing concrete, the forms shall be clean and entirely free from all chips, dirt, sawdust, and other extraneous matter. Forms for slab, beam and girder construction shall not have tie wire cuttings, nails, or any other matter which would mar the appearance of the finished construction. Clean forms and keep them free of any foreign matter during concrete placing.
- F. The concrete shall be mixed in quantities required for immediate use. Any concrete which is not in place within the time limits specified shall not be used. Concrete shall not be re-tempered.
- G. Concrete shall not be placed if impending weather conditions would impair the quality of the finished work.
- H. Unless otherwise provided, the following requirements shall govern the time sequence on which construction operations shall be carried.
  - 1. Forms for walls or columns shall not be erected on concrete footings until the concrete in the footing has cured for at least two (2) curing days. Concrete may be placed in a wall or column as soon as the forms and reinforcing steel placements are approved.
  - 2. Steel beams or forms and falsework for superstructures shall not be erected on concrete substructures until the substructure concrete has cured for at least four (4) curing days. Falsework required for superstructures shall not be erected until the substructure has

cured for four (4) curing days and shall not be removed until the superstructure has cured.

### **3.2 EMBEDDED ITEMS**

- A. Where aluminum anchors, aluminum shapes, or aluminum electrical conduits are embedded in concrete, paint aluminum contact surfaces with zinc rich primer. Allow the paint to thoroughly dry before placing the aluminum in contact with the concrete.
- B. Paint steel or other ferrous metal to be mounted on or placed in contact with dry/cured concrete.

### **3.3 JOINTS**

#### **A. Expansion Joints and Devices**

- 1. Workmanship: Exercise careful workmanship in joint construction to separate the concrete sections by an open joint or by the joint materials and make the joints true to the outline indicated.
- 2. Expansion Joints: Construct expansion joints and devices to provide expansion and contraction. Construct joints which are to be left open or filled with poured joint material with forms which are adaptable for loosening or early removal. In order to avoid jamming by the expansion action of the concrete and the consequent likelihood of injuring adjacent concrete, remove or loosen these forms as soon as possible after the concrete has initially set. Make provisions for loosening the forms to permit free concrete expansion without requiring full removal.

#### **B. Construction Joints**

- 1. Construction joints are formed by placing plastic concrete in direct contact with concrete which has attained its initial set. When concrete is specified as monolithic, the term shall be interpreted as the manner and sequence of concrete placement so that construction joints do not occur.
  - a. Unless noted otherwise, the maximum horizontal spacing of construction joints shall be 40-feet.
  - b. For slabs on grade, the maximum spacing between two construction joints or between a construction joint and a control joint shall be 15-feet, unless noted otherwise.
  - c. Unless noted otherwise or approved by the Engineer, the maximum vertical spacing of construction joints shall be 15-feet. If not detailed on the drawings, construction joint details and locations shall be submitted to the Engineer for approval.
- 2. Additional horizontal and vertical construction joints, when submitted and approved by the Engineer, may have an impact on reinforcing details. Revise reinforcing details to reflect additional joints.
- 3. Unless otherwise provided, construction joints shall be square and normal to the forms. Provide bulkheads in the forms for all joints except horizontal joints.
- 4. At the proper time, clean horizontal construction joints for receiving the succeeding lift using air-water cutting. The surface shall be exposed sound, clean aggregate. The air pressure supply to the jet shall be approximately 100 lbs. per square inch, and the water pressure sufficient to bring the water into effective influence of the air pressure. After cutting, wash the surface until there is no trace of cloudiness in the wash water.
- 5. In areas where air-water cutting cannot be satisfactorily accomplished, or in areas where it is undesirable to disturb the surface of the concrete before it has hardened, prepare the

surface for receiving the next lift by wet sand blasting to immediately remove all laitance and unsound concrete prior to placing of the next lift. Thoroughly wash the surface of the concrete after sand blasting to remove all loose material.

6. Provide construction joints with concrete keyways, reinforcing steel dowels, and water stops. The method of forming keys in keyed joints shall permit the easy removal of forms without chipping, breaking, or damaging the concrete.

### 3.4 CONCRETE PLACEMENT

#### A. Cold Weather

1. If air temperature is at or below 40 degrees F, cold weather concreting shall be performed in accordance with ACI-306R.
2. No concrete shall be mixed or placed when the atmospheric temperature is at or below 35 degrees F. The temperature shall be taken in the shade away from artificial heat.
3. In cases where the temperature drops below 40 degrees F after the concreting operations have been started, sufficient canvas and framework or other type of housing shall be furnished to enclose and protect the structure, in accordance with the requirements of ACI-306R. Sufficient heating apparatus such as stoves, salamanders, or steam equipment and fuel to provide heat shall be supplied. The concrete shall be protected when placed under all weather conditions. Should concrete placed under such conditions prove unsatisfactory, remove, and replace the concrete at no cost to the Owner.
4. When mixing with the air temperature below 40 degrees F, water used for mixing shall be heated to raise the concrete temperature to 70 degrees F. The temperature of the mixing water shall not exceed 165 degrees F when entering the mixer.
5. If heating the mixing water only does not raise the placing temperature of the concrete to 70 degrees F, the aggregate must also be heated, either by steam or dry heat, to raise the placing temperature of the concrete to the required temperature. In no case shall the aggregate temperature exceed 150 degrees F as it enters the mixer. The heating apparatus shall heat the mass of the aggregate uniformly and preclude the occurrence of hot spots which burn the material.
6. Salts, chemicals, or other foreign materials shall not be mixed with the concrete to preventing freezing. Calcium chloride is not permitted.

#### B. Hot Weather

1. Hot weather is defined as any combination of high air temperature, low relative humidity and wind velocity that impairs the quality of the concrete. Hot weather concreting shall be in accordance with ACI-305R. Concrete shall be placed in the forms without the addition of any more water than that required by the design (slump). No excess water shall be added on the concrete surface for finishing. Control of initial set of the concrete and extending the time for finishing operations may be accomplished with the use of approved water-reducing and set-retarding admixture, as specified.
2. Maximum time intervals between the addition of mixing water and/or cement to the batch, and the placing of concrete in the forms shall not exceed the following (excluding HRWR admixture use):

Concrete Temperature	Maximum Time from Water Batch to Placement
Non-Agitated Concrete	
Up to 80° F	30 Minutes

Over 80° F	15 Minutes
Agitated Concrete	
Up to 75° F	90 Minutes
75° to 89° F	60 Minutes

The use of an approved set-retarding admixture will permit the extension of the above time maximums by 30 minutes, for agitated concrete only.

The use of an approved high range water reducing (HRWR) admixture will allow placement time extensions as determined by the manufacturer.

3. The maximum temperature of concrete shall not exceed 90 degrees F at the time the concrete is placed. The temperatures of the mixing water shall be reduced by the use of chilled water or ice.
4. The maximum temperature of concrete with high range water reducing admixture shall not exceed 100 degrees F at the time concrete is placed.
5. Under extreme heat, wind, or humidity conditions, concreting operations may be suspended if the quality of the concrete being placed is not acceptable.

### 3.5 FINISHING FORMED SURFACES

- A. Forms for walls, columns and sides of beams and girders shall be removed as specified in Section 03100, CONCRETE FORMWORK. Patch, repair, finish, and clean concrete after form removal. Finish concrete within seven (7) days of form removal. Cure concrete as finishing progresses.
- B. Air voids, for all types of finishes, are defects and shall be removed by rubbing or patching.
- C. Finish Schedule

Type of Finish	Location
No Finish	Surfaces which are not visible from the inside or outside of the completed structure or more than 12-inches below finish grade (i.e., back of retaining walls below embankment, etc.)
Smooth Finish	Surfaces exposed to view and areas below to a point 12-inches below grade

- D. No Finish: After forms are removed, repair or patch tie holes and defects. Otherwise, no additional finish is required.
- E. Smooth Finish: Unless otherwise shown on the schedule above, provide smooth form finish for concrete surfaces to be exposed to view. The form facing material shall produce a smooth, hard, uniform texture on the concrete. The arrangement of the facing material shall be orderly and symmetrical with a minimum number of seams. Patch tie holes and defects and remove fins flush with the adjacent surface.

### 3.6 FINISHING FLOORS AND SLABS

- A. General: Comply with recommendations in ACI 302.1R for screeding, restraightening, and finishing operations for concrete surfaces. Do not wet concrete surfaces.

- B. Finish slabs, platforms, and steps monolithically and apply as indicated on the drawings and the following schedule of finishes:

Type of Finish	Location
Broom Finish	Exterior concrete platforms, steps, and ramps.

1. Broom Finish:  
Immediately after float finishing, slightly roughen trafficked surface by brooming with fiber-bristle broom perpendicular to main traffic route. Coordinate required final finish with Architect before application.

- C. Finishing in Hot, Dry Weather:

During periods of high temperature and/or low humidity, take extreme care in finishing the slabs to eliminate initial shrinkage cracks. Following the initial set of concrete, but while the concrete is still "green", continue to finish as required to remove shrinkage cracks which may occur. In hot, dry weather, keep a cement finisher on the job following normal finishing operations for a sufficient length of time to insure the removal of initial shrinkage cracks.

### 3.7 CONCRETE PROTECTION AND CURING

- A. General: Give careful attention to proper concrete curing. The curing methods shall be wet curing, sheet materials conforming to ASTM C171, or membrane curing compound conforming to ASTM C309. Membrane curing is not permitted on surfaces to be rubbed or on surfaces to which additional concrete, plaster mix mortar or terrazzo is to be applied. Unless the curing method is specified otherwise, select the appropriate curing method.

- B. Length of Curing Period:

1. A "curing day" shall be any day on which the atmospheric temperature taken in the shade, or the air temperature adjacent to the concrete, remains above 50 degrees F for at least 18 hours.
2. Cure concrete for a period of seven (7) consecutive days. In cold weather, when curing may be retarded, extend this period to seven (7) "curing days", up to a limit of 14 consecutive days.

- C. Wet Curing

1. Immediately following the finishing operations, cover concrete slabs, including roof slabs, with wet cotton mats or with a temporary covering of canvas or burlap. Keep thoroughly wet for a period of four (4) curing days after the concrete is placed. The covering shall be held in direct contact with the concrete. A temporary covering shall be required when the size of slab, size of mats, or other factors dictate that the mats cannot be placed immediately after the finishing operations without marring the finishing of the slab.
2. Water used for curing shall be free from injurious amounts of oil, acid, alkali, salt, or other deleterious substances.
3. Canvas or burlap covering material shall weigh not less than 12 ounces per square yard. Place the sections with a lap at the edges of at least 8". Saturate cover material with water previous to placing. Keep saturated as long as it remains in place. Use care in the placing of the cover material to prevent marring the concrete surface.

4. When temporary coverings are used, keep them in place only until the slab has sufficiently hardened so that a cotton mat covering can be substituted without marring or disturbing the slab finish. Thoroughly saturate cotton mats before placing and keep the mats on the slab in a saturated condition for a period of at least four (4) curing days.
- D. Sheet Curing: Sheet materials shall conform to ASTM C171. They shall be in contact with the entire concrete surface and applied according to the manufacturer's recommendations. Patch all holes. Where pedestrian traffic is unavoidable, provide suitable walkways to protect the sheet material.
- E. Membrane Curing
1. Membrane curing shall not be used on surfaces which receive paint, floor hardener, or plaster mix finish or other finish which would be hindered by the use of the curing compound.
  2. Cover the surface of the concrete with a continuous, uniform, water-impermeable coating, conforming to ASTM C309 "Liquid Membrane Forming Compounds for Curing Concrete" and apply according to ACI 308.
  3. Immediately after the removal of the side and end forms, apply a coating to the sides and ends of all concrete. Apply the solution under pressure with a spray nozzle so that the entire exposed surface is completely covered with a uniform film. The rate of application shall insure complete coverage, but the area covered shall not exceed 150 square feet per gallon of curing compound.
  4. The coating shall be sufficiently transparent and free of permanent color to not result in a pronounced color change from that of the natural concrete at the conclusion of the curing period. The coating shall, however, contain a dye of color strength to render the film distinctively visible on the concrete for a period of at least four (4) hours after application.
  5. After application and under normal conditions, the curing compound shall be dry to touch within one (1) hour and shall dry thoroughly and completely within four (4) hours. When thoroughly dry, it shall provide a continuous flexible membrane free from cracks or pinholes and shall not disintegrate, check, peel, or crack during the required curing period.
  6. If the seal is broken during the curing period, immediately repair it with additional sealing solution.

### **3.8 CONCRETE SURFACE REPAIRS**

- A. After the tie rods are broken back or removed, thoroughly clean the holes to remove grease and loose particles. Patch holes with structural concrete repair material. After the holes are completely filled, strike off flush excess mortar and finish the surface to render the filled hole inconspicuous.
- B. If the surface of the concrete is bulged, uneven, or shows honeycombing or form marks, which in the Engineer's opinion cannot be repaired satisfactorily, remove, and replace the entire section.
- C. Patch honeycomb and minor defects in all concrete surfaces with structural concrete repair material. Cut back each defective area with a pneumatic chipping tool as deep as the defect extends, but in no case less than 1/2". Prepare the existing concrete according to the recommendations of patching material manufacturers. Apply repair material according to the manufacturer's recommendations. Finish the surface of the patches to match finish on surrounding concrete.



### 3.9 FIELD QUALITY CONTROL

#### A. Testing

##### 1. General

- a. Tests shall be required throughout the work to monitor the quality of concrete. Samples shall be taken in accordance with ASTM C172.
- b. The Engineer may waive these requirements on concrete placements of ten (10) cubic yards or less. However, evidence shall be furnished showing a design mix which meets the specifications.
- c. Unless noted otherwise, testing of the materials, ready mix, transit mix or central plant concrete will be by an independent testing agency. The independent testing agency will be approved by the Owner and paid by the Contractor. A summary of all tests performed will be available. No concrete shall be placed without a representative present at either the plant or at the project site.
- d. Unless the Owner's laboratory is on the site, provide housing for the curing and storage of test specimens and equipment.

##### 2. Slump Test:

Slump tests, in accordance with ASTM C143, shall be used to indicate the workability and consistency of the concrete mix from batch to batch. Generally, a slump test shall be made at the start of operations each day, at regular intervals throughout a working day, and at any time when the appearance of the concrete suggests a change in uniformity.

##### 3. Air Content Test:

Tests for the concrete's air content shall be made in accordance with ASTM C231 or ASTM C173, at the point of delivery of concrete, prior to placing in forms. The test shall be made frequently to monitor a proper air content uniform from batch to batch.

##### 4. Temperature Test:

The temperature of the concrete to be placed shall be taken with a thermometer immediately before placement, with the point of measurement being in the chute or bucket. Temperature test shall be performed for each truck. Record temperatures on batch ticket.

##### 5. Compression Test:

- a. Compression test specimens shall be 6" x 12" concrete cylinders made and cured in accordance with ASTM C31. No fewer than two (2) specimens shall be made for each test at each age (7 and 28 days). Samples shall be taken at a minimum of every 50 cubic yards of concrete for each class placed. At least one (1) set of test specimens per day shall be made for each class of concrete used that day. Specimens shall be cured under laboratory conditions specified in ASTM C31. Additional concrete cylinders may be required for curing on the job under actual job curing conditions. These samples could be required when:

- 1) There is a possibility of the air temperature surrounding the concrete falling below 40 degrees F, or rising above 90 degrees F.
- 2) The curing procedure may need to be improved and/or lengthened.
- 3) It is necessary to determine when the structure may be put into service.

- b. Compression strength tests shall be made on the laboratory-cured and job-cured concrete cylinders at seven (7) and 28 days, in accordance with ASTM C39. The value of each test result shall be the average compressive strength of two (2) samples taken at the same time from the same batch of concrete. For the 28-day cylinders, the strength level shall be satisfactory if the averages of all sets of three (3) consecutive strength test results exceed the required design compressive strength, and no individual strength test result falls below the required compressive strength by more than 500 psi.

6. High Early Strength Concrete Test  
When Type "III" High Early Strength Portland Cement is used instead of Type "I" Portland Cement, the minimum allowable 28-day strength for Type "I" Portland Cement concrete shall be at seven (7) days. The ages at time of test for Type "III" shall be three (3) days and seven (7) days, instead of seven (7) days and 28 days, respectively, for Type "I."
7. Failure to Meet Requirements
  - a. Should the 7-day strengths shown by the test specimens fall below the required values, additional curing shall be performed on those portions of the structures represented by the test specimens at the Contractor's expense. Test cores shall be obtained and tested in accordance with ASTM Test Method for Obtaining and Testing Drilled Cores and Sawed Beams of Concrete, Designation C42. If additional curing does not give the strength required, the Owner reserves the right to require strengthening, replacement of those substandard portions of the structure, or additional testing, at the Contractor's expense.
  - b. Upon receipt of the Contractor's written request, substandard concrete work may be re-examined in place by non-destructive testing methods or core samples, in accordance with ACI 301. The services of an independent testing laboratory shall be retained, and all expenses paid without compensation from the Owner. Laboratory results shall be evaluated by the Engineer, who shall make the final decision on acceptability of the concrete in question. Core sample holes shall be repaired.
- B. The Owner may withhold payment for any section of concrete which does not meet the requirements of these specifications. Withheld payment shall be based upon the unit prices established for concrete and reinforcing steel. Payment shall be withheld until the unacceptable concrete has been refinished, removed, and replaced or otherwise brought into conformance with the specifications.

**END OF SECTION**

## **03 34 13 CONTROLLED LOW STRENGTH MATERIAL (CLSM)**

### **PART 1 - GENERAL**

#### **1.1 SUMMARY**

- A. Section includes:
  - 1. Controlled low strength material (CLSM) for use in the following:
    - a. Flowable backfill.
- B. Deviations from this City of Lewisville Standard Specification
  - 1. None.
- C. Related Specification Sections include, but are not necessarily limited to:
  - 1. Division 0 – Bidding Requirements, Contract Forms and Conditions of the Contract
  - 2. Division 1 – General Requirements
  - 3. Section 03 30 00 - Cast-in-Place Concrete

#### **1.2 PRICE AND PAYMENT PROCEDURES**

- A. Measurement and Payment
  - 1. Measurement
    - a. This Item is considered subsidiary to the structure or Items being placed.
  - 2. Payment
    - a. The work performed and the materials furnished in accordance with this Item are subsidiary to the structure or Items being placed and no other compensation will be allowed.

#### **1.3 REFERENCES**

- A. Reference Standards
  - 1. Reference standards cited in this Specification refer to the current reference standard published at the time of the latest revision date logged at the end of this Specification, unless a date is specifically cited.
- B. ASTM International (ASTM):
  - 1. C31 - Standard Practice for Making and Curing Concrete Test Specimens in the Field.
  - 2. C33 - Standard Specification for Concrete Aggregates.
  - 3. C39 - Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens.
  - 4. C143 - Standard Test Method for Slump of Hydraulic Cement Concrete.
  - 5. C231 - Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method.
  - 6. C260 - Standard Specification for Air-Entraining Admixtures for Concrete.
  - 7. C618 - Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete.

#### **1.4 ADMINISTRATIVE REQUIREMENTS [NOT USED]**

#### **1.5 SUBMITTALS**

- A. Provide submittals in accordance with Section 01 33 00.

- B. All submittals shall be approved by the City prior to delivery and/or fabrication for specials.

**1.6 ACTION SUBMITTALS/INFORMATIONAL SUBMITTALS**

- A. Product data
- B. Sieve analysis
  - 1. Submit sieve analyses of fine and coarse aggregates being used.
    - a. Resubmit at any time there is a significant change in grading of materials.
  - 2. Mix
    - a. Submit full details, including mix design calculations for mix proposed for use.
- C. Trial batch test data
  - 1. Submit data for each test cylinder.
  - 2. Submit data that identifies mix and slump for each test cylinder.

**1.7 CLOSEOUT SUBMITTALS [NOT USED]**

**1.8 MAINTENANCE MATERIAL SUBMITTALS [NOT USED]**

**1.9 QUALITY ASSURANCE [NOT USED]**

**1.10 DELIVERY, STORAGE, AND HANDLING [NOT USED]**

**1.11 FIELD CONDITIONS [NOT USED]**

**1.12 WARRANTY [NOT USED]**

**PART 2 - PRODUCTS**

**2.1 OWNER-FURNISHED OR OWNER-SUPPLIED PRODUCTS [NOT USED]**

**2.2 PRODUCT TYPES AND MATERIALS**

- A. Materials
  - 1. Portland cement: Type II low alkali Portland cement as specified in Section 03 30 00.
  - 2. Fly ash: Class F fly ash in accordance with ASTM C618.
  - 3. Water: As specified in Section 03 30 00.
  - 4. Admixture: Air entraining admixture in accordance with ASTM C260.
  - 5. Fine aggregate: Concrete sand (does not need to be in accordance with ASTM C33). No more than 12 percent of fine aggregate shall pass a No. 200 sieve, and no plastic fines shall be present.
  - 6. Coarse aggregate: Pea gravel no larger than 3/8 inch.
- B. Mixes
  - 1. Performance requirements
    - a. Total calculated air content
      - 1) Not less than 8.0 percent or greater than 12.0 percent.
    - b. Minimum unconfined compressive strength
      - 1) Not less than 50 psi measured at 28 days.
    - c. Maximum unconfined compressive strength
      - 1) Not greater than 150 psi measured at 28 days.

- 2) Limit the long-term strength (90 days) to 200 psi such that material could be re-excavated with conventional excavation equipment in the future if necessary.
  - d. Wet density
    - 1) No greater than 132 pounds per cubic foot.
  - e. Color
    - 1) No coloration required unless noted.
    - 2) Submit dye or other coloration means for approval.
2. Suggested design mix

<b>Material</b>	<b>Weight</b>	<b>Specific Gravity</b>	<b>Absolute Volume Cubic Foot</b>
Cement	30 pounds	3.15	0.15
Fly Ash	300 pounds	2.30	2.09
Water	283 pounds	1.00	4.54
Coarse Aggregate	1,465 pounds	2.68	8.76
Fine Aggregate	1,465 pounds	2.68	8.76
Admixture	4-6 ounces	-	2.70
<b>TOTAL</b>	<b>3,543 pounds</b>	<b>-</b>	<b>27.00</b>

### 2.3 ACCESSORIES [NOT USED]

### 2.4 SOURCE QUALITY CONTROL

- A. Trial batch
  - 1. After mix design has been accepted by Engineer, have trial batch of the accepted mix design prepared by testing laboratory acceptable to Engineer.
  - 2. Prepare trial batches using specified cementitious materials and aggregates proposed to be used for the Work.
  - 3. Prepare trial batch with sufficient quantity to determine slump, workability, consistency, and to provide sufficient test cylinders.
- B. Test cylinders:
  - 1. Prepare test cylinders in accordance with ASTM C31 with the following exceptions:
    - a. Fill the concrete test cylinders to overflowing and tap sides lightly to settle the mix.
    - b. Do not rod the concrete mix.
    - c. Strike off the excess material.
  - 2. Place test cylinders in a moist curing room. Exercise caution in moving and transporting the cylinders since they are fragile and will withstand only minimal bumping, banging, or jolting without damage.
  - 3. Do not remove the test cylinder from mold until the cylinder is to be capped and tested.
  - 4. The test cylinders may be capped with standard sulfur compound or neoprene pads:
    - a. Perform the capping carefully to prevent premature fractures.
    - b. Use neoprene pads a minimum of 1/2 inch thick, and 1/2 inch larger in diameter than the test cylinders.

- c. Do not perform initial compression test until the cylinders reach a minimum age of 3 days.
- C. Compression test 8 test cylinders: Test 4 test cylinders at 3 days and 4 at 28 days in accordance with ASTM C39 except as modified herein:
  - 1. The compression strength of the 4 test cylinders tested at 28 days shall be equal to or greater than the minimum required compression strength, but not exceed maximum compression strength.
- D. If the trial batch tests do not meet the Specifications for strength or density, revise and resubmit the mix design, and prepare additional trial batch and tests. Repeat until an acceptable trial batch is produced that meets the Specifications.
  - 1. All the trial batches and acceptability of materials shall be paid by the CONTRACTOR.
  - 2. After acceptance, do not change the mix design without submitting a new mix design, trial batches, and test information.
- E. Determine slump in accordance with ASTM C143 with the following exceptions:
  - 1. Do not rod the concrete material.
  - 2. Place material in slump cone in 1 semi-continuous filling operation, slightly overfill, tap lightly, strike off, and then measure and record slump.

### **PART 3 - EXECUTION**

#### **3.1 INSTALLERS [NOT USED]**

#### **3.2 EXAMINATION [NOT USED]**

#### **3.3 PREPARATION [NOT USED]**

#### **3.4 INSTALLATION**

- A. Place CLSM by any method which preserves the quality of the material in terms of compressive strength and density:
  - 1. Limit lift heights of CLSM placed against structures and other facilities that could be damaged due to the pressure from the CLSM, to the lesser of 4 feet or the lift height indicated on the Drawings. Do not place another lift of CLSM until the last lift of CLSM has set and gained sufficient strength to prevent lateral load due to the weight of the next lift of CLSM.
  - 2. The basic requirement for placement equipment and placement methods is the maintenance of its fluid properties.
  - 3. Transport and place material so that it flows easily around, beneath, or through walls, pipes, conduits, or other structures.
  - 4. Use a slump of the placed material greater than 9 inches, and sufficient to allow the material to flow freely during placement:
    - a. After trial batch testing and acceptance, maintain slump developed during testing during construction at all times within  $\pm 1$  inch.
  - 5. Use a slump, consistency, workability, flow characteristics, and pumpability (where required) such that when placed, the material is self-compacting, self-densifying, and has sufficient plasticity that compaction or mechanical vibration is not required.
  - 6. When using as embedment for pipe take appropriate measures to ensure line and grade of pipe.

### **3.5 REPAIR [NOT USED]**

### **3.6 RE-INSTALLATION [NOT USED]**

### **3.7 FIELD QUALITY CONTROL**

#### **A. General**

1. Make provisions for and furnish all material for the test specimens and provide manual assistance to assist the Engineer in preparing said specimens.
2. Be responsible for the care of and providing curing condition for the test specimens.

#### **B. Tests by the City**

1. During the progress of construction, the City will have tests made to determine whether the CLSM, as being produced, complies with the requirements specified hereinbefore. Test cylinders will be made and delivered to the laboratory by the Engineer and the testing expense will be borne by the City.
2. Test cylinders
  - a. Prepare test cylinders in accordance with ASTM C31 with the following exceptions:
    - 1) Fill the concrete test cylinders to overflowing and tap sides lightly to settle the mix.
    - 2) Do not rod the concrete mix.
    - 3) Strike off the excess material.
  - b. Place the cylinders in a safe location away from the construction activities. Keep the cylinders moist by covering with wet burlap, or equivalent. Do not sprinkle water directly on the cylinders.
  - c. After 2 days, place the cylinders in a protective container for transport to the laboratory for testing. The concrete test cylinders are fragile and shall be handled carefully. The container may be a box with a Styrofoam or similar lining that will limit the jarring and bumping of the cylinders.
  - d. Place test cylinders in a moist curing room. Exercise caution in moving and transporting the cylinders since they are fragile and will withstand only minimal bumping, banging, or jolting without damage.
  - e. Do not remove the test cylinder from mold until the cylinder is to be capped and tested.
  - f. The test cylinders may be capped with standard sulfur compound or neoprene pads:
    - 1) Perform the capping carefully to prevent premature fractures.
    - 2) Use neoprene pads a minimum of 1/2 inch thick, and 1/2 inch larger in diameter than the test cylinders.
    - 3) Do not perform initial compression test until the cylinders reach a minimum age of 3 days.
3. The number of cylinder specimens taken each day shall be determined by the Inspector.
  - a. Test 1 cylinder at 3 days and 2 at 28 days in accordance with ASTM C39 except as modified herein.
  - b. The compression strength of the cylinders tested at 28 days shall be equal to or greater than the minimum required compression strength, but not exceed maximum compression strength.
4. The City will test the air content of the CLSM. Test will be made immediately after discharge from the mixer in accordance with ASTM C231.
5. Test the slump of CLSM using a slump cone in accordance with ASTM C143 with the following exceptions:
  - a. Do not rod the concrete material.

- b. Place material in slump cone in 1 semi-continuous filling operation, slightly overfill, tap lightly, strike off, and then measure and record slump.
6. If compressive strength of test cylinders does not meet requirements, make corrections to the mix design to meet the requirements of this specification.

**3.8 SYSTEM STARTUP [NOT USED]**

**3.9 ADJUSTING [NOT USED]**

**3.10 CLEANING [NOT USED]**

**3.11 CLOSEOUT ACTIVITIES [NOT USED]**

**3.12 PROTECTION [NOT USED]**

**3.13 MAINTENANCE [NOT USED]**

**3.14 ATTACHMENTS [NOT USED]**

**END OF SECTION**



**PART 1 - GENERAL****1.1 SUMMARY**

- A. Section includes:
  - 1. Concrete base material for trench repair
- B. Deviations from this City of Lewisville Standard Specification
  - 1. None.
- C. Related Specification Sections include, but are not necessarily limited to:
  - 1. Division 0 – Bidding Requirements, Contract Forms and Conditions of the Contract
  - 2. Division 1 – General Requirements
  - 3. Section 03 30 00 – Cast-in-Place Concrete

**1.2 PRICE AND PAYMENT PROCEDURES**

- A. Measurement and Payment
  - 1. Measurement
    - a. This Item is considered subsidiary to the structure or Items being placed.
  - 2. Payment
    - a. The work performed and the materials furnished in accordance with this Item are subsidiary to the structure or Items being placed and no other compensation will be allowed.

**1.3 REFERENCES**

- A. Reference Standards
  - 1. Reference standards cited in this Specification refer to the current reference standard published at the time of the latest revision date logged at the end of this Specification unless a date is specifically cited.
- B. ASTM International (ASTM):
  - 1. C31, Standard Practice for Making and Curing Concrete Test Specimens in the Field.
  - 2. C33, Standard Specification for Concrete Aggregates.
  - 3. C39, Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens.
  - 4. C143, Standard Test Method for Slump of Hydraulic-Cement Concrete.
  - 5. C172, Standard Practice for Sampling Freshly Mixed Concrete.
  - 6. C231, Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method.
  - 7. C260, Standard Specification for Air-Entraining Admixtures for Concrete.
  - 8. C618, Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete.
  - 9. C1064, Standard Test Method for Temperature of Freshly Mixed Hydraulic-Cement Concrete.

**1.4 ADMINISTRATIVE REQUIREMENTS [NOT USED]****1.5 SUBMITTALS**

- A. Provide submittals in accordance with Section 01 33 00.

- B. All submittals shall be approved by the City prior to delivery and/or fabrication for specials.

**1.6 ACTION SUBMITTALS/INFORMATIONAL SUBMITTALS**

- A. Submit proposed mix design for Engineer's review a minimum of 2 weeks prior to start of low density concrete backfill work.

**1.7 CLOSEOUT SUBMITTALS [NOT USED]**

**1.8 MAINTENANCE MATERIAL SUBMITTALS [NOT USED]**

**1.9 QUALITY ASSURANCE [NOT USED]**

**1.10 DELIVERY, STORAGE, AND HANDLING [NOT USED]**

**1.11 FIELD CONDITIONS [NOT USED]**

**1.12 WARRANTY [NOT USED]**

**PART 2 - PRODUCTS**

**2.1 OWNER-FURNISHED OR OWNER-SUPPLIED PRODUCTS [NOT USED]**

**2.2 PRODUCT TYPES AND MATERIALS**

- A. Mix Design
  - 1. Performance requirements
    - a. Concrete Base Material for Trench Repair
      - 1) 28-day compressive strength of not less than 750 psi and not more than 1,200 psi.
- B. Materials
  - 1. Portland cement
    - a. Type II low alkali portland cement as specified in Section 03 30 00.
  - 2. Fly ash
    - a. Class F fly ash in accordance with ASTM C618.
  - 3. Water
    - a. As specified in Section 03 30 00.
  - 4. Admixture
    - a. Air entraining admixture in accordance with ASTM C260.
  - 5. Fine aggregate
    - a. Concrete sand (does not need to be in accordance with ASTM C33).
    - b. No more than 12 percent of fine aggregate shall pass a No. 200 sieve, and no plastic fines shall be present.
  - 6. Coarse aggregate
    - a. Pea gravel no larger than 3/8 inch.

## **2.3 ACCESSORIES [NOT USED]**

## **2.4 SOURCE QUALITY CONTROL [NOT USED]**

# **PART 3 - EXECUTION**

## **3.1 INSTALLERS [NOT USED]**

## **3.2 EXAMINATION [NOT USED]**

## **3.3 PREPARATION [NOT USED]**

## **3.4 INSTALLATION**

- A. Place concrete base material by any method which preserves the quality of the material in terms of compressive strength and density.
  - 1. The basic requirement for placement equipment and placement methods is the maintenance of its fluid properties.
  - 2. Transport and place material so that it flows easily around, beneath, or through walls, pipes, conduits, or other structures.
  - 3. Use a slump, consistency, workability, flow characteristics, and pumpability (where required) such that when placed, the material is self-compacting, self-densifying, and has sufficient plasticity that compaction or mechanical vibration is not required.

## **3.5 REPAIR [NOT USED]**

## **3.6 RE-INSTALLATION [NOT USED]**

## **3.7 FIELD QUALITY CONTROL**

- A. General
  - 1. Make provisions for and furnish all material for the test specimens and provide manual assistance to assist the Engineer in preparing said specimens.
  - 2. Be responsible for the care of and providing curing condition for the test specimens.
- B. Concrete Tests: Perform testing of composite samples of fresh concrete obtained according to ASTM C172 according to the following requirements:
  - 1. Testing Frequency: Obtain 1 composite sample for each day's pour of each concrete mixture up to 25 cubic yards, plus 1 set for each additional 50 cubic yards or fraction thereof.
  - 2. Slump: ASTM C143; 1 test at point of placement for each composite sample, but not less than 1 test for each day's pour of each concrete mixture. Perform additional tests when concrete consistency appears to change.
  - 3. Air Content: ASTM C231, pressure method, for normal-weight concrete; 1 test for each composite sample, but not less than 1 test for each day's pour of each concrete mixture.
  - 4. Concrete Temperature: ASTM C1064; 1 test hourly when air temperature is 40 degrees Fahrenheit and below and when 80 degrees Fahrenheit and above, and 1 test for each composite sample.
  - 5. Compression Test Specimens: ASTM C31.
    - a. Cast and laboratory cure 4 cylinders for each composite sample.
      - 1) Do not transport field cast cylinders until they have cured for a minimum of 24 hours.
  - 6. Compressive-Strength Tests: ASTM C39
    - a. Test 1 cylinder at 7 days.

- 3.8 SYSTEM STARTUP [NOT USED]
- 3.9 ADJUSTING [NOT USED]
- 3.10 CLEANING [NOT USED]
- 3.11 CLOSEOUT ACTIVITIES [NOT USED]
- 3.12 PROTECTION [NOT USED]
- 3.13 MAINTENANCE [NOT USED]
- 3.14 ATTACHMENTS [NOT USED]

**END OF SECTION**

**PART 1    GENERAL**

**1.1    SUMMARY**

- A. Section includes: Grouting basin bottom slabs.
- B. Related sections:
  - 1. The Contract Documents are complementary; what is called for by one is as binding as if called for by all.
  - 2. It is the Contractor's responsibility for scheduling and coordinating the Work of subcontractors, suppliers, and other individuals or entities performing or furnishing any of Contractor's Work.

**1.2    REFERENCES**

- A. International Concrete Repair Institute (ICRI):
  - 1. 310.2 - Selecting and Specifying Concrete Surface Preparation for Sealers, Coatings, and Polymer Overlays.

**1.3    DEFINITIONS**

- A. Grout that has not bonded: Grout that, after placing and setting, has hollow sound when tapped with 4-foot long, nominal, 2-inch by 4-inch piece of lumber.
- B. Jitterbug: An expanded metal or grate tamper designed for finishing concrete surfaces with a rough surface profile.

**1.4    SUBMITTALS**

- A. Manufacturer's instructions:
  - 1. For equipment to be used in grouting basin bottom slabs:
    - a. Submit grout placement instructions from manufacturer of equipment designated to operate in basin.
    - b. Include in such instruction's statements on limitations and precautions to be observed when using equipment for grout placement.

**1.5    QUALITY ASSURANCE**

- A. Pre-installation conference for grouting basin bottom slabs: Schedule meeting with Engineer not less than 24 hours before planned grouting operations to discuss method of placement of grout.

**PART 2    PRODUCTS**

**2.1    MATERIALS**

- A. Materials for grout:
  - 1. Cement, sand, and water: As specified in Section 03 30 00.

## 2.2 MIXES

- A. Grout mixture:
  - 1. One-part Portland cement and 4-1/2 parts sand, by weight.
  - 2. Water content:
    - a. Sufficient to allow workability for spreading grout with screeds attached to arms of equipment mechanism.
    - b. Not excessive, to prevent formation of surface water, laitance, segregation, and to allow grout to stay in place after screeding.
  - 3. Do not use admixtures.

## PART 3 EXECUTION

### 3.1 PREPARATION

- A. Surface preparation:
  - 1. Basin bottom slab surface preparation:
    - a. Concrete slab surfaces shall have rough texture, suitable for bonding grout.
    - a. During concrete placement: finish concrete surface with jitterbug. Do not provide a smooth troweled surface.
    - b. Roughen top of slab surface to a ICRI 310.2 surface profile of CSP-5 or rougher using one of the following methods:
      - 1) Abrasive blasting.
      - 2) Steel shotblasting.
      - 3) Ultra-high-pressure water jetting.
    - c. Clean entire slab surface as required to remove dirt, oil, curing compound, laitance, dust, and other matter that may prevent proper grout bonding.
    - d. Saturate concrete slabs with water for minimum of three (3) days just before placing grout. At time grout is placed, concrete shall be saturated and surface damp.
- B. Equipment preparation:
  - 1. Preparation of equipment for grouting basin bottom slabs:
    - a. Setting the screeds:
      - 1) Bolt nominal 2-inch by 4-inch section of lumber blades on arms of equipment mechanism.
      - 2) Locate leading edge of lumber approximately 2 inches in front of blade and cut it parallel to centerline of arm.
      - 3) Securely nail nominal 2-inch by 6-inch screed board to ends of 2 by 4 lumber, in manner such that screed runs parallel to centerline of arm.
      - 4) Nail bent sheet metal to lower edge of screed board.
      - 5) Ensure that bottom of screed board is 1-1/2 inches below steel blades on arms of equipment mechanism.

### 3.2 APPLICATION

- A. Grouting basin bottom slabs:
  - 1. Placement, general:

- a. Place grout in accordance with equipment manufacturer's instructions and in accordance with limitations and precautions given in such instructions.
  - b. Bring promptly to attention of the Engineer, conflicts between manufacturer's instructions and this Section.
2. Placing grout:
- a. Use grouting equipment to apply grout for basin bottom slabs.
  - b. Perform grouting continuously without interruptions until basin slab is covered.
  - c. Place ring of grout approximately 3 feet wide on outer edge of slab and gradually widened towards center following spiral pattern until basin bottom slab is covered.
  - d. Unacceptable placing procedure: Following procedures will not be accepted:
    - 1) Grouting by circular sectors or "pie" sections.
    - 2) Grouting from center outward.
  - e. Use finishing workers to control area immediately in front of screed boards in manner so that:
    - 1) Grout is installed to specified thickness.
    - 2) No low areas occur.
    - 3) No excessive amount of grout accumulates.
    - 4) Grout surface has uniform wood trowel finish without ridges, gouges, or other defect.
  - f. Coordinate grout placement rate and number of finishing workers with travel speed of arms of equipment mechanism.
  - g. Last grout area to be grouted in center may be finished by worker operating from 1 of the arms.
  - h. Use misters or means acceptable to Engineer to keep grout from drying out before start of curing.
3. Following grout placement:
- a. After completion of slab grouting, allow mechanism to run continuously until there is no more danger that grout sloughing may occur.
  - b. Prevent dry clumps of grout or rocks from being caught under screed board and gouging finish surface of grout.
4. Corrections:
- a. Before grout has set:
    - 1) Where sloughing has occurred, remove grout from sloughed areas and place grout in low areas.
    - 2) Repair gouges in grouted surface.
5. Curing:
- a. After grout has set, water cure grout for 7 days.
  - b. Keep grout surface continuously wet for duration of curing period.

B. Tolerances:

- 1. For grouting basin bottom slabs:
  - a. Tolerance in elevation of finished grout surface: Plus, or minus 1/8 inch.
    - 1) Specified tolerance is more exacting than customary industry standards for slab finish.
    - 2) Tolerance is required for proper operation of equipment.
  - b. Thickness of grout layer:
    - 1) Not less than 1 inch at any point.
    - 2) Provide average thickness of grout as indicated on the Drawings.

### **3.3 FIELD QUALITY CONTROL**

#### **A. Inspection:**

1. Verify grout elevation tolerance on basin bottom slabs as follows:
  - a. After grout has set, operate grouting equipment with blades set to clear grout surface.
  - b. Under these conditions, blades shall not clear grout surface by more than 1/4 inch at any point:
    - 1) Excess clearance: Correct as specified in article titled "Adjusting" in this Section.

### **3.4 ADJUSTING**

#### **A. Grouting basin bottom slabs:**

1. After grout has set:
  - a. Where clearance between blades and grouted surface exceeds tolerance specified in this Section, grind high points in grout surface using terrazzo machine until specified tolerance is met.
  - b. Grout that has not bonded to concrete slab is not acceptable. Remove and replace such grout.

**END OF SECTION**



**03 80 00            MODIFICATIONS TO EXISTING CONCRETE STRUCTURES**

**1.0        GENERAL**

**1.1        SUMMARY**

- A. Section includes:
  - 1. Modifications to existing concrete structures, including:
    - a. Manholes
    - b. Junctionboxes
    - c. Vaults
    - d. Retainingwalls
    - e. Wing and head walls
    - f. Culverts
  - 2. This section does not include modifications to Reinforced Concrete Pipe.
- B. Deviations from this City of Lewisville Standard Specification
  - 1. None.
- C. Related Specification Sections include, but are not necessarily limited to:
  - 2. Division 0 – Bidding Requirements, Contract Forms and Conditions of the Contract
  - 3. Division 1 – General Requirements

**1.2        PRICE AND PAYMENT PROCEDURES**

- A. Measurement and Payment
  - 1. Measurement
    - a. This Item is considered subsidiary to the structure or Items being placed.
  - 2. Payment
    - a. The work performed and the materials furnished in accordance with this Item are subsidiary to the structure or Items being placed and no other compensation will be allowed.

**1.3        REFERENCES**

- A. Reference Standards
  - 1. Reference standards cited in this Specification refer to the current reference standard published at the time of the latest revision date logged at the end of this Specification unless a date is specifically cited.
  - 2. ASTM International (ASTM):
    - a. A615, Deformed and Plain Billet-Steel Bars for Concrete Reinforcement.

- b. C881, Standard Specification for Epoxy-Resin-Base Bonding Systems for Concrete.
- c. C882, Standard Test Method for Bond Strength of Epoxy-Resin Systems Used with Concrete by Slant Shear.
- d. D570, Standard Test Method for Water Absorption of Plastics.
- e. D638, Standard Test Method for Tensile Properties of Plastics.
- f. D695, Standard Test Method for Compressive Properties of Rigid Plastics.
- g. D732, Standard Test Method for Shear Strength of Plastics by Punch Tool.
- h. D790, Standard Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials.

B. Where reference is made to 1 of the above standards, the revision in effect at the time of bid opening applies.

**1.4 ADMINISTRATIVE REQUIREMENTS [NOT USED]**

**1.5 SUBMITTALS**

A. Provide submittals in accordance with Section 01 33 00.

B. All submittals shall be approved by the City prior to delivery and/or fabrication for specials.

**1.6 ACTION SUBMITTALS/INFORMATIONAL SUBMITTALS**

A. Product Data

- 1. Submit manufacturer's Product Data on all product brands proposed for use to the Engineer for review.
- 2. Include the manufacturer's installation and/or application instructions.

**1.7 CLOSEOUT SUBMITTALS [NOT USED]**

**1.8 MAINTENANCE MATERIAL SUBMITTALS [NOT USED]**

**1.9 QUALITY ASSURANCE**

A. When removing materials or portions of existing structures and when making openings in existing structures, take precautions and all erect all necessary barriers, shoring and bracing, and other protective devices to prevent damage to the structures beyond the limits necessary for the new work, protect personnel, control dust, and to prevent damage to the structures or contents by falling or flying debris.

B. Core sanitary sewer manhole penetrations.

**1.10 DELIVERY, STORAGE, AND HANDLING**

A. Deliver the specified products in original, unopened containers with the manufacturer's name, labels, product identification, and batch numbers.

B. Store and condition the specified product as recommended by the manufacturer.

**1.11 FIELD CONDITIONS [NOT USED]**

**1.12 WARRANTY [NOT USED]**

**2.0 PRODUCTS**

- A. OWNER-FURNISHED OR OWNER-SUPPLIED PRODUCTS [NOTUSED]
- B. PRODUCT TYPE AND MATERIALS

- A. Manufacturers

- 1. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
  - a. Available Products
    - 1) Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, products specified.
  - b. Available Manufacturers
    - 1) Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified.

- B. Materials

- 1. General
  - a. Comply with this Section and any state or local regulations.
- 2. Steel Reinforcement
  - a. Reinforcing Bars
    - 1) ASTM A615, Grade 60, deformed.
- 3. Epoxy Bonding Agent
  - a. A 2-component, solvent-free, asbestos-free, moisture-insensitive epoxy resin material used to bond plastic concrete to hardened concrete complying with the requirements of ASTM C881, Type V, and the additional requirements specified herein.
  - b. Properties of the cured material
    - 1) Compressive Strength (ASTM D695)
      - a) 8,500 psi minimum at 28 days
    - 2) Tensile Strength (ASTM D638)
      - a) 4,000 psi minimum at 14 days
    - 3) Flexural Strength (ASTM D790 - Modulus of Rupture)
      - a) 6,300 psi minimum at 14 days
    - 4) Shear Strength (ASTM D732)
      - a) 5,000 psi minimum at 14 days
    - 5) Water Absorption (ASTM D570 - 2-hour boil)
      - a) 1 percent maximum at 14 days
    - 6) Bond Strength (ASTM C882) Hardened to Plastic

- a) 1,500 psi minimum at 14 days moist cure
  - 7) Color
    - a) Gray
  - 8) Available Manufacturers:
    - a) Sika Corporation, Lyndhurst, New Jersey - Sikadur 32, Hi-Mod
    - b) BASF, Cleveland, Ohio - Concrecive 1438
4. Epoxy Paste
- a. A 2-component, solvent-free, asbestos free, moisture insensitive epoxy resin material used to bond dissimilar materials to concrete such as setting railing posts, dowels, anchor bolts, and all-threads into hardened concrete and complying with the requirements of ASTM C881, Type I, Grade 3, and the additional requirements specified herein.
  - b. Properties of the cured material
    - 1) Compressive Properties (ASTM D695): 10,000 psi minimum at 28 days
    - 2) Tensile Strength (ASTM D638): 3,000 psi minimum at 14 days. Elongation at break - 0.3 percent minimum
    - 3) Flexural Strength (ASTM D790 - Modulus of Rupture): 3,700 psi minimum at 14 days
    - 4) Shear Strength (ASTM D732): 2,800 psi minimum at 14 days
    - 5) Water Absorption (ASTM D570): 1.0 percent maximum at 7 days
    - 6) Bond Strength (ASTM C882): 2,000 psi at 14 days moist cure
    - 7) Color: Concrete grey
    - 8) Available Manufacturers
      - a) Overhead Applications
        - 1. Sika Corporation, Lyndhurst, New Jersey - Sikadur 32, Hi-Mod LV
        - 2. BASF - Concrecive 1438
      - b) All Other Applications
        - 1. Sika Corporation, Lyndhurst, New Jersey - Sikadur Hi-mod LV 31
        - 2. BASF - Concrecive 1401
5. Repair Mortars
- a. Provide an asbestos free, moisture insensitive, polymer-modified, Portland cement-based cementitious trowel grade mortar for repairs on horizontal or vertical surfaces.
    - 1) Available Manufacturers
      - a) a) Sika Corporation, Lyndhurst New Jersey - SikaTop 122

b) b) BASF – Emaco Nanocrete R3

6. Pipe Penetration Sealants

a. A 1 component polyurethane, extrudable swelling bentonite-free waterstop that is chemically resistant, not soluble in water and capable of withstanding wet/dry cycling.

1) Available Manufacturers

a) a) Sika Corporation, Lyndhurst New Jersey – SikaSwell S-2

b) b) Approved equal

C. ACCESSORIES [NOT USED]

D. SOURCE QUALITY CONTROL [NOT USED]

**3.0 EXECUTION**

**3.1** INSTALLERS [NOT USED]

**3.2** EXAMINATION [NOT USED]

**3.3** PREPARATION

A. General

1. Cut, repair, reuse, demolish, excavate or otherwise modify parts of the existing structures or appurtenances, as indicated on the Drawings, specified herein, or necessary to permit completion of the Work. Finishes, joints, reinforcements, sealants, etc., are specified in respective Sections. Comply with other requirements of this of Section and as shown on the Drawings.
2. Store, mix, and apply all commercial products specified in this Section in strict compliance with the manufacturer's recommendations.
3. Make repairs in all cases where concrete is repaired in the vicinity of an expansion joint or control joint to preserve the isolation between components on either side of the joint.
4. When drilling holes for dowels/bolts at new or existing concrete, stop drilling if rebar is encountered and relocate the hole to avoid rebar as approved by the Engineer. Do not cut rebar without prior approval by the Engineer.

B. Concrete Removal

1. Remove concrete designated to be removed to specific limits as shown on the Drawings or directed by the Engineer, by chipping, jackhammering, or saw-cutting as appropriate in areas where concrete is to be taken out. Do not jackhammer sanitary sewer manhole penetrations. Remove concrete in such a manner that surrounding concrete or existing reinforcing to be left in place and existing in place equipment is not damaged.
2. Where existing reinforcing is exposed due to saw cutting/core drilling and no new material is to be placed on the sawcut surface, apply a coating or surface treatment of epoxy paste to the entire cut surface to a thickness of 1/4 inch.
3. In all cases where the joint between new concrete or grout and existing concrete will be exposed in the finished work, except as otherwise shown or specified, provide a 1-inch-

deep saw cut on each exposed surface of the existing concrete at the edge of concrete removal.

4. Repair concrete specified to be left in place that is damaged using approved means to the satisfaction of the Engineer.
5. The Engineer may from time-to-time direct additional repairs to existing concrete. Make these repairs as specified or by such other methods as may be appropriate.

C. Connection Surface Preparation

1. Prepare connection surfaces as specified below for concrete areas requiring patching, repairs or modifications as shown on the Drawings, specified herein, or as directed by the Engineer.
2. Remove all deteriorated materials, dirt, oil, grease, and all other bond inhibiting materials from the surface by dry mechanical means, i.e., sandblasting, grinding, etc., as approved by the Engineer. Be sure the areas are not less than 1/2-inch in depth. Irregular voids or surface stones need not be removed if they are sound, free of laitance, and firmly embedded into parent concrete, subject to the Engineer's final inspection.
3. If reinforcing steel is exposed, it must be cleaned by wire brush or other similar means to remove all contaminants, rust, etc., as approved by the Engineer. If 1/2 of the diameter of the reinforcing steel is exposed, chip out behind the steel. Chip a minimum of 1 inch behind the steel. Do not Damage reinforcing to be saved during the demolition operation.
4. Clean reinforcing from existing demolished concrete that is shown to be incorporated in new concrete by wire brush or other similar means to remove all loose material and products of corrosion before proceeding with the repair. Cut, bend, or lap to new reinforcing as shown on the Drawings and provided with 1-inch minimum cover all around.
5. The following are specific concrete surface preparation "methods" to be used where called for on the Drawings, specified herein, or as directed by the Engineer.

a. Method A

- 1) After the existing concrete surface at connection has been roughened and cleaned, thoroughly moisten the existing surface with water.
- 2) Brush on a 1/16-inch layer of cement and water mixed to the consistency of a heavy paste.
- 3) Immediately after application of cement paste, place new concrete or grout mixture as detailed on the Drawings.

b. Method B

- 1) After the existing concrete surface has been roughened and cleaned, apply epoxy bonding agent at connection surface.
- 2) Comply strictly with the manufacturer's recommendations for the field preparation and application of the epoxy bonding agent.
- 3) Place new concrete or grout mixture to limits shown on the Drawings within time constraints recommended by the manufacturer to ensure bond.

c. Method C

- 1) Drill a hole 1/4 inch larger than the diameter of the dowel.
- 2) Blow the hole clear of loose particles and dust just prior to installing epoxy. First fill the drilled hole with epoxy paste, then butter the dowels/bolts with paste then insert by tapping.
- 3) Unless otherwise shown on the Drawings, drill and set deformed bars to a depth of 10 bar diameters and smooth bars to a depth of 15 bar diameters.
- 4) If not noted on the Drawings, the Engineer will provide details regarding the size and spacing of dowels.

d. Method D

- 1) Combination of Method B and C.

- 3.4 INSTALLATION [NOT USED]
- 3.5 REPAIR [NOT USED]
- 3.6 RE-INSTALLATION [NOT USED]
- 3.7 FIELD QUALITY CONTROL [NOT USED]
- 3.8 SYSTEM STARTUP [NOT USED]
- 3.9 ADJUSTING [NOT USED]
- 3.10 CLEANING [NOT USED]
- 3.11 CLOSEOUT ACTIVITIES [NOT USED]
- 3.12 PROTECTION [NOT USED]
- 3.13 MAINTENANCE [NOT USED]
- 3.14 ATTACHMENTS [NOT USED]

**END OF SECTION**

**DIVISION 31**  
**EARTHWORK**





**31 10 00 SITE CLEARING**

**PART 1 - GENERAL**

**1.1 SUMMARY**

- A. Section Includes:
  - 1. Preparation of right-of-way and other designated areas for construction operations by removing and disposing of all obstructions including clearing and grubbing and trees when removal of such obstructions is not specifically shown on the Drawings to be paid by other Sections.
- B. Deviations from this Specification
  - 1. None.
- C. Related Specification Sections include but are not necessarily limited to.
  - 1. Division 0 – Procurement and Contracting Requirements
  - 2. Division 1 – General Requirements
  - 3. Section 02 41 13 – Selective Site Demolition
  - 4. Section 02 41 14 – Utility Removal/Decommissioning

**1.2 PRICE AND PAYMENT PROCEDURES**

- A. Measurement and Payment
  - 1. Site Clearing
- B. Measurement and Payment
  - 1. Measurement
    - a. This Item is considered subsidiary to the installation of the utility pipeline as designated in the Drawings.
  - 2. Payment
    - a. The work performed in accordance with this Item are considered subsidiary to the installation of the utility as indicated on the plans. No other compensation will be allowed.
      - 1) .
    - b. The work shall include:
      - 1) All efforts associated with permitting.
      - 2) Pruning of designated trees and shrubs
      - 3) Removal and disposal of trees, structures, and obstructions
      - 4) Backfilling of holes
      - 5) Clean-up
  - 3. Tree Removal (typically included in "Site Clearing")
    - a. Measurement
      - 1) This Item is considered subsidiary to the Site Clearing.
    - b. Payment
      - 1) The work performed in accordance with this Item shall be subsidiary to Site Clearing:
    - c. The work shall include:
      - 1) All efforts associated with permitting.
      - 2) Pruning of designated trees and shrubs
      - 3) Removal and disposal of structures and obstructions
      - 4) Grading and backfilling of holes
      - 5) Excavation

- 6) Fertilization
- 7) Clean-up
- 4. Tree Removal and Transplantation
  - a. Measurement
    - 1) This Item is considered subsidiary to the Site Clearing.
  - b. Payment
    - 1) The work performed in accordance with this Item shall be subsidiary to Site Clearing:
  - c. The work shall include:
    - 1) All efforts associated with permitting.
    - 2) Pruning of designated trees and shrubs
    - 3) Removal and disposal of structures and obstructions
    - 4) Moving tree with truck mounted tree spade
    - 5) Grading and backfilling of holes
    - 6) Replanting tree at temporary location (determined by Contractor)
    - 7) Maintaining tree until Work is completed.
    - 8) Replanting tree into original or designated location
    - 9) Excavation
    - 10) Fertilization
    - 11) Clean-up

**1.3 REFERENCES [NOT USED]**

**1.4 ADMINISTRATIVE REQUIREMENTS**

A. Permits

- 1. Contractor shall obtain Tree Removal Permits as required by the City's Tree Ordinance.

B. Preinstallation Meetings

- 1. Hold a preliminary site clearing meeting and include the Contractor, City Arborist, City Inspector, Engineer, and the Authority Project Manager for the purpose of reviewing the Contractor's tree removal plan. Clearly mark all trees to remain on the project site prior to the meeting.
- 2. The Contractor will provide the City and Authority with a Disposal Letter if required.

**1.5 SUBMITTALS [NOT USED]**

**1.6 ACTION SUBMITTALS/INFORMATIONAL SUBMITTALS [NOT USED]**

**1.7 CLOSEOUT SUBMITTALS [NOT USED]**

**1.8 MAINTENANCE MATERIAL SUBMITTALS [NOT USED]**

**1.9 QUALITY ASSURANCE [NOT USED]**

**1.10 DELIVERY, STORAGE, AND HANDLING [NOT USED]**

**1.11 FIELD CONDITIONS [NOT USED]**

**1.12 WARRANTY [NOT USED]**

**PART 2 - PRODUCTS [NOT USED]**

## **PART 3 - EXECUTION**

### **3.1 INSTALLERS [NOT USED]**

### **3.2 EXAMINATION [NOT USED]**

### **3.3 PREPARATION**

- A. All trees identified to be protected and/or preserved should be clearly flagged with survey tape.
- B. Following taping and prior to any removals or site clearing, the Contractor shall meet with the Authority, the Engineer, and the City, if necessary, to confirm trees to be saved.

### **3.4 INSTALLATION**

- A. Protection of Trees
  - 1. Prohibited Activities: The following activities shall be prohibited within the limits of the drip line of any tree which is subject to the requirements of this ordinance.
    - a. Material Storage: No materials intended for use in construction or waste materials accumulated due to excavation or demolition shall be placed within the limits of the drip line of any tree.
    - b. Equipment Cleaning/liquid disposal: No equipment may be cleaned, or other liquids deposited within the limits of the dripline of a tree. This would include but not be limited to, paint, oil, solvents, asphalt, concrete, mortar, or other materials.
    - c. Tree Attachments: No signs, wires, or other attachments, other than those of a protective nature shall be attached to any tree.
    - d. Vehicular Traffic: No vehicular and construction equipment traffic or parking is allowed within the limits of the dripline of trees.
  - 2. Pre-Construction: The ensuing procedures shall be followed prior to construction.
    - a. Tree Flagging: All trees to be removed from the construction site shall be flagged with bright red vinyl tape wrapped around the main trunk at a height of four feet (4) or more such that the tape is visible to workers on foot or driving equipment.
    - b. Protective Fencing: All trees shall have protective fencing located at the tree's drip line. The protective fencing may be comprised of snow fencing, orange vinyl construction fencing, chain link fence or other similar fencing with a four-foot (4) approximate height. The protective fencing may be located within the drip line of the specimen tree for approved construction only. The fencing shall follow the delineation of the approved construction.
    - c. Bark Protection: In situations where a tree remains in the immediate areas of intended construction, the tree shall be protected by enclosing the entire circumference of the tree's trunk with lumber encircled with wire and other means that does not damage the tree.
    - d. Construction Pruning: In a case where a low hanging limb may be broken during the course of construction, the obtrusive limb may be cut. The limb shall be cut either flush to the trunk on or at the next joint of the limb. The wound shall then be sealed with pruning paint. In no instance shall pruning involve a portion of the trunk or thirty percent (30%) of the entire canopy without the Administrative Official's prior approval.
  - 3. Improvement within the Critical Root Zone of a Tree: Design constraints often dictate that trees slated for preservation have some encroachment on their critical root zone. The following is the minimum design criteria would put the tree at risk and therefore no longer be considered a preserved tree. In such a case replacement trees shall also be required.

- a. Grade Changes: In the event that grade changes must be made around a tree or group of trees, the following should be implemented in order to maintain oxygen and water exchange within the tree's critical root zone.
    - 1) Minimum of seventy-five percent (75%) of the critical root zone must be preserved at natural grade with natural ground cover or landscaping for the tree to be considered a preserved tree.
    - 2) No cut or fill greater than two inches (2) shall be located closer to the tree trunk than one half ( $\frac{1}{2}$ ) of the radius of the critical root zone.
    - 3) Decrease Grade: Provide retaining walls outside the dripline to mitigate cuts.
  - b. Boring of Utilities: May be permitted under protection trees in certain circumstances. The minimum length of the bore shall be the width of the tree's canopy and shall be a minimum depth of forty-eight inches (48).
  - c. Trenching: Irrigation systems shall be designed to avoid trenching across the critical root zone of any tree.
  - d. Paving: A maximum of twenty-five percent (25%) of the critical root zone of a tree may be covered with impervious paving. The pavement and the cut and fill for the pavement is to not exceed one-half ( $\frac{1}{2}$ ) of the critical root zone radius distance.
4. Additional Requirements
- a. All trees shown on this plan to be preserved shall be protected during construction with temporary fencing. Tree protection fences shall be installed prior to the commencement of any site preparation work (clearing, grubbing, or grading).
  - b. Fences shall completely surround the tree or clusters of trees. The fence shall be located at the outermost limits of the tree branches or dripline. The fence will be maintained throughout the construction project in order to prevent the following.
    - 1) Should compaction in the critical root zone resulting from vehicular traffic or storage of equipment or materials.
    - 2) Critical root zone disturbances due to grade changes greater than two inches (2) cut or fill or boring which was not authorized by the City.
    - 3) Wounds, to the trunk, limbs, or exposed roots by mechanical equipment.
    - 4) Other activities detrimental to trees such as chemical storage, cement truck cleaning and fires.
  - c. In cases of area constraints where the protective fence is closer to the trunk than four feet (4), the trunk must be protected with strapped-on planking to a height of eight feet (8) or to the limits of the lower branching.
  - d. All grading within critical root zones of specimen trees shall be performed by hand or small equipment to minimize damage. Prior to grading, relocate the protective fencing to two feet (2) behind the grade change area.
  - e. Trees most heavily impacted by construction activities should be watered deeply once a week during periods of hot and dry weather. Tree crowns should be sprayed with water periodically to reduce dust accumulation on the leaves.
  - f. Trenching for landscape irrigation shall be located as far from the existing trunks as possible.
  - g. Pruning to provide clearance for structures, vehicular traffic and equipment shall take place before construction begins.
  - h. Trees and brush shall be mulched on-site.
    - 1) Burning as a method of disposal is not allowed.

B. Hazardous Materials

- 1. The Contractor will notify the Engineer immediately if any hazardous or questionable materials not shown on the Drawings are encountered. This includes but not limited to:
  - a. Floor tiles

- b. Roof tiles
  - c. Shingles
  - d. Siding
  - e. Utility piping
2. The testing, removal, and disposal of hazardous materials will be in accordance with Division 1.
- C. Site Clearing
1. Clear areas shown on the Drawings of all obstructions, except those landscape features that are to be preserved. Such obstructions include, but are not limited to:
    - a. Remains of buildings and other structures
    - b. Foundations
    - c. Floor slabs
    - d. Concrete
    - e. Brick
    - f. Lumber
    - g. Plaster
    - h. Septic tank drain fields
    - i. Abandoned utility pipes or conduits.
    - j. Equipment
    - k. Trees
    - l. Fences
    - m. Retaining walls
    - n. Other items as specified on the Drawings.
  2. Remove vegetation and other landscape features not designated for preservation, whether above or below ground, including, but not limited to:
    - a. Curb and gutter
    - b. Driveways
    - c. Paved parking areas
    - d. Miscellaneous stone
    - e. Sidewalks
    - f. Drainage structures
    - g. Manholes
    - h. Inlets
    - i. Abandoned railroad tracks.
    - j. Scrap iron
    - k. Other debris
  3. Remove culverts, storm sewers, manholes, and inlets in proper sequence to maintain traffic and drainage in accordance with Section 02 41 14.
  4. In areas receiving embankment, remove obstructions not designated for preservation to 2 feet below natural ground.  
In areas to be excavated, remove obstructions to 2 feet below the excavation level.
  5. In all other areas, remove obstructions to 1 foot below natural ground.
  6. When allowed by the Drawings or directed by the Engineer, cut trees and stumps off to ground level.
    - a. Removal of existing structures shall be as per Section 02 41 13.
- D. Disposal
1. Dispose of all trees within 24 hours of removal.
  2. All materials and debris removed becomes the property of the Contractor, unless otherwise stated on the Drawings.
  3. The Contractor will dispose of material and debris off-site in accordance with local, state, and federal laws and regulations.

### 3.5 REPAIR [NOT USED]

- 3.6 RE-INSTALLATION [NOT USED]
- 3.7 FIELD QUALITY CONTROL [NOT USED]
- 3.8 SYSTEM STARTUP [NOT USED]
- 3.9 ADJUSTING [NOT USED]
- 3.10 CLEANING [NOT USED]
- 3.11 CLOSEOUT ACTIVITIES [NOT USED]
- 3.12 PROTECTION [NOT USED]
- 3.13 MAINTENANCE [NOT USED]
- 3.14 ATTACHMENTS [NOT USED]

**END OF SECTION**

**PART 1 - GENERAL**

**1.1 SUMMARY**

- A. Section Includes:
  - 1. Preparing subgrades for; slabs on grade, walks, pavements, turf and grasses, and plants.
  - 2. Excavating and backfilling for buildings and structures.
  - 3. Drainage course for concrete slabs-on-grade.
  - 4. Sub-base course for concrete walks and pavements.
  - 5. Sub-base course and base course for asphalt paving.
  - 6. Excavating and backfilling for utility trenches.

**1.2 DEFINITIONS**

- A. Backfill: Soil material used to fill an excavation.
  - 1. Initial Backfill: Backfill placed beside and over pipe in a trench, including haunches to support sides of pipe.
  - 2. Final Backfill: Backfill placed over initial backfill to fill a trench.
- B. Base Course: Aggregate layer placed between the sub-base course and hot-mix asphalt paving.
- C. Bedding Course: Aggregate layer placed over the excavated subgrade in a trench before laying pipe.
- D. Borrow Soil: Satisfactory soil imported from off-site for use as fill or backfill.
- E. Drainage Course: Aggregate layer supporting the slab-on-grade that also minimizes upward capillary flow of pore water.
- F. Excavation: Removal of material encountered above subgrade elevations and to lines and dimensions indicated.
  - 1. Authorized Additional Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions as directed by Owner. Authorized additional excavation and replacement material will be paid for according to Contract provisions for changes in the Work.
  - 2. Unauthorized Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions without direction by Owner. Unauthorized excavation, as well as remedial work directed by Owner, shall be without additional compensation.
- G. Fill: Soil materials used to raise existing grades.
- H. Structures: Buildings, footings, foundations, retaining walls, slabs, tanks, curbs, mechanical and electrical appurtenances, or other man-made stationary features constructed above or below the ground surface.
- I. Sub-base Course: Aggregate layer placed between the subgrade and base course for hot-mix asphalt pavement, or aggregate layer placed between the subgrade and a cement concrete pavement or a cement concrete or hot-mix asphalt walk.
- J. Subgrade: Uppermost surface of an excavation or the top surface of a fill or backfill



immediately below sub-base, drainage fill, drainage course, or topsoil materials.

- K. Utilities: On-site underground pipes, conduits, ducts, and cables, as well as underground services within buildings.

### **1.3 QUALITY ASSURANCE**

- A. Pre-excavation Conference is to be scheduled by the contractor 72 hours prior to commencement.

### **1.4 PROJECT CONDITIONS**

- A. Utility Locator Service: Notify utility locator service for area where Project is located before beginning earth moving operations.
- B. Do not commence earth moving operations until plant-protection measures specified in Section 01 56 39 "Temporary Tree and Plant Protection" are in place.

## **PART 2 - PRODUCTS**

### **2.1 SOIL MATERIALS**

- A. General: Provide borrow soil materials when sufficient satisfactory soil materials are not available from excavations.
- B. Satisfactory Soils: Soil Classification Groups GW, GP, GM, SW, SP, and SM according to ASTM D 2487 and Groups A-1, A-2-4, A-2-5, and A-3 according to AASHTO M 145, or a combination of these groups; free of rock or gravel larger than 3 inches in any dimension, debris, waste, frozen materials, vegetation, and other deleterious matter.
  - 1. Liquid Limit: To Be Specified in Scope
  - 2. Plasticity Index: To Be Specified in Scope
- C. Unsatisfactory Soils: Soil Classification Groups GC, SC, CL, ML, OL, CH, MH, OH, and PT according to ASTM D 2487 Groups A-2-6, A-2-7, A-4, A-5, A-6, and A-7 according to AASHTO M 145, or a combination of these groups.
  - 1. Unsatisfactory soils also include satisfactory soils not maintained within 2 percent of optimum moisture content at time of compaction.
- D. Sub-base Material: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; with at least 90 percent passing a 1-1/2-inch sieve and not more than 12 percent passing a No. 200 sieve.
- E. Base Course: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; with at least 95 percent passing a 1-1/2-inch sieve and not more than 8 percent passing a No. 200 sieve.
- F. Engineered Fill: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; with at least 90 percent passing a 1-1/2-inch sieve and not more than 12 percent passing a No. 200 sieve.
- G. Bedding Course: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; except with 100 percent passing a 1-inch sieve and not more than 8 percent passing a No. 200 sieve.
- H. Drainage Course: Narrowly graded mixture of washed crushed stone or crushed or uncrushed gravel; ASTM D 448; coarse-aggregate grading Size 57; with 100

percent passing a 1-1/2-inch sieve and 0 to 5 percent passing a No. 8 sieve.

## **2.2 ACCESSORIES**

- A. Warning Tape: Acid- and alkali-resistant, polyethylene film warning tape manufactured for marking and identifying underground utilities, 6 inches wide and 4 mils thick, continuously inscribed with a description of the utility; colored to comply with local practice or requirements of authorities having jurisdiction.
- B. Detectable Warning Tape: Acid- and alkali-resistant, polyethylene film warning tape manufactured for marking and identifying underground utilities, a minimum of 6 inches wide and 4 mils thick, continuously inscribed with a description of the utility, with metallic core encased in a protective jacket for corrosion protection, detectable by metal detector when tape is buried up to 30 inches deep; colored to comply with local practice or requirements of authorities having jurisdiction.

## **PART 3 - EXECUTION**

### **3.1 PREPARATION**

- A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earth moving operations.
- B. Protect and maintain erosion and sedimentation controls during earth moving operations.
- C. Protect subgrades and foundation soils from freezing temperatures and frost. Remove temporary protection before placing subsequent materials.

### **3.2 EXCAVATION, GENERAL**

- A. Unclassified Excavation: Excavate to subgrade elevations regardless of the character of surface and subsurface conditions encountered. Unclassified excavated materials may include rock, soil materials, and obstructions. No changes in the Contract Sum or the Contract Time will be authorized for rock excavation or removal of obstructions.
  - 1. If excavated materials intended for fill and backfill include unsatisfactory soil materials and rock, replace with satisfactory soil materials.

### **3.3 EXCAVATION FOR STRUCTURES**

- A. Excavate to indicated elevations and dimensions within a tolerance of plus or - 1 inch. If applicable, extend excavations a sufficient distance from structures for placing and removing concrete formwork, for installing services and other construction, and for inspections.
  - 1. Excavations for Footings and Foundations: Do not disturb bottom of excavation. Excavate by hand to final grade just before placing concrete reinforcement. Trim bottoms to required lines and grades to leave solid base to receive other work.
- B. Excavations at Edges of Tree- and Plant-Protection Zones:
  - 1. Excavate by hand to indicated lines, cross sections, elevations, and subgrades. Use narrow tine spading forks to comb soil and expose roots. Do not break, tear, or chop exposed roots. Do not use mechanical equipment that rips, tears, or pulls roots.
  - 2. Cut and protect roots according to requirements in Section 015639 "Temporary Tree and Plant Protection."

### **3.4 EXCAVATION FOR WALKS AND PAVEMENTS**

- A. Excavate surfaces under walks and pavements to indicated lines, cross sections, elevations, and subgrades.

### **3.5 EXCAVATION FOR UTILITY TRENCHES**

- A. Excavate trenches to indicated gradients, lines, depths, and elevations.
- B. Excavate trenches to uniform widths to provide the following clearance on each side of pipe or conduit. Excavate trench walls vertically from trench bottom to 12 inches higher than top of pipe or conduit unless otherwise indicated.
  - 1. Clearance: 12 inches each side of pipe or conduit or as indicated.
- C. Trench Bottoms: Excavate and shape trench bottoms to provide uniform bearing and support of pipes and conduit. Shape subgrade to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits. Remove projecting stones and sharp objects along trench subgrade.
  - 1. Excavate trenches 6 inches deeper than elevation required in rock or other unyielding bearing material, 4 inches deeper elsewhere, to allow for bedding course.
- D. Trenches in Tree- and Plant-Protection Zones:
  - 1. Hand-excavate to indicate lines cross sections, elevations, and subgrades. Use narrow tine spading forks to comb soil and expose roots. Do not break, tear, or chop exposed roots. Do not use mechanical equipment that rips, tears, or pulls roots.
  - 2. Do not cut main lateral roots or taproots; cut only smaller roots that interfere with installation of utilities.
  - 3. Cut and protect roots according to requirements in Section 01 56 39 "Temporary Tree and Plant Protection."

### **3.6 SUBGRADE INSPECTION**

- A. Proof-roll subgrade below the building slabs and pavements with a pneumatic-tired dump truck to identify soft pockets and areas of excess yielding. Do not proof-roll wet or saturated subgrades.
- B. Reconstruct subgrades damaged by freezing temperatures, frost, rain, accumulated water, or construction activities, as directed by Owner, without additional compensation.

### **3.7 UNAUTHORIZED EXCAVATION**

- A. Fill unauthorized excavation under foundations or wall footings by extending bottom elevation of concrete foundation or footing to excavation bottom, without altering top elevation. Lean concrete fill, with 28-day compressive strength of 2500 psi, may be used when approved by Owner.
  - 1. Fill unauthorized excavations under other construction, pipe, or conduit as directed by Owner.

### **3.8 STORAGE OF SOIL MATERIALS**

- A. Stockpile borrow soil materials and excavated satisfactory soil materials without intermixing. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.

1. Stockpile soil materials away from edge of excavations. Do not store within drip line of remaining trees.

### **3.9 UTILITY TRENCH BACKFILL**

- A. Place backfill on subgrades free of mud, frost, snow, or ice.
- B. Place and compact bedding course on trench bottoms and where indicated. Shape bedding course to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits.
- C. Trenches under Footings: Backfill trenches excavated under footings and within 18 inches of bottom of footings with satisfactory soil; fill with concrete to elevation of bottom of footings. Concrete is specified in "Cast-in-Place Concrete" Section 03 30 53 "Miscellaneous Cast-in-Place Concrete."
- D. Place and compact initial backfill of sub-base material with satisfactory soil, free of particles larger than 1 inch in any dimension, to a height of 12 inches over the pipe or conduit.
  1. Carefully compact initial backfill under pipe haunches and compact evenly up on both sides and along the full length of piping or conduit to avoid damage or displacement of piping or conduit. Coordinate backfilling with utilities testing.
- E. Place and compact final backfill of satisfactory soil to final subgrade elevation.
- F. Install warning tape directly above utilities, 12 inches below finished grade, except 6 inches below subgrade under pavements and slabs.

### **3.10 SOIL FILL**

- A. Plow, scarify, bench, or break up sloped surfaces steeper than 1 vertical to 4 horizontal so fill material will bond with existing material.
- B. Place and compact fill material in layers to required elevations as follows:
  1. Under grass and planted areas, use satisfactory soil material.
  2. Under walks and pavements, use satisfactory soil material.
  3. Under steps and ramps, use engineered fill.
  4. Under building slabs, use engineered fill.
  5. Under footings and foundations, use engineered fill.

### **3.11 SOIL MOISTURE CONTROL**

- A. Uniformly moisten or aerate subgrade and each subsequent fill or backfill soil layer before compaction to within 2 percent of optimum moisture content.
  1. Do not place backfill or fill soil material on surfaces that are muddy, frozen, or contain frost or ice.
  2. Remove and replace, or scarify and air dry, otherwise satisfactory soil material that exceeds optimum moisture content by 2 percent and is too wet to compact to specified dry unit weight.

### **3.12 COMPACTION OF SOIL BACKFILLS AND FILLS**

- A. Place backfill and fill soil materials in layers not more than 8 inches in loose depth for material compacted by heavy compaction equipment, and not more than 8 inches in loose depth for material compacted by hand-operated tampers. Use only machines intended for soil compaction.

- B. Place backfill and fill soil materials evenly on all sides of structures to required elevations, and uniformly along the full length of each structure.
- C. Compact soil materials to not less than the following percentages of maximum dry unit weight according to ASTM D 698 and ASTM D 1557:
  - 1. Under pavement, structures, building slabs, steps, scarify and recompact top 12 inches of existing subgrade and each layer of backfill or fill soil material at 95 percent.
  - 2. Under walkways, scarify and recompact top 6 inches below subgrade and compact each layer of backfill or fill soil material at 95 percent.
  - 3. Under turf or unpaved areas, scarify and recompact top 6 inches below subgrade and compact each layer of backfill or fill soil material at 95 percent.
  - 4. For utility trenches, compact each layer of initial and final backfill soil material at 95 percent.

### **3.13 GRADING**

- A. General: Uniformly grade areas to a smooth surface, free of irregular surface changes.
- B. Comply with compaction requirements and grade to cross sections, lines, and elevations indicated.
- C. Site Rough Grading: Slope grades to direct water away from buildings and to prevent ponding. Finish subgrades to required elevations within the following tolerances:
  - 1. Turf or Unpaved Areas: + or - 1 inch
  - 2. Walks: + or - 1 inch.
  - 3. Pavements: + or - ½ inch.
- D. Grading inside Building Lines: Finish subgrade to a tolerance of ½ inch when tested with a 10-foot straightedge.

### **3.14 SUB-BASE AND BASE COURSES UNDER PAVEMENTS AND WALKS**

- A. Place sub-base course and base course on subgrades free of standing water, mud, frost, snow, or ice.
- B. On prepared subgrade, place sub-base course and base course under pavements and walks as follows:
  - 1. Shape sub-base course and base course to required crown elevations and cross- slope grades.
  - 2. Place sub-base course and base course that exceeds 6 inches in compacted thickness in layers of equal thickness, with no compacted layer more than 6 inches thick or less than 3 inchesthick.
  - 3. Compact sub-base course and base course at optimum moisture content to required grades, lines, cross sections, and thickness to not less than 95 percent of maximum dry unit weight according to ASTM D 698 ASTM D 1557.

### **3.15 DRAINAGE COURSE UNDER CONCRETE SLABS-ON-GRADE**

- A. Place drainage course on subgrades free of standing water, mud, frost, snow, or ice.

- B. On prepared subgrade, place and compact drainage course under cast-in-place concrete slabs-on-grade as follows:
  - 1. Place drainage course that exceeds 6 inches in compacted thickness in layers of equal thickness, with no compacted layer more than 6 inches thick or less than 3 inches thick.
  - 2. Compact each layer of drainage course to required cross sections and thicknesses to not less than 95 percent of maximum dry unit weight according to ASTM D 698.

### **3.16 FIELD QUALITY CONTROL**

- A. Testing Agency: Owner will engage a qualified geotechnical engineering testing agency to perform tests and inspections.
- B. Allow testing agency to inspect and test subgrades and each fill or backfill layer. Proceed with subsequent earth moving only after test results for previously completed work comply with requirements.
- C. Footing Subgrade: At footing subgrades, at least one test of each soil stratum will be performed to verify design bearing capacities. Subsequent verification and approval of other footing subgrades may be based on a visual comparison of subgrade with tested subgrade when approved by Owner.
- D. When testing agency reports that subgrades, fills, or backfills have not achieved degree of compaction specified, scarify, and moisten or aerate, or remove and replace soil materials to depth required; re-compact and retest until specified compaction is obtained.

### **3.17 PROTECTION**

- A. Protecting Graded Areas: Protect newly graded areas from traffic, freezing, and erosion. Keep free of trash and debris.
- B. Repair and reestablish grades to their specified tolerances were completed or partially completed surfaces become eroded, rutted, settled, or where they lose compaction due to subsequent construction operations or weather conditions.
- C. Where settling occurs before Project correction period elapses, remove finished surfacing, backfill with additional soil material, compact, and reconstruct surfacing.
- D. Restore appearance, quality, and condition of finished surfacing to match adjacent work, and eliminate evidence of restoration to greatest extent possible.

### **3.18 DISPOSAL OF SURPLUS AND WASTE MATERIALS**

- A. Remove surplus satisfactory soil and waste materials, including unsatisfactory soil, trash, and debris, and legally dispose of them off Owner's property.

**END OF SECTION**

**PART 1 - GENERAL****1.1 SUMMARY**

- A. Section Includes:
  - 1. Furnish, place and compact Borrow material for grading.
- B. Deviations from this Standard Specification
  - 1. None.
- C. Related Specification Sections include, but are not necessarily limited to:
  - 1. Division 0 – Bidding Requirements, Contract Forms and Conditions of the Contract
  - 2. Division 1 – General Requirements
  - 3. Section 31 24 00 – Embankments

**1.2 PRICE AND PAYMENT PROCEDURES**

- A. Measurement and Payment
  - 1. Borrow by Plan Quantity
    - a. Measurement
      - 1) Measurement for this Item shall be by the cubic yard in its final position using the average end area method. Limits of measurement are shown on the Drawings.
      - 2) When measured by the cubic yard in its final position, this is a plans quantity measurement Item. The quantity to be paid is the quantity shown in the proposal, unless modified by Article 11.04 of the General Conditions. Additional measurements or calculations will be made if adjustments of quantities are required.
    - b. Payment
      - 1) The work performed and materials furnished in accordance with this Item and measured as provided under “Measurement” will be paid for at the unit price bid per cubic yard of “Borrow by Plan” for the various borrow materials. No additional compensation will be allowed for rock or shrinkage/swell factors, as these are the Contractor’s responsibility.
    - c. The price bid shall include:
      - 1) Transporting or hauling material
      - 2) Furnishing, placing, compacting and finishing Borrow
      - 3) Construction Water
      - 4) Dust Control
      - 5) Clean-up
      - 6) Proof Rolling
      - 7) Disposal of excess or waste material
      - 8) Reworking or replacement of undercut material

**1.3 REFERENCES**

- A. Reference Standards
  - 1. Reference standards cited in this Specification refer to the current reference standard published at the time of the latest revision date logged at the end of this Specification, unless a date is specifically cited.
  - 2. ASTM Standards

- a. ASTM D2487, Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System)
- b. ASTM D4318-10, Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils
- c. ASTM D6913, Standard Test Methods for Particle-Size Distribution (Gradation) of Soils Using Sieve Analysis
- d. ASTM D698, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400ft-lbf/ft<sup>3</sup>)

**1.4 ADMINISTRATIVE REQUIREMENTS [NOT USED]**

**1.5 SUBMITTALS**

- A. Submittals shall be in accordance with Section 01 33 00.
- B. All submittals shall be approved by the City prior to construction.
- C. Submit laboratory tests reports for each soil borrow source used to supply general borrow and select fill materials.

**1.6 ACTION SUBMITTALS/INFORMATIONAL SUBMITTALS**

- A. Shop Drawings
  - 1. Stockpiled Borrow material
    - a. Provide a description of the storage of the delivered Borrow material only if the Contract Documents do not allow storage of materials in the right-of-way of the easement.

**1.7 CLOSEOUT SUBMITTALS [NOT USED]**

**1.8 MAINTENANCE MATERIAL SUBMITTALS [NOT USED]**

**1.9 QUALITY ASSURANCE**

- A. Borrow material shall be tested prior to delivery to the Site.
  - 1. Provide Proctor Test results, Gradation and Atterberg Limits for Borrow material from each source.
    - a. All testing listed above shall be performed in terms of ASTM D698, ASTM D6913 and ASTM D4318-10 respectively.

**1.10 DELIVERY, STORAGE, AND HANDLING**

- A. Delivery
  - 1. Coordinate all deliveries and haul-off.
- B. Storage
  - 1. Within Existing Rights-of-Way (ROW)
    - a. Borrow materials may be stored within existing ROW, easements or temporary construction easements, unless specifically disallowed in the Contract Documents.
    - b. Do not block drainage ways, inlets or driveways.
    - c. Provide erosion control in accordance with Section 31 25 00.
    - d. Store materials only in areas barricaded as provided in the traffic control plans.
    - e. In non-paved areas, do not store material on the root zone of any trees or in landscaped areas.
  - 2. Designated Storage Areas
    - a. If the Contract Documents do not allow the storage of Borrow materials within the ROW, easement or temporary construction easement, then secure and maintain an adequate storage location.



- b. Provide an affidavit that rights have been secured to store the materials on private property.
- c. Provide erosion control in accordance with Section 31 25 00.
- d. Do not block drainage ways.
- e. Only materials used for 1 working day will be allowed to be stored in the work zone.

**1.11 FIELD CONDITIONS [NOT USED]**

**1.12 WARRANTY [NOT USED]**

**PART 2 - PRODUCTS**

**2.1 OWNER-FURNISHED [NOT USED]**

**2.2 PRODUCT TYPES AND MATERIALS**

**A. Borrow**

- 1. Additional soil beneath pavements, roadways, foundations and other structures required to achieve the elevations shown on the Drawings.
- 2. Acceptable Fill Material
  - a. In-situ or imported soils classified as CL, CH, SC or GC in accordance with ASTM D2487
  - b. Free from deleterious materials, boulders over 6 inches in size and organics
  - c. Can be placed free from voids
  - d. Must have 20 percent passing the number 200 sieve
- 3. Blended Fill Material
  - a. In-situ soils classified as SP, SM, GP or GM in accordance with ASTM D2487
  - b. Blended with in-situ or imported Acceptable Fill material to meet the requirements of an Acceptable Fill Material
  - c. Free from deleterious materials, boulders over 6 inches in size and organics
  - d. Must have 20 percent passing the number 200 sieve
- 4. Select Fill
  - a. Classified as SC or CL in accordance with ASTM D2487
  - b. Liquid limit less than 35
  - c. Plasticity index between 8 and 20
- 5. Cement Stabilized Sand (CSS)
  - a. Sand or silty sand
  - b. Free of clay or plastic material
  - c. Minimum of 4 percent cement content of Type I/II portland cement
  - d. 100 to 150 psi compressive strength at 2 days in accordance with ASTM D1633, Method A
  - e. 200 to 250 psi compressive strength at 23 days in accordance with ASTM D1633, Method A
  - f. Mix in a stationary pug mill, weigh-batch or continuous mixing plant

**2.3 ASSEMBLY OR FABRICATION TOLERANCES [NOT USED]**

**2.4 ACCESSORIES [NOT USED]**

**2.5 SOURCE QUALITY CONTROL [NOT USED]**

**PART 3 - EXECUTION**

**3.1 INSTALLERS [NOT USED]**

**3.2 EXAMINATION [NOT USED]**

**3.3 PREPARATION [NOT USED]**

**3.4 INSTALLATION**

A. All Borrow placement shall be performed in accordance to Section 31 24 00.

**3.5 REPAIR [NOT USED]**

**3.6 RE-INSTALLATION [NOT USED]**

**3.7 FIELD QUALITY CONTROL**

A. Field quality control will be performed in accordance to Section 31 24 00.

**3.8 SYSTEM STARTUP [NOT USED]**

**3.9 ADJUSTING [NOT USED]**

**3.10 CLEANING [NOT USED]**

**3.11 CLOSEOUT ACTIVITIES [NOT USED]**

**3.12 PROTECTION [NOT USED]**

**3.13 MAINTENANCE [NOT USED]**

**3.14 ATTACHMENTS [NOT USED]**

**END OF SECTION**

**31 24 00 EMBANKMENTS**

**PART 1 - GENERAL**

**1.1 SUMMARY**

A. Section Includes:

1. Transporting and placement of Acceptable Fill Material within the boundaries of the Site for construction of:
  - a. Roadways
  - b. Embankments
  - c. Drainage Channels
  - d. Site Grading
  - e. Any other operation involving the placement of on-site materials

B. Deviations from this Standard Specification

1. None.

C. Related Specification Sections include, but are not necessarily limited to:

1. Division 0 – Bidding Requirements, Contract Forms and Conditions of the Contract
2. Division 1 – General Requirements
3. Section 31 23 23 – Borrow

**1.2 PRICE AND PAYMENT PROCEDURES**

A. Measurement and Payment

1. Embankments by Plan Quantity

a. Measurement

- 1) Measurement for this Item shall be by the cubic yard in its final position using the average end area method. Limits of measurement are shown on the Drawings.
- 2) When measured by the cubic yard in its final position, this is a plans quantity measurement Item. The quantity to be paid is the quantity shown in the proposal, unless modified by Article 11.04 of the General Conditions. Additional measurements or calculations will be made if adjustments of quantities are required.

b. Payment

- 1) The work performed and materials furnished in accordance with this Item and measured as provided under "Measurement" will be paid for at the unit price bid per cubic yard of "Embankment by Plan". No additional compensation will be allowed for rock or shrinkage/swell factors, as these are the Contractor's responsibility.
- c. The price bid shall include:
  - 1) Transporting or hauling material
  - 2) Placing, compacting, and finishing Embankment
  - 3) Construction Water
  - 4) Dust Control
  - 5) Clean-up
  - 6) Proof Rolling
  - 7) Disposal of excess materials
  - 8) Reworking or replacement of undercut material

### 1.3 REFERENCES

#### A. Reference Standards

1. Reference standards cited in this specification refer to the current reference standard published at the time of the latest revision date logged at the end of this specification, unless a date is specifically cited.
2. ASTM Standards
  - a. ASTM D4318-10, Test Procedure for Determining Liquid Limit, Plastic Limit, and Plasticity Index of Soils
  - b. ASTM D4943-08, Standard Test Method for Shrinkage Factors of Soils by the Wax Method
  - c. ASTM D698-07e1, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort
  - d. ASTM D1557-09, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort
  - e. ASTM D7382-08, Standard Test for Determination of Maximum Dry Unit Weight and Water Content Range for Effective Compaction of Granular Soils Using a Vibrating Hammer
  - f. ASTM D1556-07, Standard Test for Density and Unit Weight of Soil In-Place by the Sand Cone Method

**1.4 ADMINISTRATIVE REQUIREMENTS**

A. Sequencing

1. Sequence work such that calls of proctors are complete in accordance with ASTM D698 prior to commencement of construction activities.

**1.5 SUBMITTALS**

A. Submittals shall be in accordance with Section 01 33 00.

B. All submittals shall be approved by the City prior to construction

**1.6 ACTION SUBMITTALS/INFORMATIONAL SUBMITTALS**

A. Shop Drawings

1. Stockpiled material
  - a. Provide a description of the storage of the excavated material only if the Contract Documents do not allow storage of materials in the right-of-way or the easement

**1.7 CLOSEOUT SUBMITTALS [NOT USED]**

**1.8 MAINTENANCE MATERIAL SUBMITTALS [NOT USED]**

**1.9 QUALITY ASSURANCE [NOT USED]**

**1.10 DELIVERY, STORAGE, AND HANDLING**

A. Storage

1. Within Existing Rights-of-Way (ROW)
  - a. Soil may be stored within existing ROW, easements or temporary construction easements, unless specifically disallowed in the Contract Documents.
  - b. Do not block drainage ways, inlets or driveways.
  - c. Provide erosion control in accordance with Section 31 25 00.
  - d. When the Work is performed in active traffic areas, store materials only in areas barricaded as provided in the traffic control plans.
  - e. In non-paved areas, do not store material on the root zone of any trees or in landscaped areas.
2. Designated Storage Areas
  - a. If the Contract Documents do not allow the storage within the ROW, easement or temporary construction easement, then secure and maintain an adequate storage location.

- b. Provide an affidavit that rights have been secured to store the materials on private property.
- c. Provide erosion control in accordance with Section 31 25.00.
- d. Do not block drainage ways.

**1.11 FIELD CONDITIONS**

A. Existing Conditions

- 1. Any data which has been or may be provided on subsurface conditions is not intended as a representation or warranty of accuracy or continuity between soils. It is expressly understood that neither the City nor the Engineer will be responsible for interpretations or conclusions drawn there from by the Contractor.
- 2. Data is made available for the convenience of the Contractor.

**1.12 WARRANTY [NOT USED]**

**PART 2 - PRODUCTS**

**2.1 OWNER-FURNISHED [NOT USED]**

**2.2 PRODUCT TYPES AND MATERIALS**

A. Materials

- 1. Acceptable Fill Material
  - a. In-situ or imported soils classified as CL, CH, SC or GC in accordance with ASTM D2487
  - b. Free from deleterious materials, boulders over 6 inches in size and organics
  - c. Can be placed free from voids
  - d. Must have 20 percent passing the number 200 sieve
- 2. Blended Fill Material
  - a. In-situ soils classified as GW, GP, GM, SW, SP, or SM in accordance with ASTM D2487
  - b. Blended with in-situ or imported acceptable backfill material to meet the requirements of an Acceptable Backfill Material
  - c. Free from deleterious materials, boulders over 6 inches in size and organics
  - d. Must have 20 percent passing the number 200 sieve
- 3. Unacceptable Fill Material

- a. In-situ soils classified as ML, MH, PT, OL or OH in accordance with ASTM D2487
- 4. Select Fill
  - a. Classified as SC or CL in accordance with ASTM D2487
  - b. Liquid limit less than 35
  - c. Plasticity index between 8 and 20

**2.3 ASSEMBLY OR FABRICATION TOLERANCES [NOT USED]**

**2.4 ACCESSORIES [NOT USED]**

**2.5 SOURCE QUALITY CONTROL [NOT USED]**

**PART 3 - EXECUTION**

**3.1 INSTALLERS [NOT USED]**

**3.2 EXAMINATION [NOT USED]**

**3.3 PREPARATION**

A. Protection of In-Place Conditions

1. Pavement

- a. Conduct activities in such a way that does not damage existing pavement that is designated to remain.
- b. Repair or replace any pavement damaged due to the negligence of the contractor outside the limits designated for pavement removal at no additional cost

2. Trees

- a. When operating outside of existing ROW, stake permanent and temporary construction easements.
- b. Restrict all construction activities to the designated easements and ROW.
- c. Flag and protect all trees designated to remain in accordance with Section 31 10 00.
- d. Conduct embankments in a manner such that there is no damage to the tree canopy.
- e. Prune or trim tree limbs as specifically allowed by the Drawings or as specifically allowed by the City.
  - 1) Pruning or trimming may only be accomplished with equipment specifically designed for tree pruning or trimming.

3. Above ground Structures
  - a. Protect all above ground structures adjacent to the construction.
4. Traffic
  - a. Maintain existing traffic, except as modified by the traffic control plan, and in accordance with Section 34 71 13.
  - b. Do not block access to driveways or alleys for extended periods of time unless:
    - 1) Alternative access has been provided
    - 2) Proper notification has been provided to the property owner or resident
    - 3) It is specifically allowed in the traffic control plan

### **3.4 INSTALLATION**

#### **A. Embankments General**

1. Placing and Compacting Embankment Material
  - a. Perform fill operation in an orderly and systematic manner using equipment in proper sequence to meet the compaction requirements
  - b. Scarify and loosen the unpaved surface areas, except rock, to a depth of at least 6 inches, unless otherwise shown on the Drawings
  - c. Place fill on surfaces free from trees, stumps, roots, vegetation, or other deleterious materials
  - d. Bench slopes before placing material.
  - e. Begin filling in the lowest section or the toe of the work area
  - f. When fill is placed directly or upon older fill, remove debris and any loose material and proof roll existing surface.
  - g. After spreading the loose lifts to the required thickness and adjusting its moisture content as necessary, simultaneously recompact scarified material with the placed embankment material.
  - h. Roll with sufficient number passes to achieve the minimum required compaction.
  - i. Provide water sprinkled as necessary to achieve required moisture levels for specified compaction
  - j. Do not add additional lifts until the entire previous lift is properly compacted.
2. Surface Water Control
  - a. Grade surface horizontally but provide with sufficient longitudinal and transverse slope to allow for runoff of surface water from every point.



- b. Conduct fills so that no obstruction to drainage from any other sections of fill is created.
- c. Install temporary dewatering sumps in low areas during filling where excess amounts of runoff collect.
- d. Compact uniformly throughout. Keep surfaces of fill reasonably smooth and free from humps and hollows that would prevent proper uniform compaction.
- e. Do not place fill during or shortly after rain events which prevent proper work placement of the material and compaction
- f. Prior to resuming compaction operations, remove muddy material off the surface to expose firm and compacted materials

B. Embankments for Roads

- 1. Only Acceptable Fill Material will be allowed for roadways
- 2. Embankments for roadbeds shall be constructed in layers approximately parallel to the finished grade of the street
- 3. Construct generally to conform to the cross section of the subgrade section as shown in the Drawings.
- 4. Establish grade and shape to the typical sections shown on the Drawings
- 5. Maintain finished sections of embankment to the grade and compaction requirements until the project is accepted.

C. Earth Embankments

- 1. Earth embankment is mainly composed of material other than rock. Construct embankments in successive layers, evenly distributing materials in lengths suited for sprinkling and rolling.
- 2. Rock or Concrete
  - a. Obtain approval from the City prior to incorporating rock and broken concrete produced by the construction project in the lower layers of the embankment.
  - b. No Rock or Concrete will be permitted in embankments in any location where future utilities are anticipated.
  - c. When the size of approved rock or broken concrete exceeds the layer thickness place the rock and concrete outside the limits of the proposed structure or pavement. Cut and remove all exposed reinforcing steel from the broken concrete.
- 3. Move the material dumped in piles or windrows by blading or by similar methods and incorporate it into uniform layers.

4. Featheredge or mix abutting layers of dissimilar material for at least 100 feet to ensure there are no abrupt changes in the material.
5. Break down clods or lumps of material and mix embankment until a uniform material is attained.

#### D. Rock Embankments

1. Rock embankment is mainly composed of rock.
2. Rock Embankments for roadways are only allowed when specifically designated on the Drawings.
3. Construct rock embankments in successive layers for the full width of the roadway cross-section with a depth of 18-inches or less.
4. The layer depth for large rock sizes shall not exceed a depth of 18-inches in any case. Fill voids created by the large stone matrix with smaller stones during the placement and filling operations.
5. Ensure the depth of the embankment layer is greater than the maximum dimension of any rock.
6. Do not place rock greater than 18-inches in its maximum dimension.
7. Construct the final layer with graded material so that the density and uniformity is in accordance compaction requirements.
8. The upper or final layer of rock embankments shall contain no material larger than 4 inches in their maximum dimension.

#### E. Density

1. Compact each layer until the maximum dry density as determined by ASTM D698 is achieved.
  - a. Not Under Roadway or Structure:
    - 1) areas to be compacted in the open, not beneath any structure, pavement, flatwork, or is a minimum of 1foot outside of the edge of any structure, edge of pavement, or back of curb.
      - a) Compact each layer to a minimum of 90 percent Standard Proctor Density.
  - b. Embankments under future paving:
    - 1) Compact each layer to a minimum of 95 percent standard proctor density with a moisture content not to exceed +4 percent or -2 percent of optimum moisture or as indicated on the Drawings
  - c. Embankments under structures:

- 1) Compacted each layer as indicated on the Drawings

F. Maintenance of Moisture and Reworking

1. Maintain the density and moisture content once all requirements are met.
2. For soils with a PI greater than 15, maintain the moisture content no lower than 4 percentage points below optimum.
3. Rework the material to obtain the specified compaction when the material loses the required stability, density, moisture, or finish.
4. Alter the compaction methods and procedures on subsequent work to obtain specified density as directed by the City.

**3.5 REPAIR [NOT USED]**

**3.6 RE-INSTALLATION [NOT USED]**

**3.7 FIELD QUALITY CONTROL**

A. Field Tests and Inspections

1. Proctors

- a. The City will perform Proctors in accordance with ASTM D698.
- b. Test results will generally be available to within 4 calendar days and distributed to:
  - 1) Contractor
  - 2) City Project Manager
  - 3) City Inspector
  - 4) Engineer
- c. Notify the City if the characteristic of the soil changes.
- d. City will perform new proctors for varying soils:
  - 1) When indicated in the geotechnical investigation in the Appendix
  - 2) If notified by the Contractor
  - 3) At the convenience of the City
- e. Embankments where different soil types are present and are blended, the proctors shall be based on the mixture of those soils.

2. Proof Rolling

- a. Embankments under Future Pavement
  - 1) City Project Representative must be on-site during proof rolling operations.

- 2) Use equipment that will apply sufficient load to identify soft spots that rut or pump.
    - a) Acceptable equipment includes fully loaded single-axle water truck with a 1500 gallon capacity.
  - 3) Make at least 2 passes with the proof roller (down and back = 1 pass).
  - 4) Offset each trip by at most 1 tire width.
  - 5) If an unstable or non-uniform area is found, correct the area.
  - 6) Correct
    - a) Soft spots that rut or pump greater than 3/4 inch.
    - b) Areas that are unstable or non-uniform
  - 7) If a non-uniform area is found then correct the area.
- b. Embankments Not Under Future Paving
- 1) No Proof Rolling is required.
3. Density Testing of Embankments
- a. Density Test shall be in conformance with ASTM D2922.
  - b. For Embankments under future pavement:
    - 1) The City will perform density testing twice per working day when compaction operations are being conducted.
    - 2) The testing lab shall take a minimum of 3 density tests, but the number of test shall be appropriate for the area being compacted.
    - 3) Testing shall be representative of the current lift being compacted.
    - 4) Special attention should be placed on edge conditions.
  - c. For Embankments not under future pavement or structures:
    - 1) The City will perform density testing once working day when compaction operations are being conducted.
    - 2) The testing lab shall take a minimum of 3 density tests.
    - 3) Testing shall be representative of the current lift being compacted.
  - d. Make the area where the embankment is being placed available for testing.
  - e. The City will determine the location of the test.
  - f. The City testing lab will provide results to Contractor and the City's Inspector upon completion of the testing.
  - g. A formal report will be posted to the City's Buzzsaw site within 48 hours.

- h. Test reports shall include:
  - 1) Location of test by station number
  - 2) Time and date of test
  - 3) Depth of testing
  - 4) Field moisture
  - 5) Dry density
  - 6) Proctor identifier
  - 7) Percent Proctor Density

B. Non-Conforming Work

- 1. All non-conforming work shall be removed and replaced.

**3.8 SYSTEM STARTUP [NOT USED]**

**3.9 ADJUSTING [NOT USED]**

**3.10 CLEANING [NOT USED]**

**3.11 CLOSEOUT ACTIVITIES [NOT USED]**

**3.12 PROTECTION [NOT USED]**

**3.13 MAINTENANCE [NOT USED]**

**3.14 ATTACHMENTS [NOT USED]**

**END OF SECTION**

**PART 1 - GENERAL****1.1 SUMMARY**

- A. Section Includes:
  - 1. Implementation of the project's Storm Water Pollution Prevention Plan (SWPPP) and installation, maintenance and removal of erosion and sediment control devices
- B. Related Specification Sections include, but are not necessarily limited to:
  - 1. Division 0 – Procurement and Contracting Requirements
  - 2. Division 1 – General Requirements

**1.2 PRICE AND PAYMENT PROCEDURES**

- A. Measurement and Payment
  - 1. Storm Water Pollution Prevention Plan
    - a. Measurement for this Item shall be by lump sum.
    - b. Payment
      - 1) The work performed and the materials furnished in accordance with this Item shall be paid for at the lump sum price bid for "Storm Water Pollution Prevention Plan and control in accordance with specifications, laws rules and assumption of responsibility for plan and control".
    - c. The price bid shall include:
      - 1) Preparation of SWPPP and submittal to the respective government agency
      - 2) Implementation
      - 3) Permitting fees
      - 4) Installation
      - 5) Maintenance
      - 6) Removal

**1.3 REFERENCES**

- A. Reference Standards
  - 1. Reference standards cited in this Specification refer to the current reference standard published at the time of the latest revision date logged at the end of this Specification unless a date is specifically cited.
  - 2. ASTM Standard:
    - a. ASTM D3786, Standard Test Method for Bursting Strength of Textile Fabrics— Diaphragm Bursting Strength Tester Method
    - b. ASTM D4632, Standard Test Method for Grab Breaking Load and Elongation of Geotextiles
    - c. ASTM D4751, Standard Test Method for Determining Apparent Opening Size of a Geotextile
    - d. ASTM D4833, Standard Test Method for Index Puncture Resistance of Geomembranes and Related Products
  - 3. Texas Commission on Environmental Quality (TCEQ) TPDES General Permit No. TXR150000
  - 4. TxDOT Departmental Material Specifications (DMS)
    - a. DMS-6230 "Temporary Sediment Control Fence Fabric"
  - 5. TxDOT Publications
    - a. "Storm Water Management Guidelines for Construction Activities," TxDOT, 2002

**1.4 ADMINISTRATIVE REQUIREMENTS [NOT USED]**

**1.5 SUBMITTALS**

- A. Storm Water Pollution Prevention Plan (SWPPP) approved by the jurisdiction where the project is located prior to submittal to Authority.
- B. TCEQ Notice of Intent (NOI) for Storm Water Discharges Associated with Construction Activity under the TPDES General Permit
- C. Construction Site Notice
- D. TCEQ Notice of Termination (NOT) for Storm Water Discharges Associated with Construction Activity under the TPDES General Permit
- E. Notice of Change (if applicable)

**1.6 ACTION SUBMITTALS/INFORMATIONAL SUBMITTALS [NOT USED]**

**1.7 CLOSEOUT SUBMITTALS [NOT USED]**

**1.8 MAINTENANCE MATERIAL SUBMITTALS [NOT USED]**

**1.9 QUALITY ASSURANCE [NOT USED]**

**1.10 DELIVERY, STORAGE AND HANDLING [NOT USED]**

**1.11 FIELD [SITE] CONDITIONS [NOT USED]**

**1.12 WARRANTY [NOT USED]**

**PART 2 - PRODUCTS**

**2.1 AUTHORITY-FURNISHED [OR] AUTHORITY-SUPPLIED PRODUCTS [NOT USED]**

**2.2 PRODUCT TYPES AND MATERIALS**

- A. Rock Filter Dams
  - 1. Aggregate
    - a. Furnish aggregate with hardness, durability, cleanliness, and resistance to crumbling, flaking, and eroding acceptable to the Engineer.
    - b. Provide the following:
      - 1) Types 1, 2 and 4 Rock Filter Dams
        - a) Use 3-to-6-inch aggregate.
      - 2) Type 3 Rock Filter Dams
        - a) Use 4-to-8-inch aggregate.
  - 2. Wire
    - a. Provide minimum 20-gauge galvanized wire for the steel wire mesh and tie wires for Types 2 and 3 rock filter dams.
    - b. Type 4 dams require:
      - 1) Double-twisted, hexagonal weave with a nominal mesh opening of 2½ inches x 3 ¼ inches.
      - 2) Minimum 0.0866-inch steel wire for netting
      - 3) Minimum 0.1063-inch steel wire for selvages and corners
      - 4) Minimum 0.0866 inch for binding or tie wire
- B. Geotextile Fabric
  - 1. Place the aggregate over geotextile fabric meeting the following criteria:
    - a. Tensile Strength of 250 pounds, per ASTM D4632
    - b. Puncture Strength of 135 pounds, per ASTM D4833
    - c. Mullen Burst Rate of 420 psi, per ASTM D3786.
    - d. Apparent Opening Size of No. 20 (max), per ASTM D4751

- C. Sandbag Material
  - 1. Furnish sandbags meeting Section 2.5 except that any gradation of aggregate may be used to fill the sandbags.
- D. Stabilized Construction Entrances
  - 1. Provide materials that meet the details shown on the Drawings and this Section.
    - a. Provide crushed aggregate for long and short-term construction exits.
    - b. Furnish aggregates that are clean, hard, durable, and free from adherent coatings such as salt, alkali, dirt, clay, loam, shale, soft or flaky materials and organic and injurious matter.
    - c. Use 3-to-5-inch coarse aggregate with a minimum thickness of 12 inches.
    - d. The aggregate shall be placed over a geotextile fabric meeting the following criteria:
      - 1) Tensile Strength of 300 pounds, per ASTM D4632
      - 2) Puncture Strength of 120 pounds, per ASTM D4833
      - 3) Mullen Burst Rate of 600 psi, per ASTM D3786.
      - 4) Apparent Opening Size of No. 40 (max), per ASTM D4751
- E. Embankment for Erosion Control
  - 1. Provide rock, loam, clay, topsoil, or other earth materials that will form a stable embankment to meet the intended use.
- F. Sandbags
  - 1. Provide sandbag material of polypropylene, polyethylene, or polyamide woven fabric with a minimum unit weight of 4 ounces per square yard, a Mullen burst strength exceeding 300 psi, and an ultraviolet stability exceeding 70 percent.
  - 2. Use natural coarse sand or manufactured sand meeting the gradation given in Table 1 to fill sandbags.
  - 3. Filled sandbags must be 24 to 30 inches long, 16 to 18 inches wide, and 6 to 8 inches thick.

**Table 1  
Sand Gradation**

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

- G. Temporary Sediment Control Fence
  - 1. Provide a net-reinforced fence using woven geo-textile fabric.
  - 2. Logos visible to the traveling public will not be allowed.
    - a. Fabric
      - 1) Provide fabric materials in accordance with DMS-6230, "Temporary Sediment Control Fence Fabric."
    - b. Posts
      - 1) Provide essentially straight steel posts with a minimum length of 48 inches, unless otherwise shown on the Drawings.
      - 2) T- or L-shaped steel posts must have a minimum weight of 1.3 pounds per foot.
    - c. Net Reinforcement
      - 1) Provide net reinforcement of at least 12-1/2 gauge galvanized welded wire mesh, with a maximum opening size of 2 x 4 inch, at least 24 inches wide, unless otherwise shown on the Drawings.



- d. Staples
  - 1) Provide staples with a crown at least 3/4 inch wide and legs 1/2 inch long.

H. Filter Socks

Filter socks shall either be made on site or delivered to the jobsite. The filter sock shall be produced from a 5 mil thick continuous HDPE filament, woven into a tubular mesh netting material, with openings in the knitted mesh of 3/8" (10mm). This shall then be filled with compost meeting the specifications outlined in Table 1 to the diameter of the sock. Filter sock netting materials are also available in biodegradable plastics for areas where removal and disposal are not planned. Filter socks contain the compost, allowing filtration to occur even during peak storm events and concentrated flows. Filter socks will be placed at locations indicated on plans as directed by the engineer. Filter socks should be installed parallel to the base of the slope or other affected area, perpendicular to sheet flow. In extreme conditions (i.e., 2:1 slopes), or when sheet flow flows to the area from a parcel above the work zone, a second sock shall be constructed at the top of the slope in order to dissipate flows.

On location where greater than a 200-foot long section of ground is to be treated with a filter sock, the sock lengths should be sleeved. After one sock section (200 feet) is filled and tied off (knotted) or zip tied, the second sock section shall be pulled over the first (1-2 feet) and 'sleeved' creating an overlap. Once overlapped, the second section is filled with compost starting at the sleeved area to create a seamless appearance. The socks may be staked at the overlapped area (where the sleeve is) to keep the sections together. Sleeving at the joints is necessary because it reduces the opportunity for water to penetrate the joints when installed in the field.

If the filter sock is to be left as a permanent filter or part of the natural landscape, it may be seeded at time of installation for establishment of permanent vegetation. The Engineer shall specify seed requirements.

Filter socks may be used in direct flow situations perpendicular to runoff channels not exceeding 3 feet (90 cm) in depth. Normally, 8" filter socks should be used. Be sure to stake the filter sock perpendicular to water flow, at a minimum interval of 10 linear feet, using a 2" (5 cm) by 2" (5 cm) wooden stakes. The stakes should be projected through the center of the filter sock and into the soil 1' (30 cm) foot deep and leaving 3" to 4" (7.5 to 10 cm) protruding above the Filter sock.

**Table 1 – Filter Berm and Filter Sock Media Parameters**

Parameters <sup>1,4</sup>	Reported as (units of measure)	Filter Berm to be Vegetated	Filter Berm to be left Un-vegetated	Filter Sock Media
pH <sub>2</sub>	pH units	5.0 - 8.5	N/A	5.0 – 8.5
Soluble Salt Concentration <sup>2</sup> (electrical conductivity)	dS/m (mmhos/cm)	Maximum 5	N/A	N/A
Moisture Content	%, wet weight basis	30 – 60	30 – 60	<60
Organic Matter Content	%, dry weight basis	25 – 65	25 – 100	25 – 100

<sup>1</sup>

Particle Size	% passing a selected mesh size, dry weight basis	<ul style="list-style-type: none"> <li>• 3" (75 mm), 100% passing.</li> <li>• 1" (25mm), 90% to 100% passing</li> <li>• 3/4" (19mm), 70% to 100% passing.</li> <li>• 1/4" (6.4mm), 30% to 75% passing.</li> </ul> <p>Maximum:</p> <ul style="list-style-type: none"> <li>• particle size length of 6" (152mm)</li> </ul> <p>(no more than 60% passing 1/4" (6.4 mm) in high rainfall/ flow rate situations)</p>	<ul style="list-style-type: none"> <li>• 3" (75 mm), 100% passing.</li> <li>• 1" (25mm), 90% to 100% passing.</li> <li>• 3/4" (19mm), 70% to 100% passing.</li> <li>• 1/4" (6.4mm), 30% to 75% passing.</li> </ul> <p>Maximum:</p> <ul style="list-style-type: none"> <li>• particle size length of 6" (152mm)</li> </ul> <p>(no more than 50% passing 1/4" (6.4 mm) in high rainfall/ flow rate situations)</p>	<ul style="list-style-type: none"> <li>• 2" (50 mm) 99% passing.</li> <li>• 3/8" (10 mm), 3050% passing (or 50-70% retained)</li> </ul> <p>Maximum:</p> <ul style="list-style-type: none"> <li>• 2"</li> </ul>
Stability <sup>34</sup> Carbon Dioxide Evolution Rate	mg CO <sub>2</sub> -C per g OM per day	<8	N/A	N/A
Physical Contaminants (man-made inerts)	%, dry weight basis	1	<1	<1

**2.3 ACCESSORIES [NOT USED]**

**2.4 SOURCE QUALITY CONTROL [NOT USED]**

**PART 3 - EXECUTION**

**3.1 INSTALLERS [NOT USED]**

**3.2 EXAMINATION [NOT USED]**

**3.3 PREPARATION [NOT USED]**

**3.4 INSTALLATION**

A. Storm Water Pollution Prevention Plan

1. Develop and implement the project's Storm Water Pollution Prevention Plan (SWPPP) in accordance with the TPDES Construction General Permit TXR150000 requirements. Prevent water pollution from storm water runoff by using and maintaining appropriate structural and nonstructural BMPs to reduce pollutants discharges to the MS4 from the construction site.

- B. Control Measures
  - 1. Implement control measures in the area to be disturbed before beginning construction, or as directed. Limit the disturbance to the area shown on the Drawings or as directed.
  - 2. Control site waste such as discarded building materials, concrete truck washout water, chemicals, litter, and sanitary waste at the construction site.
  - 3. If, in the opinion of the Engineer, the Contractor cannot control soil erosion and sedimentation resulting from construction operations, the Engineer will limit the disturbed area to that which the Contractor is able to control. Minimize disturbance to vegetation.
  - 4. Immediately correct ineffective control measures. Implement additional controls as directed. Remove excavated material within the time requirements specified in the applicable storm water permit.
  - 5. Upon acceptance of vegetative cover by the Authority, remove and dispose of all temporary control measures, temporary embankments, bridges, matting, falsework, piling, debris, or other obstructions placed during construction that are not a part of the finished work, or as directed.
- C. Do not locate disposal areas, stockpiles, or haul roads in any wetland, water body, or streambed.
- D. Do not install temporary construction crossings in or across any water body without the prior approval of the appropriate resource agency and the Engineer.
- E. Provide protected storage area for paints, chemicals, solvents, and fertilizers at an approved location. Keep paints, chemicals, solvents, and fertilizers off bare ground and provide shelter for stored chemicals.
- F. Installation and Maintenance
  - 1. Perform work in accordance with the TPDES Construction General Permit TXR150000.
  - 2. When approved, sediments may be disposed of within embankments, or in areas where the material will not contribute to further siltation.
  - 3. Dispose of removed material in accordance with federal, state, and local regulations.
  - 4. Remove devices upon approval or when directed.
    - a. Upon removal, finish-grade and dress the area.
    - b. Stabilize disturbed areas in accordance with the permit, and as shown on the Drawings or directed.
  - 5. The Contractor retains ownership of stockpiled material and must remove it from the project when new installations or replacements are no longer required.
- G. Rock Filter Dams for Erosion Control
  - 1. Remove trees, brush, stumps, and other objectionable material that may interfere with the construction of rock filter dams.
  - 2. Place sandbags as a foundation when required or at the Contractor's option.
  - 3. For Types 1, 2, 3, and 5, place the aggregate to the lines, height, and slopes specified, without undue voids.
  - 4. For Types 2 and 3, place the aggregate on the mesh and then fold the mesh at the upstream side over the aggregate and secure it to itself on the downstream side with wire ties, or hog rings, or as directed.
  - 5. Place rock filter dams perpendicular to the flow of the stream or channel unless otherwise directed.

6. Construct filter dams according to the following criteria, unless otherwise shown on the Drawings:
  - a. Type 1 (Non-reinforced)
    - 1) Height - At least 18 inches measured vertically from existing ground to top of filter dam.
    - 2) Top Width - At least 2 feet
    - 3) Slopes - At most 2:1
  - b. Type 2 (Reinforced)
    - 1) Height - At least 18 inches measured vertically from existing ground to top of filter dam.
    - 2) Top Width - At least 2 feet
    - 3) Slopes - At most 2:1
  - c. Type 3 (Reinforced)
    - 1) Height - At least 36 inches measured vertically from existing ground to top of filter dam.
    - 2) Top Width - At least 2 feet
    - 3) Slopes - At most 2:1
  - d. Type 4 (Sack Gabions)
    - 1) Unfold sack gabions and smooth out kinks and bends.
    - 2) For vertical filling, connect the sides by lacing in a single loop–double loop pattern on 4- to 5-inches spacing. At 1 end, pull the end lacing rod until tight, wrap around the end, and twist 4 times. At the filling end, fill with stone, pull the rod tight, cut the wire with approximately 6 inches remaining, and twist wires 4 times.
    - 3) For horizontal filling, place sack flat in a filling trough, fill with stone, and connect sides and secure ends as described above.
    - 4) Lift and place without damaging the gabion.
    - 5) Shape sack gabions to existing contours.
  - e. Type 5
    - 1) Provide rock filter dams as shown on the Drawings.

#### H. Construction Entrances

1. When tracking conditions exist, prevent traffic from crossing or exiting the construction site or moving directly onto a public roadway, alley, sidewalk, parking area, or other right of way areas other than at the location of construction entrances.
2. Place the exit over a foundation course, if necessary.
  - a. Grade the foundation course or compacted subgrade to direct runoff from the construction exits to a sediment trap as shown on the Drawings or as directed.
3. At drive approaches, make sure the construction entrance is the full width of the drive and meets the length shown on the Drawings.
  - a. The width shall be at least 14 feet for 1-way and 24 feet for 2-way traffic for all other points of ingress or egress or as directed by the Engineer.

#### I. Earthwork for Erosion Control

1. Perform excavation and embankment operations to minimize erosion and to remove collected sediments from other erosion control devices.
  - a. Excavation and Embankment for Erosion Control Measures
    - 1) Place earth dikes, swales, or combinations of both along the low crown of daily lift placement, or as directed, to prevent runoff spillover.
    - 2) Place swales and dikes at other locations as shown on the Drawings or as directed to prevent runoff spillover or to divert runoff.
    - 3) Construct cuts with the low end blocked with undisturbed earth to prevent erosion of hillsides.
    - 4) Construct sediment traps at drainage structures in conjunction with other erosion control measures as shown on the Drawings or as directed.

- 5) Where required, create a sediment basin providing 3,600 cubic feet of storage per acre drained, or equivalent control measures for drainage locations that serve an area with 10 or more disturbed acres at 1 time, not including offsite areas.
  - b. Excavation of Sediment and Debris
    - 1) Remove sediment and debris when accumulation affects the performance of the devices, after a rain, and when directed.
- J. Sandbags for Erosion Control
1. Construct a berm or dam of sandbags that will intercept sediment-laden storm water runoff from disturbed areas, create a retention pond, detain sediment, and release water in sheet flow.
  2. Fill each bag with sand so that at least the top 6 inches of the bag is unfilled to allow for proper tying of the open end.
  3. Place the sandbags with their tied ends in the same direction.
  4. Offset subsequent rows of sandbags 1/2 the length of the preceding row.
  5. Place a single layer of sandbags downstream as a secondary debris trap.
  6. Place additional sandbags as necessary or as directed for supplementary support to berms or dams of sandbags or earth.
- K. Temporary Sediment-Control Fence
1. Provide temporary sediment-control fence near the downstream perimeter of a disturbed area to intercept sediment from sheet flow.
  2. Incorporate the fence into erosion-control measures used to control sediment in areas of higher flow. Install the fence as shown on the Drawings, as specified in this Section, or as directed.
    - a. Post Installation
      - 1) Embed posts at least 18 inches deep, or adequately anchor, if in rock, with a spacing of 6 to 8 feet and install on a slight angle toward the run-off source.
    - b. Fabric Anchoring
      - 1) Dig trenches along the uphill side of the fence to anchor 6 to 8 inches of fabric.
      - 2) Provide a minimum trench cross-section of 6 x 6 inches.
      - 3) Place the fabric against the side of the trench and align approximately 2 inches of fabric along the bottom in the upstream direction.
      - 4) Backfill the trench, then hand-tamp.
    - c. Fabric and Net Reinforcement Attachment
      - 1) Unless otherwise shown under the Drawings, attach the reinforcement to wooden posts with staples, or to steel posts with T-clips, in at least 4 places equally spaced.
      - 2) Sewn vertical pockets may be used to attach reinforcement to end posts.
      - 3) Fasten the fabric to the top strand of reinforcement by hog rings or cord every 15 inches or less.
    - d. Fabric and Net Splices
      - 1) Locate splices at a fence post with a minimum lap of 6 inches attached in at least 6 places equally spaced, unless otherwise shown under the Drawings.
        - a) Do not locate splices in concentrated flow areas.
      - 2) Requirements for installation of used temporary sediment-control fence include the following:
        - a) Fabric with minimal or no visible signs of biodegradation (weak fibers)
        - b) Fabric without excessive patching (more than 1 patch every 15 to 20 feet)
        - c) Posts without bends
        - d) Backing without holes

**3.5 REPAIR/RESTORATION [NOT USED]**

**3.6 RE-INSTALLATION [NOT USED]**

**3.7 FIELD [OR] SITE QUALITY CONTROL [NOT USED]**

**3.8 SYSTEM STARTUP [NOT USED]**

**3.9 ADJUSTING [NOT USED]**

**3.10 CLEANING**

A. Waste Management

1. Remove sediment, debris and litter as needed.

**3.11 CLOSEOUT ACTIVITIES**

A. Erosion control measures remain in place and are maintained until all soil disturbing activities at the project site have been completed.

B. Establish a uniform vegetative cover with a density of 70 percent on all unpaved areas, on areas not covered by permanent structures, or in areas where permanent erosion control measures (i.e., riprap, gabions, or geotextiles) have been employed.

**3.12 PROTECTION [NOT USED]**

**3.13 MAINTENANCE**

A. Install and maintain the integrity of temporary erosion and sedimentation control devices to accumulate silt and debris until earthwork construction and permanent erosion control features are in place or the disturbed area has been adequately stabilized as determined by the Engineer.

B. If a device ceases to function as intended, repair or replace the device or portions thereof as necessary.

C. Perform inspections of the construction site as prescribed in the Construction General Permit TXR150000.

D. Records of inspections and modifications based on the results of inspections must be maintained and available in accordance with the permit.

**3.14 ATTACHMENTS [NOT USED]**

**END OF SECTION**

**DIVISION 32**  
**EXTERIOR**  
**IMPROVEMENTS**





**PART 1 - GENERAL****1.1 SUMMARY**

- A. Section includes:
  - 1. Concrete pavement repair to include, but not limited to:
    - a. Utility cuts (water, sanitary sewer, drainage, etc.)
    - b. Warranty work
    - c. Repairs of damage caused by Contractor.
    - d. Any other concrete pavement repair needed during the course of construction.
- B. Related Specification Sections include, but are not necessarily limited to:
  - 1. Section 32 13 13 - Concrete Paving
  - 2. Section 33 05 10 - Utility Trench Excavation, Embedment and Backfill

**1.2 PRICE AND PAYMENT PROCEDURES**

- A. Measurement and Payment
  - 1. Concrete Pavement Repair
    - a. Measurement
      - 1) Measurement for this Item shall be by the square yard of Concrete Pavement Repair for various:
        - a) Street types
      - 2) Limits of repair will be based on the time of service of the existing pavement. The age of the pavement will need to be determined by the Engineer through coordination with the City. For pavement ages:
        - a) 10 years or less: repair entire panel
        - b) Greater than 10 years: repair to limits per Drawings.
    - b. Payment
      - 1) The work performed and materials furnished in accordance with this Item and measured as provided under "Measurement" shall be paid for at the unit price bid per square yard of Concrete Pavement Repair
    - c. The price bid shall include:
      - 1) Shaping and fine grading the placement area
      - 2) Furnishing and applying all water required
      - 3) Furnishing, loading, and unloading, storing, hauling, and handling all concrete
      - 4) Furnishing, loading, and unloading, storing, hauling, and handling all base material
      - 5) Mixing, placing, finishing, and curing all concrete
      - 6) Furnishing and installing reinforcing steel
      - 7) Furnishing all materials and placing longitudinal, warping, expansion and contraction joints, including all steel dowels, dowel caps and load transmission units required, wire and devices for placing, holding, and supporting the steel bar, load transmission units, and joint filler in the proper position; for coating steel bars where required by the Drawings.
      - 8) Sealing joints
      - 9) Monolithically poured curb.
      - 10) Cleanup

**1.3 REFERENCES [NOT USED]**

**1.4 ADMINISTRATIVE REQUIREMENTS**

A. Permitting

1. Obtain Street Use Permit to make utility cuts in the street from the City's Transportation and Public Works Department in conformance with current ordinances.
2. City's Transportation and Public Works Department will inspect paving repair after construction.

**1.5 SUBMITTALS [NOT USED]**

**1.6 ACTION SUBMITTALS/INFORMATIONAL SUBMITTALS**

- A. Concrete Mix Design: submit for approval in accordance with Section 32 13 13.

**1.7 CLOSEOUT SUBMITTALS [NOT USED]**

**1.8 MAINTENANCE MATERIAL SUBMITTALS [NOT USED]**

**1.9 QUALITY ASSURANCE [NOT USED]**

**1.10 DELIVERY, STORAGE, AND HANDLING [NOT USED]**

**1.11 FIELD CONDITIONS**

- A. Weather Conditions: Place concrete as specified in Section 32 13 13.

**1.12 WARRANTY [NOT USED]**

**PART 2 - PRODUCTS**

**2.1 OWNER-FURNISHED PRODUCTS [NOT USED]**

**2.2 MATERIALS**

- A. Embedment and Backfill: see Section 33 05 10.
- B. Base material: Concrete base: see Section 32 13 13.
- C. Concrete: see Section 32 13 13.
1. Concrete paving: Class H or Class HES.
  2. Replace concrete to the specified thickness.

**2.3 ACCESSORIES [NOT USED]**

**2.4 SOURCE QUALITY CONTROL [NOT USED]**

**PART 3 - EXECUTION**

**3.1 INSTALLERS [NOT USED]**

**3.2 EXAMINATION [NOT USED]**

**3.3 PREPARATION**

- A. Replace a continuous section if multiple repairs are closer than 10 feet apart from edge of one repair to the edge of a second repair.
- B. If the cut is to be covered, use steel plates of sufficient strength and thickness to support traffic.
1. Construct a transition of hot-mix or cold-mix asphalt from the top of the steel plate to the existing pavement to create a smooth riding surface.
    - a. Hot-mix or cold-mix asphalt: conform to the requirements of Section 32 12 16.

C. Surface Preparation: mark pavement cut repairs for approval by the Authority and City.

### **3.4 INSTALLATION**

#### **A. Sawing**

##### **1. General**

- a. Saw cut perpendicular to the surface to full pavement depth.
- b. Saw cut the edges of pavement and appurtenances damaged subsequent to sawing to remove damaged areas.
- c. Such saw cuts shall be parallel to the original saw cut and to neat straight lines.

##### **2. Sawing equipment**

- a. Power-driven
- b. Manufactured for the purpose of sawing pavement.
- c. In good operating condition
- d. Shall not spall or fracture concrete adjacent to the repair area.

##### **3. Repairs: In true and straight lines to dimensions shown on the Drawings**

##### **4. Utility Cuts**

- a. In a true and straight line on both sides of the trench
- b. Minimum of 12 inches outside the trench walls

##### **5. Prevent dust and residues from sawing from entering the atmosphere or drainage facilities.**

#### **B. Removal**

1. Use care in removing concrete to be repaired to prevent spalling or fracturing concrete adjacent to the repair area.

#### **C. Base: as specified in Drawings**

#### **D. Concrete Paving**

1. Concrete placement: in accordance with Section 32 13 13.
2. Reinforce concrete replacement: as specified in Drawings

### **3.5 REPAIR/RESTORATION [NOT USED]**

### **3.6 RE-INSTALLATION [NOT USED]**

### **3.7 FIELD QUALITY CONTROL [NOT USED]**

### **3.8 SYSTEM STARTUP [NOT USED]**

### **3.9 ADJUSTING [NOT USED]**

### **3.10 CLEANING [NOT USED]**

### **3.11 CLOSEOUT ACTIVITIES [NOT USED]**

### **3.12 PROTECTION [NOT USED]**

### **3.13 MAINTENANCE [NOT USED]**

### **3.14 ATTACHMENTS [NOT USED]**

**END OF SECTION**

**PART 1 - GENERAL****1.1 SUMMARY**

- A. Section Includes:
  - 1. Foundation course for surface course or for other base course composed of flexible base constructed in one or more courses in conformity with the typical section.
- B. Deviations from this Standard Specification
  - 1. None
- C. Related Specification Sections include, but are not necessarily limited to:
  - 1. Division 0 – Bidding Requirements, Contract Forms, and Conditions of the Contract
  - 2. Division 1 – General Requirements

**1.2 PRICE AND PAYMENT PROCEDURES**

- A. Measurement and Payment
  - 1. Measurement
    - a. Measurement for this Item will be by the square yard of Flexible Base Course for various:
      - 1) Depths
      - 2) Types
      - 3) Gradations
  - 2. Payment
    - a. The work performed and materials furnished in accordance with this Item and measured as provided under "Measurement" will be paid for at the unit price bid per square yard of Flexible Base Course.
  - 3. The price bid shall include:
    - a. Preparation and correction of subgrade
    - b. Furnishing of material
    - c. Hauling
    - d. Blading
    - e. Sprinkling
    - f. Compacting

### 1.3 REFERENCES

#### A. Definitions

1. RAP – Recycled Asphalt Pavement.

#### B. Reference Standards

1. Reference standards cited in this specification refer to the current reference standard published at the time of the latest revision date logged at the end of this specification unless a date is specifically cited.
2. ASTM International (ASTM):
  - a. D698, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12 400 ft-lbf/ft<sup>3</sup> (600 kN-m/m<sup>3</sup>))
3. Texas Department of Transportation (TXDOT):
  - a. Tex-104-E, Determining Liquid Limits of Soils
  - b. Tex-106-E, Calculating the Plasticity Index of Soils
  - c. Tex-107-E, Determining the Bar Linear Shrinkage of Soils
  - d. Tex-110-E, Particle Size Analysis of Soils
  - e. Tex-116-E, Ball Mill Method for Determining the Disintegration of Flexible Base Material
  - f. Tex-117-E, Triaxial Compression for Disturbed Soils and Base Materials
  - g. Tex-411-A, Soundness of Aggregate Using Sodium Sulfate or Magnesium Sulfate
  - h. Tex-413-A, Determining Deleterious Material in Mineral Aggregate

- 1.4 ADMINISTRATIVE REQUIREMENTS [NOT USED]
- 1.5 ACTION SUBMITTALS [NOT USED]
- 1.6 ACTION SUBMITTALS/INFORMATIONAL SUBMITTALS [NOT USED]
- 1.7 CLOSEOUT SUBMITTALS [NOT USED]
- 1.8 MAINTENANCE MATERIAL SUBMITTALS [NOT USED]
- 1.9 QUALITY ASSURANCE [NOT USED]
- 1.10 DELIVERY, STORAGE, AND HANDLING [NOT USED]
- 1.11 FIELD [SITE] CONDITIONS [NOT USED]
- 1.12 WARRANTY [NOT USED]

**PART 2 - PRODUCTS [NOT USED]**

**2.1 OWNER-FURNISHED PRODUCTS [NOT USED]**

**2.2 MATERIALS**

A. General

- 1. Furnish uncontaminated materials of uniform quality that meet the requirements of the Drawings and specifications.
- 2. Obtain materials from approved sources.
- 3. Notify City of changes to material sources.
- 4. The City may sample and test project materials at any time before compaction throughout the duration of the project to assure specification compliance.

B. Aggregate

- 1. Furnish aggregate of the type and grade shown on the Drawings and conforming to the requirements of Table 1.
- 2. Each source must meet Table 1 requirements for liquid limit, Plasticity index, and wet ball mill for the grade specified.
- 3. Do not use additives such as but not limited to lime, cement, or fly ash to modify aggregates to meet the requirements of Table 1, unless shown on the Drawings.

**Table 1**  
**Material Requirements**

Property	Test Method	Grade 1	Grade 2
Master gradation sieve size (% retained)	Tex-110-E		
2-1/2 in.		–	0
1-3/4 in.		0	0–10
7/8 in.		10–35	–
3/8 in.		30–50	–
No. 4		45–65	45–75
No. 40		70–85	60–85
Liquid limit, % max. <sup>1</sup>	Tex-104-E	35	40
PlastiCity index, max. <sup>1</sup>	Tex-106-E	10	12
Wet ball mill, % max. <sup>2</sup>	Tex-116-E	40	45
Wet ball mill, % max. increase passing the No. 40 sieve		20	20
Classification <sup>3</sup>	Tex-117-E	1.0	1.1–2.3
Min. compressive strength <sup>3</sup> , psi lateral pressure 0 psi		45	35

Property	Test Method	Grade 1	Grade 2
lateral pressure 15 psi		175	175

1. Determine plastic index in accordance with Tex-107-E (linear shrinkage) when liquid limit is unattainable as defined in Tex-104-E.

2. When a soundness value is required by the Drawings, test material in accordance with Tex-411-A.

3. Meet both the classification and the minimum compressive strength, unless otherwise shown on the Drawings.

4. Material Tolerances

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

5. Material Types

- a. Do not use fillers or binders unless approved.
- b. Furnish the type specified on the Drawings in accordance with the following:
  - 1) Type A
    - a) Crushed stone produced and graded from oversize quarried aggregate that originates from a single, naturally occurring source.
    - b) Do not use gravel or multiple sources.
  - 2) Type B
    - a) Only for use as base material for temporary pavement repairs.
    - b) Do not exceed 20 percent RAP by weight unless shown on Drawings.
  - 3) Type D



- a) Type A material or crushed concrete.
- b) Crushed concrete containing gravel will be considered Type D material.
- c) The City may require separate dedicated stockpiles in order to verify compliance.
- d) Crushed concrete must meet the following requirements:
  - (1) Table 1 for the grade specified.
  - (2) Recycled materials must be free from reinforcing steel and other objectionable material and have at most 1.5 percent deleterious material when tested in accordance with TEX-413-A.

C. Water

- 1. Furnish water free of industrial wastes and other objectionable matter.

**2.3 ACCESSORIES [NOT USED]**

**2.4 SOURCE QUALITY CONTROL [NOT USED]**

**PART 3 - EXECUTION**

**3.1 INSTALLERS [NOT USED]**

**3.2 EXAMINATION [NOT USED]**

**3.3 PREPARATION**

A. General

- 1. Shape the subgrade or existing base to conform to the typical sections shown on the Drawings or as directed.
- 2. When new base is required to be mixed with existing base:
  - a. Deliver, place, and spread the new flexible base in the required amount.
  - b. Manipulate and thoroughly mix the new base with existing material to provide a uniform mixture to the specified depth before shaping.

B. Subgrade Compaction

- 1. Proof roll the roadbed before pulverizing or scarifying in accordance with the following:
  - a. Proof Rolling
    - 1) City Project Representative must be on-site during proof rolling operations.
    - 2) Use equipment that will apply sufficient load to identify soft spots that rut or pump.
      - a) Acceptable equipment includes fully loaded single-axle water truck with a 1500 gallon capacity.

- 3) Make at least 2 passes with the proof roller (down and back = 1 pass).
  - 4) Offset each trip by at most 1 tire width.
  - 5) If an unstable or non-uniform area is found, correct the area.
- b. Correct
- 1) Soft spots that rut or pump greater than 3/4 inch
  - 2) Areas that are unstable or non-uniform
2. Installation of base material cannot proceed until compacted subgrade approved by the City.

### 3.4 INSTALLATION

#### A. General

1. Construct each layer uniformly, free of loose or segregated areas, and with the required density and moisture content.
2. Provide a smooth surface that conforms to the typical sections, lines, and grades shown on the Drawings or as directed.
3. Haul approved flexible base in clean, covered trucks.

#### B. Equipment

1. General
  - a. Provide machinery, tools, and equipment necessary for proper execution of the work.
2. Rollers
  - a. The Contractor may use any type of roller to meet the production rates and quality requirements of the Contract unless otherwise shown on the Drawings or directed.
  - b. When specific types of equipment are required, use equipment that meets the specified requirements.
  - c. Alternate Equipment.
    - 1) Instead of the specified equipment, the Contractor may, as approved, operate other compaction equipment that produces equivalent results.
    - 2) Discontinue the use of the alternate equipment and furnish the specified equipment if the desired results are not achieved.
  - d. City may require Contractor to substitute equipment if production rate and quality requirements of the Contract are not met.

#### C. Placing

1. Spread and shape flexible base into a uniform layer by approved means the same day as delivered unless otherwise approved.

2. Place material such that it is mixed to minimize segregation.
3. Construct layers to the thickness shown on the Drawings, while maintaining the shape of the course.
4. Where subbase or base course exceeds 6 inches in thickness, construct in 2 or more courses of equal thickness.
5. Minimum lift depth: 3 inches
6. Control dust by sprinkling.
7. Correct or replace segregated areas as directed.
8. Place successive base courses and finish courses using the same construction methods required for the first course.

D. Compaction

1. General

- a. Compact using density control unless otherwise shown on the Drawings.
- b. Multiple lifts are permitted when shown on the Drawings or approved.
- c. Bring each layer to the moisture content directed. When necessary, sprinkle the material to the extent necessary to provide not less than the required density.
- d. Compact the full depth of the subbase or base to the extent necessary to remain firm and stable under construction equipment.

2. Rolling

- a. Begin rolling longitudinally at the sides and proceed towards the center, overlapping on successive trips by at least 1/2 the width of the roller unit.
- b. On superelevated curves, begin rolling at the low side and progress toward the high side.
- c. Offset alternate trips of the roller.
- d. Operate rollers at a speed between 2 and 6 mph as directed.
- e. Rework, recompact, and refinish material that fails to meet or that loses required moisture, density, stability, or finish before the next course is placed or the project is accepted.
- f. Continue work until specification requirements are met.
- g. Proof roll the compacted flexible base in accordance with the following:
  - 1) Proof Rolling
    - a) City Project Representative must be on-site during proof rolling operations.
    - b) Use equipment that will apply sufficient load to identify soft spots that rut or pump.

- (1) Acceptable equipment includes fully loaded single-axle water truck with a 1500 gallon capacity.
    - c) Make at least 2 passes with the proof roller (down and back = 1 pass).
    - d) Offset each trip by at most 1 tire width.
    - e) If an unstable or non-uniform area is found, correct the area.
  - 2) Correct
    - a) Soft spots that rut or pump greater than 3/4 inch.
    - b) Areas that are unstable or non-uniform.
- 3. Tolerances
  - a. Maintain the shape of the course by blading.
  - b. Completed surface shall be smooth and in conformity with the typical sections shown on the Drawings to the established lines and grades.
  - c. For subgrade beneath paving surfaces, correct any deviation in excess of 1/4 inch in cross section in length greater than 16 feet measured longitudinally by loosening, adding or removing material. Reshape and recompact by sprinkling and rolling.
  - d. Correct all fractures, settlement or segregation immediately by scarifying the areas affected, adding suitable material as required. Reshape and recompact by sprinkling and rolling.
  - e. Should the subbase or base course, due to any reason, lose the required stability, density and finish before the surfacing is complete, it shall be recompact at the sole expense of the Contractor.
- 4. Density Control
  - a. Minimum Density: 95 percent compaction as determined by ASTM D698.
  - b. Moisture content: minus 2 to plus 4 of optimum.
- E. Finishing
  - 1. After completing compaction, clip, skin, or tight-blade the surface with a maintainer or subgrade trimmer to a depth of approximately 1/4 inch.
  - 2. Remove loosened material and dispose of it at an approved location.
  - 3. Seal the clipped surface immediately by rolling with an appropriate size pneumatic tire roller until a smooth surface is attained.
  - 4. Add small increments of water as needed during rolling.
  - 5. Shape and maintain the course and surface in conformity with the typical sections, lines, and grades as shown on the Drawings or as directed.

6. In areas where surfacing is to be placed, correct grade deviations greater than 1/4 inch in 16 feet measured longitudinally or greater than 1/4 inch over the entire width of the cross-section.
7. Correct by loosening, adding, or removing material.
8. Reshape and recompact in accordance with 3.4.C.

**3.5 REPAIR/RESTORATION [NOT USED]**

**3.6 RE-INSTALLATION [NOT USED]**

**3.7 QUALITY CONTROL**

A. Density Test

1. City to measure density of flexible base course.
  - a. Notify City Project Representative when flexible base ready for density testing.
  - b. Spacing directed by City (1 per block minimum).
  - c. City Project Representative determines location of density testing.

**3.8 SYSTEM STARTUP [NOT USED]**

**3.9 ADJUSTING [NOT USED]**

**3.10 CLEANING [NOT USED]**

**3.11 CLOSEOUT ACTIVITIES [NOT USED]**

**3.12 PROTECTION [NOT USED]**

**3.13 MAINTENANCE [NOT USED]**

**3.14 ATTACHMENTS [NOT USED]**

**END OF SECTION**

**PART 1 - GENERAL****1.1 SUMMARY**

- A. Section Includes
  - 1. Treating subgrade, subbase and base courses by the pulverization, addition of cement, mixing and compacting the mix material to the required density.
  - 2. Item applies to the natural ground, embankment, existing pavement, base, or subbase courses placed and shall conform to the typical section, lines and grades shown on the Drawings.
- B. Deviations from Standards
  - 1. None
- C. Related Specification Sections include but are not necessarily limited to.
  - 1. Division 0 - Bidding Requirements, Contract Forms, and Conditions of the Contract
  - 2. Division 1 - General Requirements
  - 3. Section 32 11 23 - Flexible Base Courses

**1.2 PRICE AND PAYMENT PROCEDURES**

- A. Measurement and Payment
  - 1. Cement
    - a. Measurement
      - 1) Measurement for this Item shall be by the ton (dry weight).
    - b. Payment
      - 1) The work performed and materials furnished in accordance with this Item and measured as provided under "Measurement" will be paid for at the unit price bid per ton (dry weight) of Cement.
    - c. The price bid shall include:
      - 1) Furnishing Cement material
      - 2) All freight involved.
      - 3) All unloading, storing, and handling.
  - 2. Cement Treatment
    - a. Measurement
      - 1) Measurement for this Item shall be by the square yard of surface area.

- 2) The dimensions for determining the surface area are established by the widths shown on the Drawings and the lengths measured at placement.
- b. Payment
- 1) The work performed and materials furnished in accordance with this Item and measured as provided under "Measurement" will be paid for at the unit price bid per square yard of Cement Treatment placed for:
    - a) Various depths
- c. The price bid shall include:
- 1) Pulverizing or providing the soil material
  - 2) Handling, hauling, and spreading dry or slurry cement.
  - 3) Mixing the cement with the soil either in-place or in a mixing plant
  - 4) Furnishing, hauling, and mixing water with the soil-cement mixture
  - 5) Spreading and shaping the mixture; compacting the mixture, including all rolling required for compaction.
  - 6) Surface finishing
  - 7) Water and sprinkling
  - 8) Curing

### 1.3 REFERENCES

#### A. Reference Standards

1. Reference standards cited in this specification refer to the current reference standard published at the time of the latest revision date logged at the end of this specification unless a date is specifically cited.
2. ASTM International (ASTM):
  - a. C150, Standard Specification for Portland Cement
  - b. D698, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12 400 ft-lbf/ft<sup>3</sup> (600 kN-m/m<sup>3</sup>))
3. Texas Department of Transportation (TxDOT)
  - a. Tex-101-E, Preparing soil and flexible base materials for testing.
  - b. Tex-140-E, Measuring thickness of paving layers.

**1.4 ADMINISTRATIVE REQUIREMENTS [NOT USED]**

**1.5 ACTION SUBMITTALS [NOT USED]**

**1.6 ACTION SUBMITTALS/INFORMATIONAL SUBMITTALS [NOT USED]**

**1.7 CLOSEOUT SUBMITTALS [NOT USED]**

**1.8 MAINTENANCE MATERIAL SUBMITTALS [NOT USED]**

**1.9 QUALITY ASSURANCE [NOT USED]**

**1.10 DELIVERY, STORAGE, AND HANDLING**

A. Truck Delivered Cement

1. Each truck ticket shall bear the weight of cement measured on certified scales.
2. Submit delivery tickets, certified by supplier, that include weight with each bulk delivery of cement to the site.

**1.11 FIELD [SITE] CONDITIONS**

- A. Start cement application only when the air temperature is at least 35 degrees F and rising or is at least 40 degrees F.
- B. Measure temperature in the shade away from artificial heat.
- C. Suspend application when the City determines that weather conditions are unsuitable.

**1.12 WARRANTY [NOT USED]**

**PART 2 - PRODUCTS**

**2.1 OWNER-FURNISHED PRODUCTS [NOT USED]**

**2.2 MATERIALS**

A. General

1. Furnish uncontaminated materials of uniform quality that meet the requirements of the Drawings and specifications.
2. Notify the City of the proposed material sources and of changes to material sources.
3. Obtain verification from the City that the specification requirements are met before using the sources.
4. The City may sample and test project materials at any time before compaction.

B. Cement: ASTM C150 Type I, II or IP.

C. Flexible Base Courses: Furnish base material that meets the requirements of Section 32 11 23 for the type and grade shown on the Drawings, before the addition of cement.

D. Water: Furnish water free of industrial wastes and other objectionable material.



**2.3 ACCESSORIES [NOT USED]**

**2.4 SOURCE QUALITY CONTROL [NOT USED]**

**PART 3 - EXECUTION**

**3.1 INSTALLERS [NOT USED]**

**3.2 EXAMINATION [NOT USED]**

**3.3 PREPARATION**

- A. Shape existing material in accordance with applicable bid items to conform to typical sections shown on the Drawings and as directed.

**3.4 INSTALLATION**

A. General

- 1. Produce a completed course of treated material containing:
  - a. Uniform Portland cement mixture, free from loose or segregated areas
  - b. Uniform density and moisture content
  - c. Well bound for full depth
  - d. With smooth surface and suitable for placing subsequent courses
- 2. Maximum layer depth of cement treatment in single layer: 8 inches.
- 3. For treated subgrade exceeding 8 inches deep, pulverize, apply cement, mix, compact and finish in equal layers not exceeding 5 inches deep.

B. Equipment

- 1. Provide machinery, tools, and equipment necessary for proper execution of the work.
- 2. Rollers
  - a. The Contractor may use any type of roller to meet the production rates and quality requirements of the Contract unless otherwise shown on the Drawings or directed.
  - b. When specific types of equipment are required, use equipment that meets the specified requirements.
  - c. Alternate Equipment
    - 1) Instead of the specified equipment, the Contractor may, as approved, operate other compaction equipment that produces equivalent results.
    - 2) Discontinue the use of the alternate equipment and furnish the specified equipment if the desired results are not achieved.
  - d. City may require Contractor to substitute equipment if production rate and quality requirements of the Contract are not met.

3. Slurry Equipment
  - a. Use slurry tanks equipped with agitation devices for cement application.
  - b. The City may approve other slurring methods.
  - c. Provide a pump for agitating the slurry when the distributor truck is not equipped with an agitator.
4. Pulverization Equipment
  - a. Provide pulverization equipment that:
    - 1) Cuts and pulverizes material uniformly to the proper depth with cutters that plane to a uniform surface over the entire width of the cut.
    - 2) Provides a visible indication of the depth of cut at all times.
    - 3) Uniformly mixes the materials.

C. Pulverization

1. Pulverize or scarify existing material after shaping so that 100 percent by dry weight passes a 1-inch sieve, and 80 percent by dry weight passes a No. 4 sieve exclusive of gravel or stone retained in sieves.
2. Pulverize recycled asphalt pavement so that 100 percent by dry weight passes a 2-inch sieve, and 60 percent by dry weight passes a No. 4 sieve exclusive of gravel or stone retained in sieves.

D. Cement Application

1. Spread by an approved dry or slurry method uniformly on the soil at the rate specified on the Drawings.
2. If a bulk cement spreader is used, position by string lines or other approved method during spreading to insure a uniform distribution of cement.
3. Apply to an area that all the operations can be continuous and completed in daylight within 6-hours of initial application.
4. Do not exceed the quantity of cement that permits uniform and intimate mixture of soil and cement during dry-mixing operations.
5. Do not exceed the specified optimum moisture content for the soil and cement mixture.
6. No equipment, except that used in the spreading and mixing, allowed to pass over the freshly spread cement until it is mixed with the soil.

E. Mixing

1. Thoroughly mix the material and cement using approved equipment.
2. Mix until a homogeneous, friable mixture of material and cement is obtained, free from all clods and lumps.

3. Keep mixture within moisture tolerances throughout the operation.
4. Spread and shape the completed mixture in a uniform layer.
5. After mixing, the City shall sample the mixture at roadway moisture and test in accordance with Tex 101 E, Part III, to determine compliance with the gradation requirements in Table 1.

**Table 1**  
**Gradation Requirements Minimum % Passing**

Sieve Size	Base
1-3/4 in.	100
3/4 in.	85
No. 4	60

**F. Compaction**

1. Prior to the beginning of compaction, the mixture shall be in a loose condition for its full depth.
2. Compact material to at least 95-percent of the maximum density as determined by ASTM D698.
3. At the start of compaction, the percentage of moisture in the mixture and in unpulverized soil lumps shall be less than the quantity which shall cause the soil-cement mixture to become unstable during compaction and finishing.
4. When the uncompacted 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.
5. The specified optimum moisture content and density shall be determined in the field on the representative samples of soil-cement mixture obtained from the area being processed.
6. Final moisture content shall be within minus-2 to plus-4-of-optimum.
7. Begin compaction after mixing and after gradation and moisture requirements have been met.
8. Begin compaction at the bottom and continue until the entire depth of the mixture is uniformly compacted.
9. Uniformly compact the mixture to the specified density within 2-hours.
10. After the soil and cement mixture is compacted uniformly apply water as needed and thoroughly mix in.

11. Reshape the surface to the required lines, grades and cross section and then lightly scarify to loosen any imprint left by the compacting or shaping equipment.

#### G. Maintenance

1. Maintain the soil-cement treatment in good condition from the time it first starts work until all work shall is completed.
2. Maintenance includes immediate repairs of any defect that may occur after the cement is applied.
3. Maintenance work shall be done by the Contractor at the Contractor's expense and repeated as often as necessary to keep the area continuously intact.
4. Repairs are to be made in such a manner as to insure restoration of a uniform surface for the full depth of treatment.
5. Remedy any low area of treated subgrade by scarifying the surface to a depth of at least 2 inches, filling the area with treated material and compacting.
6. Remedy any low area of subbase or base shall by replacing the material for the full depth of subbase or base treatment rather than adding a thin layer of stabilized material to the completed work.

#### H. Finishing

1. After completing compaction of the final course, clip, skin, or tight-blade the surface of the cement-treated material with a maintainer or subgrade trimmer to a depth of approximately 1/4 inch.
2. Remove loosened material and dispose of at an approved location.
3. Roll the clipped surface immediately with a pneumatic tire roller adding small increments of moisture as needed and until a smooth surface is attained.
4. Add small amounts of water as needed during rolling. Shape and maintain the course and surface in conformity with the typical sections, lines, and grades shown on the Drawings or as directed.
5. Surface compaction and finishing shall proceed in such a manner as to produce, in not more than 2-hours, a smooth, closely knit surface, free of cracks, ridges or loose material, conforming to the drawn grade and line shown on the Drawings.
6. After the final layer or course of the cement modified soil has been compacted, it shall be brought to the required lines and grades in accordance with the typical sections.
7. The completed section shall then be finished by rolling with a pneumatic tire or other suitable roller sufficiently to create micro cracking.

#### I. Curing

1. General
  - a. Cure for at least 48 hours.

- b. Maintain the moisture content during curing at no lower than 2 percentage points below optimum.
- 2. Curing method depends on finished pavement type:
  - a. Concrete pavement:
    - 1) Sprinkle with water
    - 2) Maintain moisture during curing.
    - 3) Do not allow equipment on the finished course during curing except as required for sprinkling, unless otherwise approved.
  - b. Asphalt Pavement:
    - 1) Apply an asphalt material at a rate of 0.05 to 0.20 gallon per square yard.
    - 2) Do not allow equipment on the finished course during curing.
- 3. Continue curing until paving operations begin.

**3.5 REPAIR / RESTORATION [NOT USED]**

**3.6 RE-INSTALLATION [NOT USED]**

**3.7 FIELD QUALITY CONTROL**

A. Density Test

- 1. City Project Representative must be on site during density testing.
- 2. City to measure density of cement treated base course in accordance with ASTM D6938.
- 3. Spacing directed by City (1 per block minimum).
- 4. City Project Representative determines density testing locations.

B. Depth Test

- 1. Take minimum of one core per 500 linear feet per each direction of travel staggering test location in each lane to determine in-place depth.
- 2. City Project Representative determines depth testing locations.

**3.8 SYSTEM STARTUP [NOT USED]**

**3.9 ADJUSTING [NOT USED]**

**3.10 CLEANING [NOT USED]**

**3.11 CLOSEOUT ACTIVITIES [NOT USED]**

**3.12 PROTECTION [NOT USED]**

**3.13 MAINTENANCE [NOT USED]**

**3.14 ATTACHMENTS [NOT USED]**

**END OF SECTION**

**32 12 16 ASPHALT PAVING**

**PART 1 - GENERAL**

**1.1 SUMMARY**

- A. Section Includes:
  - 1. Constructing a pavement layer composed of a compacted, dense-graded mixture of aggregate and asphalt binder for surface or base courses.
- B. Deviations from this Standard Specification
  - 1. None.
- C. Related Specification Sections include, but are not necessarily limited to:
  - 1. Division 0 - Bidding Requirements, Contract Forms, and Conditions of the Contract
  - 2. Division 1 - General Requirements
  - 3. Section 32 01 17 - Permanent Asphalt Paving Repair

**1.2 PRICE AND PAYMENT PROCEDURES**

- A. Measurement and Payment
  - 1. Asphalt Pavement
    - a. Measurement
      - 1) Measurement for this Item shall be by the square yard of completed and accepted asphalt pavement in its final position for various:
        - a) Thicknesses
        - b) Types
    - b. Payment
      - 1) The work performed and materials furnished in accordance with this Item and measured as provided under "Measurement" will be paid for at the unit price bid per
    - c. The price bid shall include:
      - 1) Shaping and fine grading the placement area
      - 2) Furnishing, loading, unloading, storing, hauling, and handling all materials including freight and royalty
      - 3) Traffic control for all testing
      - 4) Asphalt, aggregate, and additive
      - 5) Materials and work needed for corrective action.

- 6) Trial batches
- 7) Tack coat
- 8) Removal and/or sweeping excess material

2. H.M.A.C. Transition

a. Measurement

- 1) Measurement for this Item shall be by the ton of composite Hot Mix Asphalt required for H.M.A.C. Transition.

b. Payment

- 1) The work performed and materials furnished in accordance with this Item and measured as provided under "Measurement" will be paid for at the unit price bid per ton of Hot Mix Asphalt.

c. The price bid shall include:

- 1) Shaping and fine grading the roadbed
- 2) Furnishing, loading, unloading, storing, hauling, and handling all materials including freight and royalty
- 3) Traffic control for all testing
- 4) Asphalt, aggregate, and additive
- 5) Materials and work needed for corrective action
- 6) Trial batches
- 7) Tack coat
- 8) Removal and/or sweeping excess material

3. Asphalt Base Course

a. Measurement

- 1) Measurement for this Item shall be by the square yard of Asphalt Base Course completed and accepted in its final position for:

- a) Various thicknesses
- b) Various types

b. Payment

- 1) The work performed and materials furnished in accordance with this Item and measured as provided under "Measurement" will be paid for at the unit price bid per square yard of Asphalt Base Course.

c. The price bid shall include:

- 1) Shaping and fine grading the roadbed
- 2) Furnishing, loading, unloading, storing, hauling, and handling all materials including freight and royalty

- 3) Traffic control for all testing
  - 4) Asphalt, aggregate, and additive
  - 5) Materials and work needed for corrective action
  - 6) Trial batches
  - 7) Tack coat
  - 8) Removal and/or sweeping excess material
4. H.M.A.C. Pavement Level Up
- a. Measurement
    - 1) Measurement for this Item shall be by the ton of H.M.A.C. completed and accepted in its final position.
  - b. Payment
    - 1) The work performed and materials furnished in accordance with this Item and measured as provided under "Measurement" will be paid for at the unit price bid per ton of H.M.A.C.
  - c. The price bid shall include:
    - 1) Shaping and fine grading the roadbed
    - 2) Furnishing, loading, unloading, storing, hauling, and handling all materials including freight and royalty
    - 3) Traffic control for all testing
    - 4) Asphalt, aggregate, and additive
    - 5) Materials and work needed for corrective action
    - 6) Trial batches
    - 7) Tack coat
    - 8) Removal and/or sweeping excess material
5. H.M.A.C. Speed Cushion
- a. Measurement
    - 1) Measurement for this Item shall be per each H.M.A.C. Speed Cushion installed.
  - b. Payment
    - 1) The work performed and materials furnished in accordance with this Item and measured as provided under "Measurement" will be paid for at the unit price bid per each H.M.A.C. Speed Cushion installed and accepted in its final position.
  - c. The price bid shall include:
    - 1) Shaping and fine grading the roadbed



- 2) Furnishing, loading, unloading, storing, hauling, and handling all materials including freight and royalty
- 3) Traffic control for all testing
- 4) Asphalt, aggregate, and additive
- 5) Materials and work needed for corrective action
- 6) Trial batches
- 7) Tack coat
- 8) Removal and/or sweeping excess material

### 1.3 REFERENCES

#### A. Abbreviations and Acronyms

1. RAP (reclaimed asphalt pavement)
2. SAC (surface aggregate classification)
3. BRSQC (Bituminous Rated Source Quality Catalog)
4. AQMP (Aggregate Quality Monitoring Program)
5. H.M.A.C. (Hot Mix Asphalt Concrete)
6. WMA (Warm Mix Asphalt)

#### B. Reference Standards

1. Reference standards cited in this specification refer to the current reference standard published at the time of the latest revision date logged at the end of this specification unless a date is specifically cited.
2. National Institute of Standards and Technology (NIST)
  - a. Handbook 44 - 2007 Edition: Specifications, Tolerances, and Other Technical Requirements for Weighing and Measuring Devices
3. ASTM International (ASTM):
  - a. ASTM D6084 - 06 Standard Test Method for Elastic Recovery of Bituminous Materials by Ductilometer
4. American Association of State Highway and Transportation Officials
  - a. MP2 Standard Specification for Superpave Volumetric Mix Design
  - b. PP28 Standard Practice for Superpave Volumetric Design for Hot Mix Asphalt (HMA)
  - c. T 201, Kinematic Viscosity of Asphalts (Bitumens)

- d. T 202 Standard Method of Test for Viscosity of Asphalts by Vacuum Capillary Viscometer
  - e. T 316 Standard Method of Test for Viscosity Determination of Asphalt Binder Using Rotational Viscometer
  - f. TP 1-93 Test Method for Determining the Flexural Creep Stiffness of Asphalt Binder Using the Bending Beam Rheometer (BBR)
5. Texas Department of Transportation
- a. Bituminous Rated Source Quality Catalog (BRSQC)
  - b. TEX 100-E, Surveying and Sampling Soils for Highways
  - c. Tex 106-E, Calculating the Plasticity Index of Soils
  - d. Tex 107-E, Determining the Bar Linear Shrinkage of Soils
  - e. Tex 200-F, Sieve Analysis of Fine and Coarse Aggregates
  - f. Tex 203-F, Sand Equivalent Test
  - g. Tex-204-F, Design of Bituminous Mixtures
  - h. Tex-207-F, Determining Density of Compacted Bituminous Mixtures
  - i. Tex 217-F, Determining Deleterious Material and Decantation Test for Coarse Aggregates
  - j. Tex-226-F, Indirect Tensile Strength Test
  - k. Tex-227-F, Theoretical Maximum Specific Gravity of Bituminous Mixtures
  - l. Tex-243-F, Tack Coat Adhesion
  - m. Tex-244-F, Thermal profile of Hot Mix Asphalt
  - n. Tex 280-F, Determination of Flat and Elongated Particles
  - o. Tex 406-A, Material Finer Than 75  $\mu\text{m}$  (No. 200) Sieve in Mineral Aggregates (Decantation Test for Concrete Aggregates)
  - p. Tex 408-A, Organic Impurities in Fine Aggregate for Concrete
  - q. Tex 410-A, Abrasion of Coarse Aggregate using the Los Angeles Machine
  - r. Tex 411-A, Soundness of Aggregate by Using Sodium Sulfate or Magnesium Sulfate
  - s. Tex 460-A, Determining Crushed Face Particle Count
  - t. Tex 461-A, Degradation of Coarse Aggregate by Micro-Deval Abrasion
  - u. Sulfate
  - v. Tex-530-C, Effect of Water on Bituminous Paving Mixtures
  - w. Tex-540-C, Measurement of Polymer Separation on Heating in Modified Asphalt Systems
  - x. Tex-541-C, Rolling Thin Film Oven Test for Asphalt Binders

- y. Tex-920-K, Verifying the Accuracy of Drum Mix Plant Belt Scales
- z. Tex-921-K, Verifying the Accuracy of Hot Mix Plant Asphalt Meters
- aa. Tex 923-K, Verifying the Accuracy of Liquid Additive Metering Systems

**1.4 ADMINISTRATIVE REQUIREMENTS [NOT USED]**

**1.5 ACTION SUBMITTALS [NOT USED]**

**1.6 ACTION SUBMITTALS/INFORMATIONAL SUBMITTALS**

- A. Asphalt Paving Mix Design: Submit for approval. See 2.2.B.1.

**1.7 CLOSEOUT SUBMITTALS [NOT USED]**

**1.8 MAINTENANCE MATERIAL SUBMITTALS [NOT USED]**

**1.9 QUALITY ASSURANCE [NOT USED]**

**1.10 DELIVERY, STORAGE, AND HANDLING [NOT USED]**

**1.11 FIELD CONDITIONS**

- A. Weather Conditions

- 1. Place mixture when the roadway surface temperature is equal to or higher than the temperatures listed in Table 1.

**Table 1**

**Minimum Pavement Surface Temperatures**

Originally Specified High Temperature Binder Grade	Minimum Pavement Surface Temperatures in Degrees Fahrenheit	
	Subsurface Layers or Night Paving Operations	Surface Layers Placed in Daylight Operations
PG64 or lower	45	50
PG 70	55 <sup>1</sup>	60 <sup>1</sup>
PG 76 or higher	60 <sup>1</sup>	60 <sup>1</sup>

<sup>1</sup>Contractors may pave at temperatures 10°F lower than the values shown in Table 1 when utilizing a paving process including WMA or equipment that eliminates thermal segregation. In such cases, the contractor must use either a hand held thermal camera or a hand held infrared thermometer operated in accordance with Tex-244-F to demonstrate to the satisfaction of the City that the uncompacted mat has no more than 10° F of thermal segregation.

2. Unless otherwise shown on the Drawings, place mixtures only when weather conditions and moisture conditions of the roadway surface are suitable in the opinion of the City.

## **1.12 WARRANTY [NOT USED]**

## **PART 2 - PRODUCTS**

### **2.1 OWNER-FURNISHED PRODUCTS [NOT USED]**

### **2.2 MATERIALS**

#### **A. General**

1. Furnish uncontaminated materials of uniform quality that meet the requirements of the Drawings and specifications.
2. Notify the City of all material sources.
3. Notify the City before changing any material source or formulation.
4. When the Contractor makes a source or formulation change, the City will verify that the requirements of this specification are met and may require a new laboratory mixture design, trial batch, or both.
5. The City may sample and test project materials at any time during the project to verify compliance.
6. The depth of the compacted lift should be at least 2 times the nominal maximum aggregate size.

#### **B. Aggregate**

1. General
  - a. Furnish aggregates from sources that conform to the requirements shown in Table 1, and as specified in this Section, unless otherwise shown on the Drawings.
  - b. Provide aggregate stockpiles that meet the definition in this Section for either coarse aggregate or fine aggregate.
  - c. When reclaimed asphalt pavement (RAP) is allowed by Drawing note, provide RAP stockpiles in accordance with this Section.
  - d. Aggregate from RAP is not required to meet Table 2 requirements unless otherwise shown on the Drawings.
  - e. Supply mechanically crushed gravel or stone aggregates that meet the definitions in Tex 100 E.
  - f. Samples must be from materials produced for the project.

- g. The City will establish the surface aggregate classification (SAC) and perform Los Angeles abrasion, magnesium sulfate soundness, and Micro-Deval tests.
- h. Perform all other aggregate quality tests listed in Table 2.
- i. Document all test results on the mixture design report.
- j. The City may perform tests on independent or split samples to verify Contractor test results.
- k. Stockpile aggregates for each source and type separately and designate for the City.
- l. Determine aggregate gradations for mixture design and production testing based on the washed sieve analysis given in Tex 200 F, Part II.

**Table 2**  
**Aggregate Quality Requirements**

Property	Test Method	Requirement
<b>Coarse Aggregate</b>		
SAC	AQMP	As shown on Drawings
Deleterious material, percent, max	Tex-217-F, Part I	1.5
Decantation, percent, max	Tex-217-F, Part II	1.5
Micro-Deval abrasion, percent, max	Tex-461-A	Note 1
Los Angeles abrasion, percent, max	Tex-410-A	40
Magnesium sulfate soundness, 5 cycles, percent, max	Tex-411-A	30 <sup>2</sup>
Coarse aggregate angularity, 2 crushed faces, percent, min	Tex 460-A, Part I	85 <sup>3</sup>
Flat and elongated particles @ 5:1, percent, max	Tex-280-F	10
<b>Fine Aggregate</b>		
Linear shrinkage, percent, max	Tex-107-E	3
<b>Combined Aggregate</b>		
Sand equivalent, percent, min	Tex-203-F	45

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

2. Unless otherwise shown on the Drawings.

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

m. Coarse Aggregate

- 1) Coarse aggregate stockpiles must have no more than 20 percent material passing the No. 8 sieve.
- 2) Maximum aggregate size should not be over half of the proposed lift depth to prevent particle on particle contact issues.
- 3) Provide aggregates from sources listed in the BRSQC.
- 4) Provide aggregate from unlisted sources only when tested by the City and/or approved before use.
- 5) Allow 30 calendar days for the City to sample, test, and report results for unlisted sources.

- 6) Class B aggregate meeting all other requirements in Table 2 may be blended with a Class A aggregate in order to meet requirements for Class A materials.
  - 7) When blending Class A and B aggregates to meet a Class A requirement, ensure that at least 50 percent by weight of the material retained on the No. 4 sieve comes from the Class A aggregate source.
  - 8) Blend by volume if the bulk specific gravities of the Class A and B aggregates differ by more than 0.300.
  - 9) When blending, do not use Class C or D aggregates.
  - 10) For blending purposes, coarse aggregate from RAP will be considered as Class B aggregate.
  - 11) Provide coarse aggregate with at least the minimum SAC shown on the Drawings.
  - 12) SAC requirements apply only to aggregates used on the surface of travel lanes, unless otherwise shown on the Drawings.
- n. RAP is salvaged, milled, pulverized, broken, or crushed asphalt pavement.
- 1) No RAP permitted for TYPE D H.M.A.C.
  - 2) Use no more than 20 percent RAP on TYPE B H.M.A.C. unless otherwise shown on the Drawings.
  - 3) Crush or break RAP so that 100 percent of the particles pass the 2 inch sieve.
  - 4) RAP from either Contractor or City, including RAP generated during the project, is permitted only when shown on the Drawings.
  - 5) City-owned RAP, if allowed for use, will be available at the location shown on the Drawings.
  - 6) When RAP is used, determine asphalt content and gradation for mixture design purposes.
  - 7) Perform other tests on RAP when shown on the Drawings.
  - 8) When RAP is allowed by plan note, use no more than 30 percent RAP in Type A or B mixtures unless otherwise shown on the Drawings.
  - 9) Do not use RAP contaminated with dirt or other objectionable materials.
  - 10) Do not use the RAP if the decantation value exceeds 5 percent and the plasticity index is greater than 8.
  - 11) Test the stockpiled RAP for decantation in accordance with the laboratory method given in Tex-406-A, Part I.
  - 12) Determine the plasticity index using Tex-106-E if the decantation value exceeds 5 percent.
  - 13) The decantation and plasticity index requirements do not apply to RAP samples with asphalt removed by extraction.

- 14) Do not intermingle Contractor-owned RAP stockpiles with City-owned RAP stockpiles.
  - 15) Remove unused Contractor-owned RAP material from the project site upon completion of the project.
  - 16) Return unused City-owned RAP to the designated stockpile location.
- o. Fine Aggregate
- 1) Fine aggregates consist of manufactured sands, screenings, and field sands.
  - 2) Fine aggregate stockpiles must meet the gradation requirements in Table 3.
  - 3) Supply fine aggregates that are free from organic impurities.
  - 4) The City may test the fine aggregate in accordance with Tex-408-A to verify the material is free from organic impurities.
  - 5) At most 15 percent of the total aggregate may be field sand or other uncrushed fine aggregate.
  - 6) With the exception of field sand, use fine aggregate from coarse aggregate sources that meet the requirements shown in Table 2, unless otherwise approved.
  - 7) If 10 percent or more of the stockpile is retained on the No. 4 sieve, test the stockpile, and verify that it meets the requirements in Table 1 for coarse aggregate angularity (Tex-460-A) and flat and elongated particles (Tex-280-F).

**Table 3**

**Gradation Requirements for Fine Aggregate**

<b>Sieve Size</b>	<b>percent Passing by Weight or Volume</b>
3/8"	100
#8	70-100
#200	0-30

2. Mineral Filler

- a. Mineral filler consists of finely divided mineral matter such as agricultural lime, crusher fines, hydrated lime, cement, or fly ash.
- b. Mineral filler is allowed unless otherwise shown on the Drawings.



- c. Do not use more than 2 percent hydrated lime or cement, unless otherwise shown on the Drawings. The Drawings may require or disallow specific mineral fillers. When used, provide mineral filler that:
  - 1) Is sufficiently dry, free-flowing, and free from clumps and foreign matter;
  - 2) Does not exceed 3 percent linear shrinkage when tested in accordance with Tex-107-E; and meets the gradation requirements in Table 4.

**Table 4**

**Gradation Requirements for Mineral Filler**

Sieve Size	percent Passing by Weight or Volume
#8	100
#200	55–100

- 3. Baghouse Fines
  - a. Fines collected by the baghouse or other dust-collecting equipment may be reintroduced into the mixing drum
- 4. Asphalt Binder
  - a. Furnish the type and grade of performance-graded (PG) asphalt binder specified as follows:
    - 1) Performance-Graded Binders (PG Binders)
      - a) Must be smooth and homogeneous
      - b) Show no separation when tested in accordance with Tex-540-C
      - c) Meet Table 5 requirements

**Table 5**  
**Performance-Graded Binders**

Property and Test Method	Performance Grade																	
	PG 58			PG 64				PG 70				PG 76				PG 82		
	-22	-28	-34	-16	-22	-28	-34	-16	-22	-28	-34	-16	-22	-28	-34	-16	-22	-28
Average 7-day max pavement design temperature, °C <sup>1</sup>	< 58			< 64				< 70				< 76				< 82		
Min pavement design temperature, °C <sup>1</sup>	>-22	>-28	>-34	>-16	>-22	>-28	>-34	>-16	>-22	>-28	>-34	>-16	>-22	>-28	>-34	>-16	>-22	>-28
<b>ORIGINAL BINDER</b>																		
Flash point, T 48, Min, °C	230																	
Viscosity, T 316: <sup>2,3</sup>  Max, 3.0 Paxes, test temperature, °C	135																	
Dynamic shear, T 315: <sup>4</sup>  G*/sin(d), Min, 1.00 kPa  Test temperature @ 10 rad/sec., °C	58			64				70				76				82		
Elastic recovery, D 6084, 50°F, percent Min	-	-	30	-	-	30	50	-	30	50	60	30	50	60	70	50	60	70
<b>ROLLING THIN-FILM OVEN (Tex-541-C)</b>																		

Mass loss, Tex-541-C, Max, percent	1				
Dynamic shear, T 315: G*/sin(d), Min, 2.20 kPa Test temperature @ 10 rad/sec., °C	58	64	70	76	82

**Table 5 (continued)**  
**Performance-Graded Binders**

Property and Test Method	Performance Grade																	
	PG 58			PG 64			PG 70			PG 76			PG 82					
	-22	-28	-34	-16	-22	-28	-34	-16	-22	-28	-34	-16	-22	-28	-34	-16	-22	-28
<b>PRESSURE AGING VESSEL (PAV) RESIDUE (R 28)</b>																		
PAV aging temperature, °C	100																	
Dynamic shear, T 315: G*/sin(d), Max, 5000 kPa Test temperature @ 10 rad/sec., °C	25	22	19	28	25	22	19	28	25	22	19	28	25	22	19	28	25	22
Creep stiffness, T 313: <sup>5,6</sup> S, max, 300 MPa, m-value, min, 0.300 Test temperature @ 60 sec., °C	-12	-18	-24	-6	-12	-18	-24	-6	-12	-18	-24	-6	-12	-18	-24	-6	-12	-18
Direct tension, T 314: <sup>6</sup> Failure strain, min, 1.0 percent Test temperature @ 1.0 mm/min., °C	-12	-18	-24	-6	-12	-18	-24	-6	-12	-18	-24	-6	-12	-18	-24	-6	-12	-18

1. Pavement temperatures are estimated from air temperatures using an algorithm contained in a Department-supplied computer program, may be

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provided by the Department, or by following the procedures outlined in AASHTO MP 2 and PP 28.

2. This requirement may be waived at the Department's discretion if the supplier warrants that the asphalt binder can be adequately pumped, mixed, and compacted at temperatures that meet all applicable safety, environmental, and constructability requirements. At test temperatures where the binder is a Newtonian fluid, any suitable standard means of viscosity measurement may be used, including capillary (T 201 or T 202) or rotational viscometry (T 316).

3. Viscosity at 135°C is an indicator of mixing and compaction temperatures that can be expected in the lab and field. High values may indicate high mixing and compaction temperatures. Additionally, significant variation can occur from batch to batch. Contractors should be aware that variation could significantly impact their mixing and compaction operations. Contractors are therefore responsible for addressing any constructability issues that may arise.

4. For quality control of unmodified asphalt binder production, measurement of the viscosity of the original asphalt binder may be substituted for dynamic shear measurements of  $G^*/\sin(d)$  at test temperatures where the asphalt is a Newtonian fluid. Any suitable standard means of viscosity measurement may be used, including capillary (T 201 or T 202) or rotational viscometry (T 316).

5. Silicone beam molds, as described in AASHTO TP 1-93, are acceptable for use.

6. If creep stiffness is below 300 MPa, direct tension test is not required. If creep stiffness is between 300 and 600 MPa, the direct tension failure strain requirement can be used instead of the creep stiffness requirement. The  $m$ -value requirement must be satisfied in both cases.

- b. Separation testing is not required if:
  - 1) A modifier is introduced separately at the mix plant either by injection in the asphalt line or mixer,
  - 2) The binder is blended on site in continuously agitated tanks, or binder acceptance is based on field samples taken from an in-line sampling port at the hot mix plant after the addition of modifiers.
  
- 5. Tack Coat
  - a. Unless otherwise shown on the Drawings or approved, furnish CSS-1H, SS-1H, or a PG binder with a minimum high-temperature grade of PG 58 for tack coat binder in accordance with Section 2.2.A.5.
  
- 6. Additives
  - a. General
    - 1) When shown on the Drawings, use the type and rate of additive specified.
    - 2) Other additives that facilitate mixing or improve the quality of the mixture may be allowed when approved.
  - b. Liquid Antistripping Agent
    - 1) Furnish and incorporate all required asphalt antistripping agents in asphalt concrete paving mixtures and asphalt-stabilized base mixtures to meet moisture resistance testing requirements.
    - 2) Provide a liquid antistripping agent that is uniform and shows no evidence of crystallization, settling, or separation.
    - 3) Ensure that all liquid antistripping agents arrive in:
      - a) Properly labeled and unopened containers, as shipped from the manufacturer, or
      - b) Sealed tank trucks with an invoice to show contents and quantities
      - c) Provide product information to the City including:
        - (1) Material safety data sheet
        - (2) Specific gravity of the agent at the manufacturer's recommended addition temperature,
        - (3) Manufacturer's recommended dosage range, and
        - (4) Handling and storage instructions
    - 4) Addition of lime or a liquid antistripping agent at the Mix Plant, incorporate into the binder as follows:
      - a) Handle in accordance with the manufacturer's recommendations.
      - b) Add at the manufacturer's recommended addition temperature.

- c) Add into the asphalt line by means of an in-line-metering device.
- c. Liquid Asphalt Additive Meters
  - 1) Provide a means to check the accuracy of meter output for asphalt primer, fluxing material, and liquid additives.
  - 2) Furnish a meter that reads in increments of 0.1 gal. or less.
  - 3) Verify accuracy of the meter in accordance with Tex-923-K.
  - 4) Ensure the accuracy of the meter within 5.0 percent.
- 7. Mixes
  - a. Design Requirements
    - 1) Unless otherwise shown on the Drawings, use the typical weight design example given in Tex-204-F, Part I, to design a mixture meeting the requirements listed in Tables 2 through 8.
    - 2) Furnish the City with representative samples of all materials used in the mixture design.
    - 3) The City will verify the mixture design.
    - 4) If the design cannot be verified by the City, furnish another mixture design.

**Table 6**

**Master Gradation Bands ( percent Passing by Weight or Volume)  
and Volumetric Properties**

<b>Sieve Size</b>	<b>B Fine Bas</b>	<b>C Coarse Surface</b>	<b>D Fine Surface</b>
1-1/2"	-	-	-
1"	98.0-100.0	-	-
3/4"	84.0-98.0	95.0-100.0	-
1/2"	-	-	98.0-100.0
3/8"	60.0-80.0	70.0-85.0	85.0-100.0
#4	40.0-60.0	43.0-63.0	50.0-70.0
#8	29.0-43.0	32.0-44.0	35.0-46.0
#30	13.0-28.0	14.0-28.0	15.0-29.0
#50	6.0-20.0	7.0-21.0	7.0-20.0
#200	2.0-7.0	2.0-7.0	2.0-7.0
<b>Design VMA<sup>1</sup>, percent Minimum</b>			
-	13.0	14.0	15.0
<b>Plant-Produced VMA, percent Minimum</b>			
-	12.0	13.0	14.0

1. Voids in Mineral Aggregates.



**Table 7**  
**Laboratory Mixture Design Properties**

<b>Property</b>	<b>Test Method</b>	<b>Requirement</b>
Target laboratory-molded density, percent	Tex-207-F	96.0 <sup>1</sup>
Tensile strength (dry), psi (molded to 93 percent $\pm$ 1 percent density)	Tex-226-F	85–200 <sup>2</sup>
Boil test <sup>3</sup>	Tex-530-C	–

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

8. Warm Mix Asphalt (WMA)

- a. WMA is defined as additives or processes that allow a reduction in the temperature at which asphalt mixtures are produced and placed.
- b. WMA is allowed for use at the Contractor's option unless otherwise shown on the Drawings.
- c. Produce an asphalt mixture within the temperature range of 215 degrees F and 275 degrees F.
- d. When WMA is not required by Drawings, produce an asphalt mixture within the temperature range of 215 degrees F and 275 degrees F.

**2.3 ACCESSORIES [NOT USED]**

**2.4 SOURCE QUALITY CONTROL [NOT USED]**

**PART 3 - EXECUTION**

**3.1 INSTALLERS [NOT USED]**

**3.2 EXAMINATION [NOT USED]**

**3.3 PREPARATION**

A. Hauling Operations

1. Before use, clean all truck beds to ensure mixture is not contaminated.

2. When a release agent is necessary to coat truck beds, use a release agent approved by the City.
3. Petroleum based products, such as diesel fuel, should not be used.
4. If wind, rain, temperature, or haul distance impacts cooling, insulate truck beds or cover the truck bed with tarpaulin.
5. If haul time in project is to be greater than 30 minutes, insulate truck beds or cover the truck bed with tarpaulin.

### **3.4 INSTALLATION**

#### **A. Equipment**

##### **1. General**

- a. Provide required or necessary equipment to produce, haul, place, compact, and core asphalt concrete pavement.
- b. Ensure weighing and measuring equipment complies with specification.
- c. Synchronize equipment to produce a mixture meeting the required proportions.

##### **2. Production Equipment**

- a. Provide:
  - 1) Drum-mix type, weigh-batch, or modified weigh-batch mixing plants that ensure a uniform, continuous production
  - 2) Automatic proportioning and measuring devices with interlock cut-off circuits that stop operations if the control system malfunctions
  - 3) Visible readouts indicating the weight or volume of asphalt and aggregate proportions
  - 4) Safe and accurate means to take required samples by inspection forces
  - 5) Permanent means to check the output of metering devices and to perform calibration and weight checks
  - 6) Additive-feed systems to ensure a uniform, continuous material flow in the desired proportion

##### **3. Weighing and Measuring Equipment**

###### **a. General**

- 1) Provide weighing and measuring equipment for materials measured or proportioned by weight or volume.
- 2) Provide certified scales, scale installations, and measuring equipment meeting the requirements of NIST Handbook 44, except that the required accuracy must be 0.4 percent of the material being weighed or measured.
- 3) Furnish leak-free weighing containers large enough to hold a complete batch of the material being measured.

- b. Truck Scales
  - 1) Furnish platform truck scales capable of weighing the entire truck or truck-trailer combination in a single draft.
- c. Aggregate Batching Scales
  - 1) Equip scales used for weighing aggregate with a quick adjustment at zero that provides for any change in tare.
  - 2) Provide a visual means that indicates the required weight for each aggregate.
- d. Suspended Hopper
  - 1) Provide a means for the addition or the removal of small amounts of material to adjust the quantity to the exact weight per batch.
  - 2) Ensure the scale equipment is level.
- e. Belt Scales
  - 1) Use belt scales for proportioning aggregate that are accurate to within 1.0 percent based on the average of 3 test runs, where no individual test run exceeds 2.0 percent when checked in accordance with Tex-920-K.
- f. Asphalt Material Meter
  - 1) Provide an asphalt material meter with an automatic digital display of the volume or weight of asphalt material.
  - 2) Verify the accuracy of the meter in accordance with Tex-921-K.
  - 3) When using the asphalt meter for payment purposes, ensure the accuracy of the meter is within 0.4 percent.
  - 4) When used to measure component materials only and not for payment, ensure the accuracy of the meter is within 1.0 percent.
- g. Liquid Asphalt Additive Meters
  - 1) Provide a means to check the accuracy of meter output for asphalt primer, fluxing material, and liquid additives.
  - 2) Furnish a meter that reads in increments of 0.1 gallon or less.
  - 3) Verify accuracy of the meter in accordance with Tex-923-K.
  - 4) Ensure the accuracy of the meter within 5.0 percent.
- 4. Drum-Mix Plants. Provide a mixing plant that complies with the requirements below.
  - a. Aggregate Feed System
    - 1) Provide:
      - a) A minimum of 1 cold aggregate bin for each stockpile of individual materials used to produce the mix
      - b) Bins designed to prevent overflow of material

- c) Scalping screens or other approved methods to remove any oversized material, roots, or other objectionable materials
  - d) A feed system to ensure a uniform, continuous material flow in the desired proportion to the dryer
  - e) An integrated means for moisture compensation
  - f) Belt scales, weigh box, or other approved devices to measure the weight of the combined aggregate
  - g) Cold aggregate bin flow indicators that automatically signal interrupted material flow
- b. Reclaimed Asphalt Pavement (RAP) Feed System
- 1) Provide a separate system to weigh and feed RAP into the hot mix plant.
- c. Mineral Filler Feed System
- 1) Provide a closed system for mineral filler that maintains a constant supply with minimal loss of material through the exhaust system.
  - 2) Interlock the measuring device into the automatic plant controls to automatically adjust the supply of mineral filler to plant production and provide a consistent percentage to the mixture.
- d. Heating, Drying, and Mixing Systems
- 1) Provide:
    - a) A dryer or mixing system to agitate the aggregate during heating
    - b) A heating system that controls the temperature during production to prevent aggregate and asphalt binder damage
    - c) A heating system that completely burns fuel and leaves no residue
    - d) A recording thermometer that continuously measures and records the mixture discharge temperature
    - e) Dust collection system to collect excess dust escaping from the drum.
- e. Asphalt Binder Equipment
- 1) Supply equipment to heat binder to the required temperature.
  - 2) Equip the heating apparatus with a continuously recording thermometer located at the highest temperature point.
  - 3) Produce a 24 hour chart of the recorded temperature.
  - 4) Place a device with automatic temperature compensation that accurately meters the binder in the line leading to the mixer.
  - 5) Furnish a sampling port on the line between the storage tank and mixer. Supply an additional sampling port between any additive blending device and mixer.
- f. Mixture Storage and Discharge

- 1) Provide a surge-storage system to minimize interruptions during operations unless otherwise approved.
  - 2) Furnish a gob hopper or other device to minimize segregation in the bin.
  - 3) Provide an automated system that weighs the mixture upon discharge and produces a ticket showing:
    - a) Date
    - b) Project identification number
    - c) Plant identification
    - d) Mix identification
    - e) Vehicle identification
    - f) Total weight of the load
    - g) Tare weight of the vehicle
    - h) Weight of mixture in each load
    - i) Load number or sequential ticket number for the day
- g. Truck Scales
- 1) Provide standard platform scales at an approved location.
5. Weigh-Batch Plants. Provide a mixing plant that complies with Section 2.2.B.4 "Drum-Mix Plants," except as required below:
- a. Screening and Proportioning
    - 1) Provide enough hot bins to separate the aggregate and to control proportioning of the mixture type specified.
      - a) Supply bins that discard excessive and oversized material through overflow chutes.
      - b) Provide safe access for inspectors to obtain samples from the hot bins.
  - b. Aggregate Weigh Box and Batching Scales
    - 1) Provide a weigh box and batching scales to hold and weigh a complete batch of aggregate.
    - 2) Provide an automatic proportioning system with low bin indicators that automatically stop when material level in any bin is not sufficient to complete the batch.
  - c. Asphalt Binder Measuring System
    - 1) Provide bucket and scales of sufficient capacity to hold and weigh binder for 1 batch.
  - d. Mixer

- 1) Equipment mixers with an adjustable automatic timer that controls the dry and wet mixing period and locks the discharge doors for the required mixing period
  - 2) Furnish a pug mill with a mixing chamber large enough to prevent spillage.
6. Modified Weigh-Batch Plants. Provide a mixing plant that complies with Section 2.2.B.5. "Weigh-Batch Plants," except as specifically described below.
- a. Aggregate Feeds
    - 1) Aggregate control is required at the cold feeds. Hot bin screens are not required.
  - b. Surge Bins
    - 1) Provide 1 or more bins large enough to produce 1 complete batch of mixture.
  - c. Hauling Equipment
    - 1) Provide trucks with enclosed sides to prevent asphalt mixture loss.
    - 2) Cover each load of mixture with waterproof tarpaulins.
    - 3) Before use, clean all truck beds to ensure the mixture is not contaminated.
    - 4) When necessary, coat the inside truck beds with an approved release agent from the City.
  - d. Placement and Compaction Equipment
    - 1) Provide equipment that does not damage underlying pavement.
    - 2) Comply with laws and regulations concerning overweight vehicles.
    - 3) When permitted, other equipment that will consistently produce satisfactory results may be used.
7. Asphalt Paver
- a. General
    - 1) Furnish a paver that will produce a finished surface that meets longitudinal and transverse profile, typical section, and placement requirements.
    - 2) Ensure the paver does not support the weight of any portion of hauling equipment other than the connection.
    - 3) Provide loading equipment that does not transmit vibrations or other motions to the paver that adversely affect the finished pavement quality.
    - 4) Equip the paver with an automatic, dual, longitudinal-grade control system and an automatic, transverse-grade control system.
  - b. Tractor Unit

- 1) Supply a tractor unit that can push or propel vehicles, dumping directly into the finishing machine to obtain the desired lines and grades to eliminate any hand finishing.
  - 2) Equip the unit with a hitch sufficient to maintain contact between the hauling equipment's rear wheels and the finishing machine's pusher rollers while mixture is unloaded.
- c. Screed
- 1) Provide a heated compacting screed that will produce a finished surface that meets longitudinal and transverse profile, typical section, and placement requirements.
  - 2) Screed extensions must provide the same compacting action and heating as the main unit unless otherwise approved.
- d. Grade Reference
- 1) Provide a grade reference with enough support that the maximum deflection does not exceed 1/16 inch between supports.
  - 2) Ensure that the longitudinal controls can operate from any longitudinal grade reference including a string line, ski, mobile string line, or matching shoes.
  - 3) Furnish paver skis or mobile string line at least 40 feet long unless otherwise approved.
8. Material Transfer Devices
- a. Provide the specified type of device when shown on the Drawings.
  - b. Ensure the devices provide a continuous, uniform mixture flow to the asphalt paver.
  - c. When used, provide windrow pick-up equipment constructed to pick up substantially all roadway mixture placed in the windrow.
9. Remixing Equipment
- a. When required, provide equipment that includes a pug mill, variable pitch augers, or variable diameter augers operating under a storage unit with a minimum capacity of 8 tons.
10. Motor Grader
- a. When allowed, provide a self-propelled grader with a blade length of at least 12 feet and a wheelbase of at least 16 feet.
11. Handheld Infrared Thermometer
- a. Provide a handheld infrared thermometer meeting the requirements of Tex-244-F.
12. Rollers

- a. The Contractor may use any type of roller to meet the production rates and quality requirements of the Contract unless otherwise shown on the Drawings or directed.
  - b. When specific types of equipment are required, use equipment that meets the specified requirements.
  - c. Alternate Equipment
    - 1) Instead of the specified equipment, the Contractor may, as approved, operate other compaction equipment that produces equivalent results.
    - 2) Discontinue the use of the alternate equipment and furnish the specified equipment if the desired results are not achieved.
  - d. City may require Contractor to substitute equipment if production rate and quality requirements of the Contract are not met.
13. Straightedges and Templates. Furnish 10 foot straightedges and other templates as required or approved.
14. Distributor vehicles
- a. Furnish vehicle that can achieve a uniform tack coat placement.
  - b. The nozzle patterns, spray bar height and distribution pressure must work together to produce uniform application.
  - c. The vehicle should be set to provide a “double lap” or “triple lap” coverage.
  - d. Nozzle spray patterns should be identical to one another along the distributor spray bar.
  - e. Spray bar height should remain constant.
  - f. Pressure within the distributor must be capable of forcing the tack coat material out of spray nozzles at a constant rate.
15. Coring Equipment
- a. When coring is required, provide equipment suitable to obtain a pavement specimen meeting the dimensions for testing.

**B. Construction**

- 1. Design, produce, store, transport, place, and compact the specified paving mixture in accordance with the requirements of this Section.
- 2. Unless otherwise shown on the Drawings, provide the mix design.
- 3. The City will perform quality assurance (QA) testing.
- 4. Provide quality control (QC) testing as needed to meet the requirements of this Section.

**C. Production Operations**



1. General
  - a. The City may suspend production for noncompliance with this Section.
  - b. Take corrective action and obtain approval to proceed after any production suspension for noncompliance.
2. Operational Tolerances
  - a. Stop production if testing indicates tolerances are exceeded on any of the following:
    - 1) 3 consecutive tests on any individual sieve
    - 2) 4 consecutive tests on any of the sieves
    - 3) 2 consecutive tests on asphalt content
  - b. Begin production only when test results or other information indicate, to the satisfaction of the City, that the next mixture produced will be within Table 9 tolerances.
3. Storage and Heating of Materials
  - a. Do not heat the asphalt binder above the temperatures specified in Section 2.2.A. or outside the manufacturer's recommended values.
  - b. On a daily basis, provide the City with the records of asphalt binder and hot-mix asphalt discharge temperatures in accordance with Table 10.
  - c. Unless otherwise approved, do not store mixture for a period long enough to affect the quality of the mixture, nor in any case longer than 12 hours.
4. Mixing and Discharge of Materials
  - a. Notify the City of the target discharge temperature and produce the mixture within 25 degrees F of the target.
  - b. Monitor the temperature of the material in the truck before shipping to ensure that it does not exceed 350 degrees F. The City will not pay for or allow placement of any mixture produced at more than 350 degrees F.
  - c. Control the mixing time and temperature so that substantially all moisture is removed from the mixture before discharging from the plant.

#### D. Placement Operations

1. Place the mixture to meet the typical section requirements and produce a smooth, finished surface or base course with a uniform appearance and texture.
2. Offset longitudinal joints of successive courses of hot mix by at least 6 inches.
3. Place mixture so longitudinal joints on the surface course coincide with lane lines, or as directed. Ensure that all finished surfaces will drain properly.
4. When End Dump Trucks are used, ensure the bed does not contact the paver when raised.

5. Placement can be performed by hand in situations where the paver cannot place it adequately due to space restrictions.
6. Hand-placing should be minimized to prevent aggregate segregation and surface texture issues.
7. All hand placement shall be checked with a straightedge or template before rolling to ensure uniformity.
8. Place mixture within the compacted lift thickness shown in Table 9, unless otherwise shown on the Drawings or otherwise directed.

**Table 9**  
**Compacted Lift Thickness and Required Core Height**

Mixture Type	Compacted Lift Thickness	
	Minimum (in.)	Maximum (in.)
B	2.00	3.00
C	2.00	2.50
D	1.50	2.00

9. Tack Coat
  - a. Clean the surface before placing the tack coat. Unless otherwise approved, apply tack coat uniformly at the rate directed by the City.
  - b. The City will set the rate between 0.04 and 0.10 gallons of residual asphalt per square yard of surface area.
  - c. Apply a thin, uniform tack coat to all contact surfaces of curbs, structures, and all joints.
  - d. Prevent splattering of tack coat when placed adjacent to curb, gutter, metal beam guard fence and structures.
  - e. Roll the tack coat with a pneumatic-tire roller when directed.
  - f. The City may use Tex-243-F to verify that the tack coat has adequate adhesive properties.
  - g. The City may suspend paving operations until there is adequate adhesion.
  - h. The tack coat should be placed with enough time to break or set before applying hot mix asphalt layers.
  - i. Traffic should not be allowed on tack coats.
  - j. When a tacked road surface must be opened to traffic, they should be covered with sand to provide friction and prevent pick-up.

k. A typical rate for applying a sand cover is 4 to 8 lbs/square yard.

10. General placement requirements

- a. Material should be delivered to maintain a relatively constant head of material in front of the screed.
- b. The hopper should never be allowed to empty during paving.
- c. Dumping wings between trucks not allowed. Dispose of at end of days production.

E. Lay-Down Operation

- 1. Minimum Mixture Placement Temperatures. Use Table 10 for minimum mixture placement temperatures.
- 2. Windrow Operations. When hot mix is placed in windrows, operate windrow pickup equipment so that substantially all the mixture deposited on the roadbed is picked up and loaded into the paver.

**Table 10**

**Suggested Minimum Mixture Placement Temperature**

<b>High-Temperature Binder Grade</b>	<b>Minimum Placement Temperature (Before Entering Paver)</b>
PG 64 or lower	260°F
PG 70	270°F
PG 76	280°F
PG 82 or higher	290°F

F. Compaction

- 1. Use air void control unless ordinary compaction control is specified on the Drawings.
- 2. Avoid displacement of the mixture. If displacement occurs, correct to the satisfaction of the City.
- 3. Ensure pavement is fully compacted before allowing rollers to stand on the pavement.
- 4. Unless otherwise directed, use only water or an approved release agent on rollers, tamps, and other compaction equipment.
- 5. Keep diesel, gasoline, oil, grease, and other foreign matter off the mixture.

6. Unless otherwise directed, operate vibratory rollers in static mode when not compacting, when changing directions, or when the plan depth of the pavement mat is less than 1-1/2 inches.
7. Use tamps to thoroughly compact the edges of the pavement along curbs, headers, and similar structures and in locations that will not allow thorough compaction with the rollers.
8. The City may require rolling with a trench roller on widened areas, in trenches, and in other limited areas.
9. Allow the compacted pavement to cool to 160 degrees F or lower before opening to traffic unless otherwise directed.
10. When directed, sprinkle the finished mat with water or limewater to expedite opening the roadway to traffic.
11. Air Void Control
  - a. General
    - 1) Compact dense-graded hot-mix asphalt to contain from 5 percent to 9 percent in-place air voids.
    - 2) Do not increase the asphalt content of the mixture to reduce pavement air voids.
  - b. Rollers
    - 1) Furnish the type, size, and number of rollers required for compaction, as approved.
    - 2) Use a pneumatic-tire roller to seal the surface, unless otherwise shown on the Drawings.
    - 3) Use additional rollers as required to remove any roller marks.
  - c. Air Void Determination
    - 1) Unless otherwise shown on the Drawings, obtain 2 roadway specimens at each location selected by the City for in-place air void determination.
    - 2) The City will measure air voids in accordance with Tex-207-F and Tex-227-F.
    - 3) Before drying to a constant weight, cores may be predried using a Corelok or similar vacuum device to remove excess moisture.
    - 4) The City will use the average air void content of the 2 cores to calculate the in-place air voids at the selected location.
  - d. Air Voids Out of Range
    - 1) If the in-place air void content in the compacted mixture is below 5 percent or greater than 9 percent, change the production and placement operations to bring the in-place air void content within requirements.
  - e. Test Section

- 1) Construct a test section of 1 lane-width and at most 0.2 miles in length to demonstrate that compaction to between 5 percent and 9 percent in-place air voids can be obtained.
- 2) Continue this procedure until a test section with 5 percent to 9 percent in-place air voids can be produced.
- 3) The City will allow only 2 test sections per day.
- 4) When a test section producing satisfactory in-place air void content is placed, resume full production.

## 12. Ordinary Compaction Control

- a. Furnish the type, size, and number of rollers required for compaction, as approved. Furnish at least 1 medium pneumatic-tire roller (minimum 12-ton weight).
- b. Use the control strip method given in Tex-207-F, Part IV, to establish rolling patterns that achieve maximum compaction.
- c. Follow the selected rolling pattern unless changes that affect compaction occur in the mixture or placement conditions.
- d. When such changes occur, establish a new rolling pattern.
- e. Compact the pavement to meet the requirements of the Drawings and specifications.
- f. When rolling with the 3-wheel, tandem or vibratory rollers, start by first rolling the joint with the adjacent pavement and then continue by rolling longitudinally at the sides.
- g. Proceed toward the center of the pavement, overlapping on successive trips by at least 1 ft., unless otherwise directed.
- h. Make alternate trips of the roller slightly different in length.
- i. On superelevated curves, begin rolling at the low side and progress toward the high side unless otherwise directed.

## G. Irregularities

1. Identify and correct irregularities including, but not limited to segregation, rutting, raveling, flushing, fat spots, mat slippage, irregular color, irregular texture, roller marks, tears, gouges, streaks, uncoated aggregate particles, or broken aggregate particles.
2. The City may also identify irregularities, and in such cases, the City shall promptly notify the Contractor.
3. If the City determines that the irregularity will adversely affect pavement performance, the City may require the Contractor to remove and replace (at the Contractor's expense) areas of the pavement that contain the irregularities and areas where the mixture does not bond to the existing pavement.

4. If irregularities are detected, the City may require the Contractor to immediately suspend operations or may allow the Contractor to continue operations for no more than 1 day while the Contractor is taking appropriate corrective action.
5. The City may suspend production or placement operations until the problem is corrected.
6. At the expense of the Contractor and to the satisfaction of the City, remove and replace any mixture that does not bond to the existing pavement or that has other surface irregularities identified above.

**3.5 REPAIR**

- A. See Section 32 01 17.

**3.6 QUALITY CONTROL**

- A. Production Testing

1. Perform production tests to verify asphalt paving meets the performance standard required in the Drawings and specifications.
2. City to measure density of asphalt paving with nuclear gauge.
3. City to core asphalt paving from the normal thickness of section once acceptable density achieved. City identifies location of cores.
  - a. Minimum core diameter: 4 inches
  - b. Minimum spacing: 200 feet
  - c. Minimum of 1 core every block
  - d. Alternate lanes between core
4. City to use cores to determine pavement thickness and calculate theoretical density.
  - a. City to perform theoretical density test a minimum of 1 per day per street.

- B. Density Test

1. The average measured density of asphalt paving must meet specified density.
2. Average of measurements per street not meeting the minimum specified strength shall be subject to the money penalties or removal and replacement at the Contractor's expense as show in Table 11.

**Table 11**  
**Density Payment Schedule**

Percent Rice	Percent of Contract Price Allowed
--------------	-----------------------------------

89 and lower	remove and replace at the entire cost and expense of Contractor as directed by City.
90	75-percent
91-93	100-percent
94	90-percent
95	75-percent
Over 95	remove and replace at the entire cost and expense of Contractor as directed by City.

3. The amount of penalty shall be deducted from payment due to Contractor.
4. These requirements are in addition to the requirements of Article 1.2.

C. Pavement Thickness Test

1. City measure each core thickness by averaging at least 3 measurements.
2. The number of tests and location shall be at the discretion of the City, unless otherwise specified in the special provisions or on the Drawings.
3. In the event a deficiency in the thickness of pavement is revealed during production testing, subsequent tests necessary to isolate the deficiency shall be at the Contractor's expense.
4. The cost for additional coring test shall be at the same rate charged by commercial laboratories.
5. Where the average thickness of pavement in the area found to be deficient, payment shall be made at an adjusted price as specified in Table 12.

**Table 12**  
**Thickness Deficiency Penalties**

Deficiency in Thickness Determined by Cores	Proportional Part Of Contract Price
Greater Than 0 percent - Not More than 10 percent	90 percent
Greater Than 10 percent - Not More than 15 percent	80 percent
Greater Than 15 percent	remove and replace at the entire cost and expense of Contractor as directed by City.

6. If, in the judgment of the City, the area of such deficiency warrants removal, the area shall be removed and replaced, at the Contractor's entire expense, with asphalt paving of the thickness shown on the Drawings.
7. No additional payment over the contract unit price shall be made for any pavement of a thickness exceeding that required by the Drawings.

**3.7 FIELD QUALITY CONTROL [NOT USED]**

**3.8 SYSTEM STARTUP [NOT USED]**

**3.9 ADJUSTING [NOT USED]**

**3.10 CLEANING [NOT USED]**

**3.11 CLOSEOUT ACTIVITIES [NOT USED]**

**3.12 PROTECTION [NOT USED]**

**3.13 MAINTENANCE [NOT USED]**

**3.14 ATTACHMENTS [NOT USED]**

**END OF SECTION**



**PART 1 - GENERAL**

**1.1 SUMMARY**

- A. Section includes:
  - 1. Finished pavement constructed of portland cement concrete including monolithically poured curb on the prepared subgrade or other base course.
- B. Deviations from this Standard Specification.
  - 1. None.
- C. Related Specification Sections include, but are not necessarily limited to:
  - 1. Division 0 - Bidding Requirements, Contract Forms, and Conditions of the Contract
  - 2. Division 1 - General Requirements
  - 3. Section 32 01 29 - Concrete Paving Repair
  - 4. Section 32 13 73 - Concrete Paving Joint Sealants

**1.2 PRICE AND PAYMENT PROCEDURES**

- A. Measurement
  - 1. Measurement
    - a. Measurement for this Item shall be by the square yard of completed and accepted Concrete Pavement in its final position as measured from back of curb for various:
      - 1) Classes
      - 2) Thicknesses
  - 2. Payment
    - a. The work performed and materials furnished in accordance with this Item will be paid for at the unit price bid per square yard of Concrete Pavement.
  - 3. The price bid shall include:
    - a. Shaping and fine grading the placement area
    - b. Furnishing and applying all water required

- c. Furnishing, loading, and unloading, storing, hauling, and handling all concrete ingredients including all freight and royalty involved
- d. Mixing, placing, finishing, and curing all concrete
- e. Furnishing and installing all reinforcing steel
- f. Furnishing all materials and placing longitudinal, warping, expansion, and contraction joints, including all steel dowels, dowel caps and load transmission units required, wire and devices for placing, holding, and supporting the steel bar, load transmission units, and joint filler material in the proper position; for coating steel bars where required by the Drawings.
- g. Sealing joints
- h. Monolithically poured curb.
- i. Cleanup

### 1.3 REFERENCES

#### A. Reference Standards

1. Reference standards cited in this specification refer to the current reference standard published at the time of the latest revision date logged at the end of this specification unless a date is specifically cited.
2. ASTM International (ASTM):
  - a. A615/A615M, Deformed and Plain Billet-Steel Bars for Concrete Reinforcement
  - b. C31, Standard Practice for Making and Curing Concrete Test Specimens in the Field
  - c. C33, Concrete Aggregates
  - d. C39, Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens
  - e. C42, Standard Test Method for Obtaining and Testing Drilled Cores and Sawed Beams of Concrete
  - f. C94/C94M, Standard Specifications for Ready-Mixed Concrete
  - g. C150, Portland Cement
  - h. C156, Water Retention by Concrete Curing Materials
  - i. C172, Standard Practice for Sampling Freshly Mixed Concrete
  - j. C260, Air Entraining Admixtures for Concrete
  - k. C309, Liquid Membrane-Forming Compounds for Curing Concrete, Type 2
  - l. C494, Chemical Admixtures for Concrete, Types "A", "D", "F" and "G"

- m. C618, Coal Fly Ash and Raw or Calcined Natural Pozzolan for use as a Mineral Admixture in Concrete
  - n. C881, Standard Specification for Epoxy-Resin-Base Bonding Systems for Concrete
  - o. C1064, Standard Test Method for Temperature of Freshly Mixed Hydraulic-Cement Concrete
  - p. C1602, Standard Specification for Mixing Water Used in the Production of Hydraulic Cement Concrete.
  - q. D698, Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft<sup>3</sup>)
3. American Concrete Institute (ACI):
- a. ACI 305.1-06 Specification for Hot Weather Concreting
  - b. ACI 306.1-90, Standard Specification for Cold Weather Concreting
  - c. ACI 318

**1.4 ADMINISTRATIVE REQUIREMENTS [NOT USED]**

**1.5 SUBMITTALS [NOT USED]**

**1.6 ACTION SUBMITTALS/INFORMATIONAL SUBMITTALS**

- A. Mix Design: submit for approval. See Item 2.4.A.

**1.7 CLOSEOUT SUBMITTALS [NOT USED]**

**1.8 MAINTENANCE MATERIAL SUBMITTALS [NOT USED]**

**1.9 QUALITY ASSURANCE [NOT USED]**

**1.10 DELIVERY, STORAGE, AND HANDLING [NOT USED]**

**1.11 FIELD CONDITIONS**

- A. Weather Conditions
  - 1. Place concrete when concrete temperature is between 40 and 100 degrees when measured in accordance with ASTM C1064 at point of placement.
  - 2. Hot Weather Concreting
    - a. Take immediate corrective action or cease paving when the ambient temperature exceeds 95 degrees.
    - b. Concrete paving operations shall be approved by the City when the concrete temperature exceeds 100 degrees. See Standard Specification for Hot Weather Concreting (ACI 305.1-06).

3. Cold Weather Concreting

- a. Do not place when ambient temp in shade is below 40 degrees and falling. Concrete may be placed when ambient temp is above 35 degrees and rising or above 40 degrees.
- b. Concrete paving operations shall be approved by the City when ambient temperature is below 40 degrees. See Standard Specification for Cold Weather Concreting (ACI 306.1-90).

- B. Time: Place concrete after sunrise and no later than shall permit the finishing of the pavement in natural light, or as directed by the City.

**1.12 WARRANTY [NOT USED]**

**PART 2 - PRODUCTS**

**2.1 OWNER-FURNISHED PRODUCTS [NOT USED]**

**2.2 MATERIALS**

- A. Cementitious Material: ASTM C150.
- B. Aggregates: ASTM C33.
- C. Water: ASTM C1602.
- D. Admixtures: When admixtures are used, conform to the appropriate specification:
  - 1. Air-Entraining Admixtures for Concrete: ASTM C260.
  - 2. Chemical Admixtures for Concrete: ASTM C494, Types "A", "D", "F" and "G."
  - 3. Fly Ash
    - a. Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete: ASTM C618.
    - b. Fly ash may be substituted at one pound per pound of cement up to 25% of the specified cement content when such batch design is approved by the Engineer.
- E. Steel Reinforcement: ASTM A615.
- F. Steel Wire Reinforcement: Not used for concrete pavement.
- G. Dowels and Tie Bars
  - 1. Dowel and tie bars: ASTM A615.

2. Dowel Caps
  - a. Provide dowel caps with enough range of movement to allow complete closure of the expansion joint.
  - b. Caps for dowel bars shall be of the length shown on the Drawings and shall have an internal diameter sufficient to permit the cap to freely slip over the bar.
  - c. In no case shall the internal diameter exceed the bar diameter by more 1/8 inch, and one end of the cap shall be rightly closed.
3. Epoxy for Dowel and Tie Bars: ASTM C881.
  - a. See following table for approved producers of epoxies and adhesives.

Pre-Qualified Producers of Epoxies and Adhesives	
Product Name	Producer
Concresive 1420	BASF
HTE-50	Hilti
T 308 +	Powers Fasteners
P E 1000+	Powers Fasteners
C-6	Ramset-Redhead
Epcon G-5	Ramset-Redhead
Pro-Poxy-300 Fast Tube	Unitex
Shep-Poxy TxIII	CMC Construction Services
Ultrabond 1300 Tubes	Adhesives Technology
Ultrabone 2300 N.S. A-22-2300 Slow Set	Adhesives Technology
Dynapoxy EP-430	Pecora Corp.
EDOT	Simpson Strong Tie
ET22	Simpson Strong Tie
SET 22	Simpson Strong Tie
SpecPoxy 3000FS	SpecChem

- b. Epoxy Use, Storage and Handling

- 1) Package components in airtight containers and protect from light and moisture.
- 2) Include detailed instructions for the application of the material and all safety information and warnings regarding contact with the components.
- 3) Epoxy label requirements
  - a) Resin or hardener components
  - b) Brand name
  - c) Name of manufacturer
  - d) Lot or batch number
  - e) Temperature range for storage
  - f) Date of manufacture
  - g) Expiration date
  - h) Quantity contained.
- 4) Store epoxy and adhesive components at temperatures recommended by the manufacturer.
- 5) Do not use damaged or previously opened containers and any material that shows evidence of crystallization, lumps skinning, extreme thickening, or settling of pigments that cannot be readily dispersed with normal agitation.
- 6) Follow sound environmental practices when disposing of epoxy and adhesive wastes.
- 7) Dispose of all empty containers separately.
- 8) Dispose of epoxy by completely emptying and mixing the epoxy before disposal.

#### H. Reinforcement Bar Chairs

1. Reinforcement bar chairs or supports shall be of adequate strength to support the reinforcement bars and shall not bend or break under the weight of the reinforcement bars or Contractor's personnel walking on the reinforcing bars.
2. Bar chairs may be made of metal (free of rust), precast mortar or concrete blocks or plastic.
3. For approval of plastic chairs, 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.
4. Bar chairs may be rejected for failure to meet any of the requirements of this specification.

I. Joint Filler

1. Joint filler is the material placed in concrete pavement and concrete structures to allow for the expansion and contraction of the concrete.
2. Wood Boards: Used as joint filler for concrete paving.
  - a. Boards for expansion joint filler shall be of the required size, shape and type indicated on the Drawings or required in the specifications.
    - 1) Boards shall be of selected stock of redwood or cypress. The boards shall be sound heartwood and shall be free from sapwood, knots, clustered birdseyes, checks and splits.
    - 2) Joint filler, boards, shall be smooth, flat, and straight throughout, and shall be sufficiently rigid to permit ease of installation.
    - 3) Boards shall be furnished in lengths equal to the width between longitudinal joints and may be furnished in strips or scored sheet of the required shape.
3. Dimensions. The thickness of the expansion joint filler shall be shown on the Drawings; the width shall be not less than that shown on the Drawings, providing for the top seal space.
4. Rejection. Expansion joint filler may be rejected for failure to meet any of the requirements of this specification.

J. Joint Sealants. Provide Joint Sealants in accordance with Section 32 13 73.

K. Curing Materials

1. Membrane-Forming Compounds.
  - a. Conform to the requirements of ASTM C309, Type 2, white pigmented compound and be of such nature that it shall not produce permanent discoloration of concrete surfaces nor react deleteriously with the concrete.
  - b. The compound shall produce a firm, continuous uniform moisture-impermeable film free from pinholes and shall adhere satisfactorily to the surfaces of damp concrete.
  - c. It shall, when applied to the damp concrete surface at the specified rate of coverage, dry to touch in 1 hour and dry through in not more than 4 hours under normal conditions suitable for concrete operations.
  - d. It shall adhere in a tenacious film without running off or appreciably sagging.
  - e. It shall not disintegrate, check, peel, or crack during the required curing period.
  - f. The compound shall not peel or pick up under traffic and shall disappear from the surface of the concrete by gradual disintegration.
  - g. The compound shall be delivered to the job site in the manufacturer's original containers only, which shall be clearly labeled with the manufacturer's name,

the trade name of the material and a batch number or symbol with which test samples may be correlated.

- h. When tested in accordance with ASTM C156 Water Retention by Concrete Curing Materials, the liquid membrane-forming compound shall restrict the loss of water present in the test specimen at the time of application of the curing compound to not more than 0.01-oz.-per-2 inches of surface.

## **2.3 ACCESSORIES [NOT USED]**

## **2.4 SOURCE QUALITY CONTROL**

### **A. Mix Design**

#### **1. Concrete Mix Design and Control**

- a. At least 10 calendar days prior to the start of concrete paving operations, the Contractor shall submit a design of the concrete mix it proposes to use and a full description of the source of supply of each material component.
- b. The design of the concrete mix shall produce a quality concrete complying with these specifications and shall include the following information:
  - 1) Design Requirements and Design Summary
  - 2) Material source
  - 3) Dry weight of cement/cubic yard and type
  - 4) Dry weight of fly ash/cubic yard and type, if used
  - 5) Saturated surface dry weight of fine and coarse aggregates/cubic yard
  - 6) Design water/cubic yard
  - 7) Quantities, type, and name of admixtures with manufacturer's data sheets
  - 8) Current strength tests or strength tests in accordance with ACI 318
  - 9) Current Sieve Analysis and -200 Decantation of fine and coarse aggregates and date of tests
  - 10) Fineness modulus of fine aggregate
  - 11) Specific Gravity and Absorption Values of fine and coarse aggregates
  - 12) L.A. Abrasion of coarse aggregates
- c. Once mix design approved by City, maintain intent of mix design and maximum water to cement ratio.
- d. No concrete may be placed on the job site until the mix design has been approved by the City.

#### **2. Quality of Concrete**

- a. Consistency



- 1) In general, the consistency of concrete mixtures shall be such that:
  - a) Mortar shall cling to the coarse aggregate.
  - b) Aggregate shall not segregate in concrete when it is transported to the place of deposit.
  - c) Concrete, when dropped directly from the discharge chute of the mixer, shall flatten out at the center of the pile, but the edges of the pile shall stand and not flow.
  - d) Concrete and mortar shall show no free water when removed from the mixer.
  - e) Concrete shall slide and not flow into place when transported in metal chutes at an angle of 30 degrees with the horizontal
  - f) Surface of the finished concrete shall be free from a surface film or laitance.
- 2) 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 hand sprayer only and be held to a minimum amount.
- 3) The concrete shall be workable, cohesive, possess satisfactory finishing qualities and be of the stiffest consistency that can be placed and vibrated into a homogeneous mass.
- 4) Excessive bleeding shall be avoided.
- 5) If the strength or consistency required for the class of concrete being produced is not secured with the minimum cement specified or without exceeding the maximum water/cement ratio, the Contractor may use, or the City may require, an approved cement dispersing agent (water reducer); or the Contractor shall furnish additional aggregates, or aggregates with different characteristics, or the Contractor may use additional cement in order to produce the required results.
- 6) The additional cement may be permitted as a temporary measure, until aggregates are changed, and designs checked with the different aggregates or cement dispersing agent.
- 7) The Contractor is solely responsible for the quality of the concrete produced.
- 8) The City reserves the right to independently verify the quality of the concrete through inspection of the batch plant, testing of the various materials used in the concrete and by casting and testing concrete cylinders or beams on the concrete actually incorporated in the pavement.

b. Standard Class

- 1) Unless otherwise shown on the Drawings or detailed specifications, the standard class for concrete paving for streets and alleys is shown in the following table:

Standard Classes of Pavement Concrete

Class of Concrete <sup>1</sup>	Minimum Cementitious, Lb./CY	28 Day Min. Compressive, Strength <sup>2</sup> psi	Maximum Water/ Cementitious, Ratio	Course Aggregate Maximum Size inch
P	517	3600	0.49	1-1/2
H	564	4500	0.45	1-1/2

1. All exposed horizontal concrete shall have entrained-air.
2. Minimum Compressive Strength Required.

- 2) Machine-Laid concrete: Class P
  - 3) Hand-Laid concrete: Class H
- c. High Early Strength Concrete (HES)
- 1) When shown on the Drawings or allowed, provide Class HES concrete for very early opening of pavements area or leaveouts to traffic.
  - 2) Design class HES to meet the requirements of class specified for concrete pavement and a minimum compressive strength of 2,600 psi in 24 hours, unless other early strength and time requirements are shown on the Drawings allowed.
  - 3) No strength overdesign is required.

Standard Classes of Pavement Concrete

Class of Concrete <sup>1</sup>	Minimum Cementitious Lb./CY	28 Day Min. Compressive Strength <sup>2</sup> psi	Maximum Water/ Cementitious Ratio	Course Aggregate Maximum Size,
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				inch
HES	564	4500	0.45	1-1/2

d. Slump

- 1) Slump requirements for pavement and related concrete shall be as specified in the following table:

Concrete Pavement Slump Requirements

Concrete Use	Recommended Design and Placement Slump, inch	Maximum Acceptable Placement Slump, inch
Slip-Form/Form-Riding Paving	1-1/2	3
Hand Formed Paving	4	5
Sidewalk, Curb and Gutter, Concrete Valley Gutter and Other Miscellaneous Concrete	4	5

- 2) No concrete shall be permitted with slump in excess of the maximums shown.
- 3) Any concrete mix failing to meet the above consistency requirements, although meeting the slump requirements, shall be considered unsatisfactory, and the mix shall be changed to correct such unsatisfactory conditions.

**PART 3 - EXECUTION**

**3.1 INSTALLERS [NOT USED]**

**3.2 EXAMINATION [NOT USED]**

**3.3 PREPARATION [NOT USED]**

**3.4 INSTALLATION**

A. Equipment

1. All equipment necessary for the construction of this item shall be on the project.

2. The equipment shall include spreading devices (augers), internal vibration, tamping, and surface floating necessary to finish the freshly placed concrete in such a manner as to provide a dense and homogeneous pavement.
3. Machine-Laid Concrete Pavement
  - a. Fixed-Form Paver. Fixed-form paving equipment shall be provided with forms that are uniformly supported on a very firm subbase to prevent sagging under the weight of machine.
  - b. Slip-Form Paver
    - 1) Slip-form paving equipment shall be provided with traveling side forms of sufficient dimensions, shape, and strength so as to support the concrete laterally for a sufficient length of time during placement.
    - 2) City may reject use of Slip-Form Paver if paver requires over-digging and impacts trees, mailboxes, or other improvements.
4. Hand-Laid Concrete Pavement
  - a. Machines that do not incorporate these features, such as roller screeds or vibrating screeds, shall be considered tools to be used in hand-laid concrete construction, as slumps, spreading methods, vibration, and other procedures are more common to hand methods than to machine methods.
5. City may reject equipment and stop operation if equipment does not meet requirements.

B. Concrete Mixing and Delivery

1. Transit Batching: shall not be used – onsite mixing not permitted.
2. Ready Mixed Concrete
  - a. The concrete shall be produced in an approved method conforming to the requirements of this specification and ASTM C94/C94M. City shall have access ready mix to get samples of materials.
  - b. City shall have access to ready mix plant to obtain material samples.
  - c. When ready-mix concrete is used, sample concrete per ASTM C94 Alternate Procedure 2:
    - 1) As the mixer is being emptied, individual samples shall be taken after the discharge of approximately 15 percent and 85 percent of the load.
    - 2) The method of sampling shall provide that the samples are representative of widely separated portions, but not from the very ends of the batch.
  - d. The mixing of each batch, after all materials are in the drum, shall continue until it produces a thoroughly mixed concrete of uniform mass as determined by established mixer performance ratings and inspection, or appropriate uniformity tests as described in ASTM C94.

- e. The entire contents of the drum shall be discharged before any materials are placed therein for the succeeding batch.
- f. Retempering or remixing shall not be permitted.

3. Delivery

- a. Deliver concrete at an interval not exceeding 30 minutes or as determined by City to prevent cold joint.

4. Delivery Tickets

- a. For all operations, the manufacturer of the concrete shall, before unloading, furnish to the purchaser with each batch of concrete at the site a delivery ticket on which is printed, stamped, or written, the following information to determine that the concrete was proportioned in accordance with the approved mix design:

- 1) Name of concrete supplier
- 2) Serial number of ticket
- 3) Date
- 4) Truck number
- 5) Name of purchaser
- 6) Specific designation of job (name and location)
- 7) Specific class, design identification and designation of the concrete in conformance with that employed in job specifications.
- 8) Amount of concrete in cubic yards
- 9) Time loaded or of first mixing of cement and aggregates.
- 10) Water added by receiver of concrete.
- 11) Type and amount of admixtures

C. Subgrade

- 1. When manipulation or treatment of subgrade is required on the Drawings, the work shall be performed in proper sequence with the preparation of the subgrade for pavement.
- 2. The roadbed shall be excavated and shaped in conformity with the typical sections and to the lines and grades shown on the Drawings or established by the City.
- 3. All holes, ruts and depressions shall be filled and compacted with suitable material and, if required, the subgrade shall be thoroughly wetted and reshaped.
- 4. Irregularities of more than 1/2 inch., as shown by straightedge or template, shall be corrected.

5. The subgrade shall be uniformly compacted to at least 95 percent of the maximum density as determined by ASTM D698.
6. Moisture content shall be within minus 2 percent to plus 4 percent of optimum.
7. The prepared subgrade shall be wetted down sufficiently in advance of placing the pavement to ensure its being in a firm and moist condition.
8. Sufficient subgrade shall be prepared in advance to ensure satisfactory prosecution of the work.
9. The Contractor shall notify the City at least 24 hours in advance of its intention to place concrete pavement.
10. After the specified moisture and density are achieved, the Contractor shall maintain the subgrade moisture and density in accordance with this Section.
11. In the event that rain, or other conditions may have adversely affected the condition of the subgrade or base, additional tests may be required as directed by the City.

#### D. Placing and Removing Forms

##### 1. Placing Forms

###### a. Forms for machine-laid concrete

- 1) The side forms shall be metal, of approved cross section and bracing, of a height no less than the prescribed edge thickness of the concrete section, and a minimum of 10 feet in length for each individual form.
- 2) Forms shall be of ample strength and staked with adequate number of pins capable of resisting the pressure of concrete placed against them and the thrust and the vibration of the construction equipment operating upon them without appreciable springing, settling or deflection.
- 3) The forms shall be free from warps, bends or kinks and shall show no variation from the true plane for face or top.
- 4) Forms shall be jointed neatly and tightly and set with exactness to the established grade and alignment.
- 5) Forms shall be set to line and grade at least 200 feet, where practicable, in advance of the paving operations.
- 6) In no case shall the base width be less than 8 inches for a form 8 inches or more in height.
- 7) Forms must be in firm contact with the subgrade throughout their length and base width.
- 8) If the subgrade becomes unstable, forms shall be reset, using heavy stakes or other additional supports may be necessary to provide the required stability.

- b. Forms for hand-laid concrete
  - 1) Forms shall extend the full depth of concrete and be a minimum of 1-1/2 inches in thickness or equivalent when wooden forms are used or be of a gauge that shall provide equivalent rigidity and strength when metal forms are used.
  - 2) For curves with a radius of less than 250 feet, acceptable flexible metal or wood forms shall be used.
  - 3) All forms showing a deviation of 1/8 inch in 10 feet from a straight line shall be rejected.
- 2. Settling. When forms settle over 1/8 inch under finishing operations, paving operations shall be stopped the forms reset to line and grade and the pavement then brought to the required section and thickness.
- 3. Cleaning. Forms shall be thoroughly cleaned after each use.
- 4. Removal.
  - a. Forms shall remain in place until the concrete has taken its final set.
  - b. Avoid damage to the edge of the pavement when removing forms.
  - c. Repair damage resulting from form removal and honeycombed areas with a mortar mix within 24 hours after form removal unless otherwise approved.
  - d. Clean joint face and repair honeycombed or damaged areas within 24 hours after a bulkhead for a transverse construction joint has been removed unless otherwise approved.
  - e. When forms are removed before 72 hours after concrete placement, promptly apply membrane curing compound to the edge of the concrete pavement.

E. Placing Reinforcing Steel, Tie, and Dowel Bars

- 1. General
  - a. When reinforcing steel tie bars, dowels, etc., are required they shall be placed as shown on the Drawings.
  - b. All reinforcing steel shall be clean, free from rust in the form of loose or objectionable scale, and of the type, size and dimensions shown on the Drawings.
  - c. Reinforcing bars shall be securely wired together at the alternate intersections and all splices and shall be securely wired at each intersection dowel and load-transmission unit intersected.
  - d. All bars shall be installed in their required position as shown on the Drawings.

- e. The storing of reinforcing or structural steel on completed roadway slabs generally shall be avoided and, where permitted, such storage shall be limited to quantities and distribution that shall not induce excessive stresses.
2. Splices
    - a. Provide standard reinforcement splices by lapping and tying ends.
    - b. Comply with ACI 318 for minimum lap of spliced bars where not specified on the Drawings.
  3. Installation of Reinforcing Steel
    - a. All reinforcing bars and bar mats shall be installed in the slab at the required depth below the finished surface and supported by and securely attached to bar chairs installed on prescribed longitudinal and transverse centers as shown by sectional and detailed drawings on the Drawings.
    - b. Chairs Assembly. The chair assembly shall be similar and equal to that shown on the Drawings and shall be approved by the City prior to extensive fabrication.
    - c. After the reinforcing steel is securely installed above the subgrade as specified in Drawings and as herein prescribed, no loading shall be imposed upon the bar mats or individual bars before or during the placing or finishing of the concrete.
  4. Installation of Dowel Bars
    - a. Install through the predrilled joint filler and rigidly support in true horizontal and vertical positions by an assembly of bar chairs and dowel baskets.
    - b. Dowel Baskets
      - 1) The dowels shall be held in position exactly parallel to surface and centerline of the slab, by a dowel basket that is left in the pavement.
      - 2) The dowel basket shall hold each dowel in exactly the correct position so firmly that the dowel's position cannot be altered by concreting operations.
    - c. Dowel Caps
      - 1) Install cap to allow the bar to move not less than 1-1/4 inch in either direction.
  5. Tie Bar and Dowel Placement
    - a. Place at mid-depth of the pavement slab, parallel to the surface.
    - b. Place as shown on the Drawings.
  6. Epoxy for Tie and Dowel Bar Installation
    - 1) Epoxy bars as shown on the Drawings.



- 2) Use only drilling operations that do not damage the surrounding operations.
- 3) Blow out drilled holes with compressed air.
- 4) Completely fill the drilled hole with approved epoxy before inserting the tie bar into the hole.
- 5) Install epoxy grout and bar at least 6 inches embedded into concrete.

F. Joints

1. Joints shall be placed where shown on the Drawings or where directed by the City.
2. The plane of all joints shall make a right angle with the surface of the pavement.
3. No joints shall have an error in alignment of more than 1/2 inch at any point.
4. Joint Dimensions
  - a. The width of the joint shall be shown on the Drawings, creating the joint sealant reservoir.
  - b. The depth of the joint shall be shown on the Drawings.
  - c. Dimensions of the sealant reservoir shall be in accordance with manufacturer's recommendations.
  - d. After curing, the joint sealant shall be 1/8 inch to 1/4 inch below the pavement surface at the center of the joint.
5. Transverse Expansion Joints
  - a. Expansion joints shall be installed perpendicularly to the surface and to the centerline of the pavement at the locations shown on the Drawings, or as approved by the City.
  - b. Joints shall be of the design width, and spacing shown on the Drawings, or as approved by the City.
  - c. Dowel bars, shall be of the size and type shown on the Drawings, or as approved by the City, and shall be installed at the specified spacing.
  - d. Support dowel bars with dowel baskets.
  - e. Dowels shall restrict the free opening and closing of the expansion joint and shall not make planes of weaknesses in the pavement.
  - f. Greased Dowels for Expansion Joints.
    - 1) Coat dowels with a thin film of grease or other approved de-bonding material.
    - 2) Provide dowel caps on the lubricated end of each dowel bar.

- g. Proximity to Existing Structures. When the pavement is adjacent to or around existing structures, expansion joints shall be constructed in accordance with the details shown on the Drawings.

6. Transverse Contraction Joints

- a. Contraction or dummy joints shall be installed at the locations and at the intervals shown on the Drawings.
- b. Joints shall be of the design width, and spacing shown on the Drawings, or as approved by the City.
- c. Dowel bars, shall be of the size and type shown on the Drawings, or as approved by the City, and shall be installed at the specified spacing.
- d. Joints shall be sawed into the completed pavement surface as soon after initial concrete set as possible so that some raveling of the concrete is observed in order for the sawing process to prevent uncontrolled shrinkage cracking.
- e. The joints shall be constructed by sawing to a 1/4-inch width and to a depth of 1/3 inch (1/4 inch permitted if limestone aggregate used) of the actual pavement thickness, or deeper if so, indicated on the Drawings.
- f. Complete sawing as soon as possible in hot weather conditions and within a maximum of 24 hours after saw cutting begins under cool weather conditions.
- g. If sharp edge joints are being obtained, the sawing process shall be sped up to the point where some raveling is observed.
- h. Damage by blade action to the slab surface and to the concrete immediately adjacent to the joint shall be minimized.
- i. Any portion of the curing membrane which has been disturbed by sawing operations shall be restored by spraying the areas with additional curing compound.

7. Transverse Construction Joints

- a. Construction joints formed at the close of each day's work or when the placing of concrete has been stopped for 30-minutes or longer shall be constructed by use of metal or wooden bulkheads cut true to the section of the finished pavement and cleaned.
- b. Wooden bulkheads shall have a thickness of not less than 2-inch stock material.
- c. Longitudinal bars shall be held securely in place in a plane perpendicular to the surface and at right angles to the centerline of the pavement.
- d. Edges shall be rounded to 1/4-inch radius.
- e. Any surplus concrete on the subgrade shall be removed upon the resumption of the work.

8. Longitudinal Construction Joints

a. Longitudinal construction joints shall be of the type shown on the Drawings.

9. Joint Filler

- a. Joint filler shall be as specified in 2.2.1 of the size and shape shown on the Drawings.
- b. Redwood Board joints shall be used for all pavement joints except for expansion joints that are coincident with a butt joint against existing pavements.
- c. Boards with less than 25-percent of moisture at the time of installation shall be thoroughly wetted on the job.
- d. Green lumber of much higher moisture content is desirable and acceptable.
- e. The joint filler shall be appropriately drilled to admit the dowel bars when required.
- f. The bottom edge of the filler shall extend to or slightly below the bottom of the slab. The top edge shall be held approximately 1/2 inch below the finished surface of the pavement in order to allow the finishing operations to be continuous.
- g. The joint filler may be composed of more than one length of board in the length of joint, but no board of a length less than 6 foot may be used unless otherwise shown on the Drawings.
- h. After the removal of the side forms, the ends of the joints at the edges of the slab shall be carefully opened for the entire depth of the slab.

10. Joint Sealing. Routine pavement joints shall be filled consistent with paving details and as specified in Section 32 13 73. Materials shall generally be handled and applied according to the manufacturer's recommendations as specified in Section 32 13 73.

G. Placing Concrete

- 1. Unless otherwise specified in the Drawings, the finished pavement shall be constructed monolithically and constructed by machined laid method unless impractical.
- 2. The concrete shall be rapidly deposited on the subgrade in successive batches and shall be distributed to the required depth and for the entire width of the pavement by shoveling or other approved methods.
- 3. Any concrete not placed as herein prescribed within the time limits in the following table will be rejected. Time begins when the water is added to the mixer.

Temperature – Time Requirements

Concrete Temperature	Max Time – minutes	Max Time – minutes
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(at point of placement)	(no retarding agent)	(with retarding agent) <sup>1</sup>
Non-Agitated Concrete		
All temperatures	45	45
Agitated Concrete		
Above 90°F	Time may be reduced by City	75
Above 75°F thru 90°F	60	90
75°F and Below	60	120

1 Normal dosage of retarder.

4. Rakes shall not be used in handling concrete.
5. At the end of the day, or in case of unavoidable interruption or delay of more than 30 minutes or longer to prevent cold joints, a transverse construction joint shall be placed in accordance with 3.4.F.7 of this Section.
6. Honeycombing
  - a. Special care shall be taken in placing and spading the concrete against the forms and at all joints and assemblies so as to prevent honeycombing.
  - b. Excessive voids and honeycombing in the edge of the pavement, revealed by the removal of the side forms, may be cause for rejection of the section of slab in which the defect occurs.

#### H. Finishing

1. Machine
  - a. Tolerance Limits
    - 1) While the concrete is still workable, it shall be tested for irregularities with a 10-foot straightedge placed parallel to the centerline of the pavement so as to bridge depressions and to touch all high spots.
    - 2) Ordinates measured from the face of the straightedge to the surface of the pavement shall at no place exceed 1/16 inch-per-foot from the nearest point of contact.

3) In no case shall the maximum ordinate to a 10-foot straightedge be greater than 1/8 inch.

4) Any surface not within the tolerance limits shall be reworked and refinished.

b. Edging

1) The edges of slabs and all joints requiring edging shall be carefully tooled with an edger of the radius required by the Drawings at the time the concrete begins to take its "set" and becomes non-workable.

2) All such work shall be left smooth and true to lines.

2. Hand

a. Hand finishing permitted only in intersections and areas inaccessible to a finishing machine.

b. When the hand method of striking off and consolidating is permitted, the concrete, as soon as placed, shall be approximately leveled, and then struck off with screed bar to such elevation above grade that, when consolidated and finished, the surface of the pavement shall be at the grade elevation shown on the Drawings.

c. A slight excess of material shall be kept in front of the cutting edge at all times.

d. The straightedge and joint finishing shall be as prescribed herein.

I. Curing

1. The curing of concrete pavement shall be thorough and continuous throughout the entire curing period.

2. Failure to provide proper curing as herein prescribed shall be considered as sufficient cause for immediate suspension of the paving operations.

3. The curing method as herein specified does not preclude the use of any of the other commonly used methods of curing, and the City may approve another method of curing if so, requested by the Contractor.

4. If any selected method of curing does not afford the desired results, the City shall have the right to order that another method of curing be instituted.

5. After removal of the side forms, the sides of the slab shall receive a like coating before earth is banked against them.

6. The solution shall be applied, under pressure with a spray nozzle, in such a manner as to cover the entire surfaces thoroughly and completely with a uniform film.

7. The rate of application shall be such as to ensure complete coverage and shall not exceed 20-square-yards-per-gallon of curing compound.

8. When thoroughly dry, it shall provide a continuous and flexible membrane, free from cracks or pinholes, and shall not disintegrate, check, peel, or crack during the curing period.
9. If for any reason the seal is broken during the curing period, it shall be immediately repaired with additional sealing solution.
10. When tested in accordance with ASTM C156 Water Retention by Concrete Curing Materials, the curing compound shall provide a film which shall have retained within the test specimen a percentage of the moisture present in the specimen when the curing compound was applied according to the following.
11. Contractor shall maintain and properly repair damage to curing materials on exposed surfaces of concrete pavement continuously for a least 72 hours.

J. Monolithic Curbs

1. Concrete for monolithic curb shall be the same as for the pavement and, if carried back from the paving mixer, shall be placed within 20-minutes after being mixed.
2. After the concrete has been struck off and sufficiently set, the exposed surfaces shall be thoroughly worked with a wooden flat.
3. The exposed edges shall be rounded by the use of an edging tool to the radius indicated on the Drawings.
4. All exposed surfaces of curb shall be brushed to a smooth and uniform surface.

K. Alley Paving

1. Alley paving shall be constructed in accordance with the specifications for concrete paving hereinbefore described, in accordance with the details shown on the Drawings, and with the following additional provisions:
  - a. Alley paving shall be constructed to the typical cross sections shown on the Drawings.
  - b. Transverse expansion joints of the type shown on the Drawings shall be constructed at the property line on each end of the alley with a maximum spacing of 600 feet.
  - c. Transverse contraction and dummy joints shall be placed at the spacing shown on the Drawings.
  - d. Contraction and dummy joints shall be formed in such a manner that the required joints shall be produced to the satisfaction of the City.
  - e. All joints shall be constructed in accordance with this specification and filled in accordance with the requirement of Section 32 13 73.

L. Pavement Leaveouts

1. Pavement leaveouts as necessary to maintain and provide for local traffic shall be provided at location indicated on the Drawings or as directed by the City.
2. The extent and location of each leaveout required and a suitable crossover connection to provide for traffic movements shall be determined in the field by the City.

### **3.5 REPAIR**

- A. Repair of concrete pavement concrete shall be consistent with the Drawings and as specified in Section 32 01 29.

### **3.6 RE-INSTALLATION [NOT USED]**

### **3.7 SITE QUALITY CONTROL**

#### **A. Concrete Placement**

1. Place concrete using a fully automated paving machine. Hand paving only permitted in areas such as intersections where use of paving machine is not practical.
  - a. All concrete pavement not placed by hand shall be placed using a fully automated paving machine as approved by the City.
  - b. Screeds will not be allowed except if approved by the City.

#### **B. Testing of Materials**

1. Samples of all materials for test shall be made at the expense of the City, unless otherwise specified in the special provisions or in the Drawings.
2. In the event the initial sampling and testing does not comply with the specifications, all subsequent testing of the material in order to determine if the material is acceptable shall be at the Contractor's expense at the same rate charged by the commercial laboratories.
3. All testing shall be in accordance with applicable ASTM Standards and concrete testing technician must be ACI certified or equivalent.

#### **C. Pavement Thickness Test**

1. Upon completion of the work and before final acceptance and final payment shall be made, pavement thickness test shall be made by the City.
2. The number of tests and location shall be at the discretion of the City, unless otherwise specified in the special provisions or on the Drawings.
3. The cost for the initial pavement thickness test shall be the expense of the City.

4. In the event a deficiency in the thickness of pavement is revealed during normal testing operations, subsequent tests necessary to isolate the deficiency shall be at the Contractor's expense.
5. The cost for additional coring test shall be at the same rate charged by commercial laboratories.
6. Where the average thickness of pavement in the area found to be deficient in thickness by more than 0.20 inch, but not more than 0.50-inch, payment shall be made at an adjusted price as specified in the following table.

Deficiency in Thickness Determined by Cores	Proportional Part Of Contract Price
Inches	Allowed
0.00 – 0.20	100 percent
0.21 – 0.30	80 percent
0.31 – 0.40	70 percent
0.41 – 0.50	60 percent

7. Any area of pavement found deficient in thickness by more than 0.50 inch but not more than 0.75 inch or 1/10 of the thickness specified on the Drawings, whichever is greater, shall be evaluated by the City.
8. If, in the judgment of the City the area of such deficiency should not be removed and replaced, there shall be no payment for the area retained.
9. If, in the judgment of the City, the area of such deficiency warrants removal, the area shall be removed and replaced, at the Contractor's entire expense, with concrete of the thickness shown on the Drawings.
10. Any area of pavement found deficient in thickness by more than 0.75 inch or more than 1/10 of the plan thickness, whichever is greater, shall be removed and replaced, at the Contractor's entire expense, with concrete of the thickness shown on the Drawings.
11. No additional payment over the contract unit price shall be made for any pavement of a thickness exceeding that required by the Drawings.

D. Pavement Strength Test

1. During the progress of the work the City shall provide trained technicians to cast test cylinders for conforming to ASTM C31, to maintain a check on the compressive strengths of the concrete being placed.



2. After the cylinders have been cast, they shall remain on the job site and then transported, moist cured, and tested by the City in accordance with ASTM C31 and ASTM C39.
3. In each set, 1 of the cylinders shall be tested at 7 days, 2 cylinders shall be tested at 28 days, and 1 cylinder shall be held or tested at 56 days, if necessary.
4. If the 28-day test results indicate deficient strength, the Contractor may, at its option and expense, core the pavement in question and have the cores tested by an approved laboratory, in accordance with ASTM C42 and ACI 318 protocol, except the average of all cores must meet 100 percent of the minimum specified strength, with no individual core resulting in less than 90 percent of design strength, to override the results of the cylinder tests.
5. Cylinders and/or cores must meet minimum specified strength. If cylinders do not meet minimum specified strength, additional cores shall be taken to identify the limits of deficient concrete pavement at the expense of the Contractor.
6. Cylinders and/or cores must meet minimum specified strength. Pavement not meeting the minimum specified strength shall be subject to the money penalties or removal and placement at the Contractor's expense as show in the following table.

Percent Deficient	Percent of Contract Price Allowed
Greater Than 0 percent - Not More Than 10 percent	90-percent
Greater Than 10 percent - Not More Than 15 percent	80-percent
Greater Than 15 percent	0-percent or removed and replaced at the entire cost and expense of Contractor as directed by City

7. The amount of penalty shall be deducted from payment due to Contractor, such as penalty deducted is to defray the cost of extra maintenance.
8. The strength requirements for structures and other concrete work are not altered by the special provision.
9. No additional payment over the contract unit price shall be made for any pavement of strength exceeding that required by the Drawings and/or specifications.

E. Cracked Concrete Acceptance Policy

1. If cracks exist in concrete pavement upon completion of the project, the Project Inspector shall make a determination as to the need for action to address the cracking as to its cause and recommended remedial work.

2. If the recommended remedial work is routing and sealing of the cracks to protect the subgrade, the Inspector shall make the determination as to whether to rout and seal the cracks at the time of final inspection and acceptance or at any time prior to the end of the project maintenance period. The Contractor shall perform the routing and sealing work as directed by the Project Inspector, at no cost to the City, regardless of the cause of the cracking.
3. If remedial work beyond routing and sealing is determined to be necessary, the Inspector and the Contractor will attempt to agree on the cause of the cracking. If agreement is reached that the cracking is due to deficient materials or workmanship, the Contractor shall perform the remedial work at no cost to the City. Remedial work in this case shall be limited to removing and replacing the deficient work with new material and workmanship that meets the requirements of the contract.
4. If remedial work beyond routing and sealing is determined to be necessary, and the Inspector and the Contractor agree that the cause of the cracking is not deficient materials or workmanship, the City may request the Contractor to provide an estimate of the cost of the necessary remedial work and/or additional work to address the cause of the cracking, and the Contractor will perform that work at the agreed-upon price if the City elects to do so.
5. If remedial work is necessary, and the Inspector and the Contractor cannot agree on the cause of the cracking, the City may hire an independent geotechnical engineer to perform testing and analysis to determine the cause of the cracking. The contractor will escrow 50 percent of the proposed costs of the geotechnical contract with the City. The Contractor and the City shall use the services of a geotechnical firm acceptable to both parties.
6. If the geotechnical engineer determines that the primary cause of the cracking is the Contractor's deficient material or workmanship, the remedial work will be performed at the Contractor's entire expense and the Contractor will also reimburse the City for the balance of the cost of the geotechnical investigation over and above the amount that has previously been escrowed. Remedial work in this case shall be limited to removing and replacing the deficient work with new material and workmanship that meets the requirements of the contract.
7. If the geotechnical engineer determines that the primary cause of the cracking is not the Contractor's deficient material or workmanship, the City will return the escrowed funds to the Contractor. The Contractor, on request, will provide the City an estimate of the costs of the necessary remedial work and/or additional work and will perform the work at the agreed-upon price as directed by the City.

- 3.8 SYSTEM STARTUP [NOT USED]
- 3.9 ADJUSTING [NOT USED]
- 3.10 CLEANING [NOT USED]
- 3.11 CLOSEOUT ACTIVITIES [NOT USED]
- 3.12 PROTECTION [NOT USED]
- 3.13 MAINTENANCE [NOT USED]
- 3.14 ATTACHMENTS [NOT USED]

**END OF SECTION**

**1.0 GENERAL****1.1 SUMMARY**

## A. Section Includes:

1. Concrete sidewalks
2. Driveways
3. Barrier free ramps

## B. Related Specification Sections include, but are not necessarily limited to:

1. Division 0 - Bidding Requirements, Contract Forms, and Conditions of the Contract
2. Division 1 - General Requirements
3. Section 02 41 13 - Selective Site Demolition
4. Section 32 13 13 - Concrete Paving
5. Section 32 13 73 - Concrete Paving Joint Sealants

**1.2 PRICE AND PAYMENT PROCEDURES**

## A. Measurement and Payment

## 1. Concrete Sidewalk

## a. Measurement

- 1) Measurement for this Item shall be by the square foot of completed and accepted Concrete Sidewalk in its final position for various:

- a) Thicknesses
- b) Types

## b. Payment

- 1) The work performed and materials furnished in accordance with this Item and measured as provided under "Measurement" will be paid for at the unit price bid per square foot of Concrete Sidewalk.

## c. The price bid shall include:

- 1) Excavating and preparing the subgrade
- 2) Furnishing and placing all materials

## 2. Concrete Curb at Back of Sidewalk (6-to-12-inch max)

## a. Measurement

- 1) Measurement for this Item shall be by the linear foot of completed and accepted Concrete Curb at the Back of Sidewalk within the 6-to-12-inch curb height at back of walk in its final position.

## b. Payment

- 1) The work performed and materials furnished in accordance with this Item and measured as provided under "Measurement" will be paid for at the unit price bid per linear foot of Concrete Curb at the Back of Sidewalk.

## c. The price bid shall include:

- 1) Excavating and preparing the subgrade
  - 2) Furnishing and placing all materials, including concrete and reinforcing steel
  - 3) Excavation in back of “retaining” curb
  - 4) Furnishing, placing, and compacting backfill
3. Concrete Driveway
- a. Measurement
    - 1) Measurement for this Item shall be by the square foot of completed and accepted Concrete Driveway in its final position for various:
      - a) Thicknesses
      - b) Types
    - 2) Dimensions will be taken from the back of the projected curb, including the area of the curb radii and will extend to the limits specified in the Drawings.
    - 3) Sidewalk portion of drive will be included in driveway measurement.
    - 4) Curb on drive will be included in the driveway measurement.
  - b. Payment
    - 1) The work performed and materials furnished in accordance with this Item and measured as provided under “Measurement” will be paid for at the unit price bid per square foot of Concrete Driveway.
  - c. The price bid shall include:
    - 1) Excavating and preparing the subgrade
    - 2) Furnishing and placing all materials
4. Barrier Free Ramps
- a. Measurement
    - 1) Measurement for this Item shall be per each Barrier Free Ramp completed and accepted for various:
      - a) Types
  - b. Payment
    - 1) The work performed and materials furnished in accordance with this Item and measured as provided under “Measurement” will be paid for at the unit price bid per each “Barrier Free Ramp” installed.
  - c. The price bid shall include:
    - 1) Excavating and preparing the subgrade
    - 2) Furnishing and placing all materials
    - 3) Curb Ramp
    - 4) Landing and detectable warning surface as shown on the Drawings
    - 5) Adjacent flares or side curb

### 1.3 REFERENCES

- A. Abbreviations and Acronyms
  1. TAS – Texas Accessibility Standards
  2. TDLR – Texas Department of Licensing and Regulation
- B. Reference Standards

1. Reference standards cited in this Specification refer to the current reference standard published at the time of the latest revision date logged at the end of this Specification unless a date is specifically cited.
2. American Society for Testing and Materials (ASTM)
  - a. D545, Test Methods for Preformed Expansion Joint Fillers for Concrete Construction (Non-extruding and Resilient Types)
  - b. D698, Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft<sup>3</sup>)

**1.4 ADMINISTRATIVE REQUIREMENTS [NOT USED]**

**1.5 SUBMITTALS [NOT USED]**

**1.6 ACTION SUBMITTALS/INFORMATIONAL SUBMITTALS**

- A. Mix Design: submit for approval. Section 32 13 13.
- B. Product Data: submit product data and sample for pre-cast detectable warning for barrier free ramp.

**1.7 CLOSEOUT SUBMITTALS [NOT USED]**

**1.8 MAINTENANCE MATERIAL SUBMITTALS [NOT USED]**

**1.9 QUALITY ASSURANCE [NOT USED]**

**1.10 DELIVERY, STORAGE, AND HANDLING [NOT USED]**

**1.11 FIELD CONDITIONS**

- A. Weather Conditions: Placement of concrete shall be as specified in Section 32 13 13.

**1.12 WARRANTY [NOT USED]**

**2.0 PRODUCTS**

**2.1 OWNER FURNISHED PRODUCTS [NOT USED]**

**2.2 EQUIPMENT AND MATERIALS**

- A. Forms: wood or metal straight, free from warp and of a depth equal to the thickness of the finished work.
- B. Concrete: see Section 32 13 13.

1. Unless otherwise shown on the Drawings or detailed specifications, the standard class for concrete sidewalks, driveways and barrier free ramps is shown in the following table:  
Standard Classes of Pavement Concrete

Class of Concrete <sup>1</sup>	Minimum Cementitious, Lb./CY	28 Day Min. Compressive Strength <sup>2</sup> psi	Maximum Water/Cementitious Ratio	Course Aggregate Maximum Size, inch
A	470	3000	0.58	1-1/2

- C. Reinforcement: see Section 32 13 13.

1. Sidewalk, driveway and barrier free ramp reinforcing steel shall be #3 deformed bars at 18 inches on-center-both-ways at the center plane of all slabs, unless otherwise shown on the Drawings or detailed specifications.

- D. Joint Filler

1. Wood Filler: see Section 32 13 13.

2. Pre-Molded Asphalt Board Filler
  - a. Use only in areas where not practical for wood boards. Pre-molded asphalt board filler: ASTM D545.
  - b. Install the required size and uniform thickness and as specified in Drawings.
  - c. Include 2 liners of 0.016 asphalt impregnated kraft paper filled with a mastic mixture of asphalt and vegetable fiber and/or mineral filler.

E. Expansion Joint Sealant: see Section 32 13 73 where shown on the Drawings.

**2.3 ACCESSORIES [NOT USED]**

**2.4 SOURCE QUALITY CONTROL [NOT USED]**

**3.1 EXECUTION**

**3.2 INSTALLERS [NOT USED]**

**3.3 EXAMINATION [NOT USED]**

**3.4 PREPARATION**

A. Surface Preparation

1. Excavation: Excavation required for the construction of sidewalks, driveways and barrier free ramps shall be to the lines and grades as shown on the Drawings or as established by the City.
2. Fine Grading
  - a. The Contractor shall do all necessary filling, leveling and fine grading required to bring the subgrade to the exact grades specified and compacted to at least 90 percent of maximum density as determined by ASTM D698.
  - b. Moisture content shall be within minus 2 to plus 4 of optimum.
  - c. Any over-excavation shall be repaired to the satisfaction of the City.

B. Demolition / Removal

1. Sidewalk, Driveway and/ or Barrier Free Ramp Removal: see Section 02 41 13.

**3.5 INSTALLATION**

A. General

1. Concrete sidewalks shall have a minimum thickness of 4 inches.
2. Sidewalks constructed in driveway approach sections shall have a minimum thickness equal to that of driveway approach or as called for by Drawings and specifications within the limits of the driveway approach.
3. Driveways shall have a minimum thickness of 6 inches. Standard cross-slopes for walks shall be 2 percent max in accordance with current TAS/TDLR guidelines. The construction of the driveway approach shall include the variable height radius curb in accordance with the Drawings.
4. All pedestrian facilities shall comply with provisions of TAS including location, slope, width, shapes, texture and coloring. Pedestrian facilities installed by the Contractor and not meeting TAS must be removed and replaced to meet TAS (no separate pay).

B. Forms: Forms shall be securely staked to line and grade and maintained in a true position during the depositing of concrete.

C. Reinforcement: see Section 32 13 13.

D. Concrete Placement: see Section 32 13 13.

E. Finishing

1. Concrete sidewalks, driveways and barrier free ramps shall be finished to a true, even surface.

2. Trowel and then brush transversely to obtain a smooth uniform brush finish.
3. Provide exposed aggregate finish if specified.
4. Edge joints and sides shall with suitable tools.

F. Joints

1. Expansion joints for sidewalks, driveways and barrier free ramps shall be formed using redwood.
2. Expansion joints shall be placed at 40-foot intervals for 4-foot-wide sidewalk and 50 foot intervals for 5 foot wide and greater sidewalk.
3. Expansion joints shall also be placed at all intersections, sidewalks with concrete driveways, curbs, formations, other sidewalks and other adjacent old concrete work. Similar material shall be placed around all obstructions protruding into or through sidewalks or driveways.
4. All expansion joints shall be 1/2 inch in thickness.
5. Edges of all construction and expansion joints and outer edges of all sidewalks shall be finished to approximately a 1/2-inch radius with a suitable finishing tool.
6. Sidewalks shall be marked at intervals equal to the width of the walk with a marking tool.
7. When sidewalk is against the curb, expansion joints shall match those in the curb.

G. Barrier Free Ramp

1. Furnish and install brick red color pre-cast detectable warning Dome-Tile, manufactured by StrongGo Industries or approved equal by the City.
2. Detectable warning surface shall be a minimum of 24-inch in depth in the direction of pedestrian travel, and extend to a minimum of 48-inch along the curb ramp or landing where the pedestrian access route enters the street.
3. Locate detectable warning surface so that the edge nearest the curb line is a minimum of 6-inch and maximum of 8-inch from the extension of the face of the curb.
4. Detectable warning Dome-Tile surface may be curved along the corner radius.
5. Install detectable warning surface according to manufacturer's instructions.

- 3.6 REPAIR/RESTORATION [NOT USED]**
- 3.7 RE-INSTALLATION [NOT USED]**
- 3.8 FIELD QUALITY CONTROL [NOT USED]**
- 3.9 SYSTEM STARTUP [NOT USED]**
- 3.10 ADJUSTING [NOT USED]**
- 3.11 CLEANING [NOT USED]**
- 3.12 CLOSEOUT ACTIVITIES [NOT USED]**
- 3.13 PROTECTION [NOT USED]**
- 3.14 MAINTENANCE [NOT USED]**
- 3.15 ATTACHMENTS [NOT USED]**

**END OF SECTION**



**PART 1 - GENERAL****1.1 SUMMARY**

- A. Section Includes
  - 1. Specification for silicone joint sealing for concrete pavement and curbs.
- B. Deviations from this Standard Specification.
  - 1. None.
- C. Related Specification Sections include but are not necessarily limited to.
  - 1. Section 32 13 13 - Concrete Paving.

**1.2 PRICE AND PAYMENT PROCEDURES**

- A. Measurement and Payment.
  - 1. Measurement: when specified in the plans to be a pay item, measure by the linear foot of completed and accepted joint sealant.
  - 2. Payment: Unless otherwise specified on plans, the work performed, and materials furnished as required in this Section will not be paid for directly but will be subsidiary to other bid items.

**1.3 REFERENCES**

- A. Reference Standards
  - 1. ASTM International (ASTM):
    - a. D5893, Standard Specification for Cold Applied, Single Component, Chemically Curing Silicone Joint Sealant for Portland Cement Concrete Pavements

**1.4 ADMINISTRATIVE REQUIREMENTS [NOT USED]****1.5 ACTION SUBMITTALS [NOT USED]****1.6 ACTION SUBMITTALS/INFORMATIONAL SUBMITTALS**

- A. Test and Evaluation Reports
  - 1. Prior to installation, furnish certification by an independent testing laboratory that the silicone joint sealant meets the requirements of this Section.
  - 2. Submit verifiable documentation that the manufacturer of the silicone joint sealant has a minimum two-year demonstrated, documented successful field performance with concrete pavement silicone joint sealant systems.

**1.7 CLOSEOUT SUBMITTALS [NOT USED]****1.8 MAINTENANCE MATERIAL SUBMITTALS [NOT USED]****1.9 QUALITY ASSURANCE [NOT USED]****1.10 DELIVERY, STORAGE, AND HANDLING [NOT USED]****1.11 FIELD CONDITIONS**

- A. Do not apply joint sealant when the air and pavement temperature is less than 35°F
- B. Concrete surface must be clean, dry and frost free.

- C. Do not place sealant in an expansion-type joint if surface temperature is below 35°F or above 90°F.

**1.12 WARRANTY [NOT USED]**

**PART 2 - PRODUCTS**

**2.1 AUTHORITY FURNISHED PRODUCTS [NOT USED]**

**2.2 MATERIALS & EQUIPMENT**

A. Materials

1. Joint Sealant: ASTM D5893.
2. Joint Filler, Backer Rod and Breaker Tape
  - a. The joint filler sop shall be of a closed cell expanded polyethylene foam backer rod and polyethylene bond breaker tape of sufficient size to provide a tight seal.
  - b. The back rod and breaker tape shall be installed in the saw-cut joint to prevent the joint sealant from flowing to the bottom of the joint.
  - c. The backer rod and breaker tape shall be compatible with the silicone joint sealant and no bond or reaction shall occur between them.

**2.3 ACCESSORIES [NOT USED]**

**2.4 SOURCE QUALITY CONTROL [NOT USED]**

**PART 3 - EXECUTION**

**3.1 INSTALLERS [NOT USED]**

**3.2 EXAMINATION [NOT USED]**

**3.3 PREPARATION [NOT USED]**

**3.4 INSTALLATION**

A. General.

1. The silicone sealant shall be cold applied.
2. Allow concrete to cure for a minimum of 7 days to ensure it has sufficient strength prior to sealing joints.
3. Perform joint reservoir saw cutting, cleaning, bond breaker installation, and joint sealant placement in a continuous sequence of operations.
4. See plans for the various joint details with their respective dimensions.

B. Equipment

1. Provide all necessary equipment and keep equipment in a satisfactory working condition.
2. Equipment shall be inspected by the Authority prior to the beginning of the work.
3. The minimum requirements for construction equipment shall be as follows:
  - a. Concrete Saw. The sawing equipment shall be adequate in size and power to complete the joint sawing to the required dimensions.
  - b. Air Compressors. The delivered compressed air shall have a pressure in excess of 90 psi and shall be suitable for the removal of all free water and oil from the compressed air.
  - c. Extrusion Pump. The output shall be capable of supplying a sufficient volume of sealant to the joint.

- d. Injection Tool. This mechanical device shall apply the sealant uniformly into the joint.
  - e. Sandblaster. The design shall be for commercial use with air compressors as specified in this Section.
  - f. Backer Rod Roller and Tooling Instrument. These devices shall be clean and free of contamination. They shall be compatible with the joint depth and width requirements.
- C. Sawing Joints: see Section 32 13 13.
- D. Cleaning joints
- 1. Dry saw in one direction with reverse cutting blade then sand blast.
  - 2. Use compressed air to remove the resulting dust from the joint.
  - 3. Sandblast joints after complete drying.
    - a. Attach nozzle to a mechanical aiming device so that the sand blast will be directed at an angle of 45 degrees and at a distance of 1 to 2 inches from the face of the joint.
    - b. Sandblast both joint faces sandblasted in separate, one directional passes.
    - c. When sandblasting is complete, blow-out using compressed air.
    - d. The blow tube shall fit into the joints.
  - 4. Check the blown joint for residual dust or other contamination.
    - a. If any dust or contamination is found, repeat sandblasting and blowing until the joint is cleaned.
    - b. Do not use solvents to remove stains and contamination.
  - 5. Place the bond breaker and sealant in the joint immediately upon cleaning.
  - 6. Bond Breaker Rod and Tape: install in the cleaned joint prior to the application of the joint sealant.
  - 7. Do not leave open, cleaned joints unsealed overnight.
- E. Joint Sealant
- 1. Apply the joint sealant upon placement of the bond breaker rod and tape, using the mechanical injection tool.
  - 2. Do not seal joints unless they are clean and dry.
  - 3. Remove and discard excess sealant left on the pavement surface.
    - a. Do not excess use to seal the joints.
  - 4. The pavement surface shall present a clean final condition as determined by Owner.
  - 5. Do not allow traffic on the fresh sealant until it becomes tack-free.
- F. Approval of Joints
- 1. The Authority and City may request a representative of the sealant manufacturer to be present at the job site at the beginning of the final cleaning and sealing of joints.
    - a. The representative shall demonstrate to the CONTRACTOR and the Authority and City the acceptable method for sealant installation.
    - b. The representative shall approve the clean, dry joints before the sealing operation commences.

- 3.5 [REPAIR]/[RESTORATION] [NOT USED]
- 3.6 RE-INSTALLATION [NOT USED]
- 3.7 FIELD QUALITY CONTROL [NOT USED]
- 3.8 SYSTEM STARTUP [NOT USED]
- 3.9 ADJUSTING [NOT USED]
- 3.10 CLEANING [NOT USED]
- 3.11 CLOSEOUT ACTIVITIES [NOT USED]
- 3.12 PROTECTION [NOT USED]
- 3.13 MAINTENANCE [NOT USED]
- 3.14 ATTACHMENTS [NOT USED]

END OF SECTION

**1.0 GENERAL****1.1 SUMMARY**

## A. Section Includes:

1. Furnishing and installing grass sod and permanent seeding as shown on Drawings, or as directed.

## B. Related Specification Sections include, but are not necessarily limited to:

1. Division 0 - Bidding Requirements, Contract Forms, and Conditions of the Contract
2. Division 1 - General Requirements
3. Section 32 91 19 – Topsoil Placement and Finishing of Parkways

**1.2 PRICE AND PAYMENT PROCEDURES**

## A. Measurement and Payment

## 1. Block Sod Placement

## a. Measurement

- 1) Measurement for this Item shall be by the square yard of Block Sod placed.

## b. Payment

- 1) The work performed and materials furnished in accordance with this Item and measured as provided under "Measurement" will be paid for at the unit price bid per square yard of Block Sod placed.

## c. The price bid shall include:

- 1) Furnishing and placing all sod
- 2) Rolling and tamping
- 3) Watering (until established)
- 4) Disposal of surplus materials

## 2. Seeding

## a. Measurement

- 1) Measurement for this Item shall be by the square yard of Seed spread.

## b. Payment

- 1) The work performed and materials furnished in accordance with this Item and measured as provided under "Measurement" will be paid for at the unit price bid per square yard of Seed placed for various installation methods.

## c. The price bid shall include:

- 1) Furnishing and placing all Seed
- 2) Furnishing and applying water for seed fertilizer
- 3) Slurry and hydraulic mulching

- 4) Fertilizer
  - 5) Watering and mowing (until established)
  - 6) Disposal of surplus materials
3. Mowing
- a. Measurement
    - 1) Measurement for this Item shall per each.
  - b. Payment
    - 1) The work performed and materials furnished in accordance with this Item and measured as provided under "Measurement" will be paid for at the unit price bid per each.

**1.3 REFERENCES [NOT USED]**

**1.4 ADMINISTRATIVE REQUIREMENTS [NOT USED]**

**1.5 ACTION SUBMITTALS [NOT USED]**

**1.6 INFORMATIONAL SUBMITTALS**

A. Seed

- 1. Vendors' certification that seeds meet Texas State seed law including:
  - a. Testing and labeling for pure live seed (PLS)
  - b. Name and type of seed
- 2. All seed shall be tested in a laboratory with certified results presented to the City in writing, prior to planting.
- 3. All seed to be of the previous season's crop and the date on the container shall be within 12 months of the seeding date.

**1.7 CLOSEOUT SUBMITTALS [NOT USED]**

**1.8 MAINTENANCE MATERIAL SUBMITTALS [NOT USED]**

**1.9 QUALITY ASSURANCE [NOT USED]**

**1.10 DELIVERY, STORAGE, AND HANDLING**

A. Block Sod

- 1. Protect from exposure to wind, sun and freezing.
- 2. Keep stacked sod moist.

B. Seed

- 1. If using native grass or wildflower seed, seed must have been harvested within 100 miles of the construction site.
- 2. Each species of seed shall be supplied in a separate, labeled container for acceptance by the City.

C. Fertilizer

- 1. Provide fertilizer labeled with the analysis.
- 2. Conform to Texas fertilizer law.

**1.11 FIELD [SITE] CONDITIONS [NOT USED]**

**1.12 WARRANTY [NOT USED]**

**2.0 PRODUCTS [NOT USED]**

**2.1 OWNER-FURNISHED PRODUCTS [NOT USED]**

**2.2 MATERIALS AND EQUIPMENT**

A. Materials

1. Block Sod

- a. Sod Varieties (match existing if applicable)
  - 1) "Stenotaphrum secundatum" (St. Augustine grass)
  - 2) "Cynodon dactylon" (Common Bermudagrass)
  - 3) "Buchloe dactyloides" (Buffalograss)
  - 4) an approved hybrid of Common Bermudagrass
  - 5) or an approved Zoysia grass
- b. Sod must contain stolons, leaf blades, rhizomes and roots.
- c. Sod shall be alive, healthy and free of insects, disease, stones, undesirable foreign materials and weeds and grasses deleterious to its growth or which might affect its subsistence or hardiness when transplanted.
- d. Minimum sod thickness: 3/4 inch
- e. Maximum grass height: 2 inches
- f. Acceptable growing beds
  - 1) St. Augustine grass sod: clay or clay loam topsoil
  - 2) Bermuda grasses and zoysia grasses: sand or sandy loam soils
- g. Dimensions
  - 1) Machine cut to uniform soil thickness.
  - 2) Sod shall be of equal width and of a size that permits the sod to be lifted, handled and rolled without breaking.
- h. Broken or torn sod or sod with uneven ends shall be rejected.

2. Seed

- a. General
  - 1) Plant all seed at rates based on pure live seed (PLS)
    - a) Pure Live Seed (PLS) determined using the formula:
      - i.  $\text{Percent Pure Live Seed} = \text{Percent Purity} \times [(\text{Percent Germination} + \text{Percent Firm or Hard Seed}) + 100]$
  - 2) Availability of Seed
    - a) Substitution of individual seed types due to lack of availability may be permitted by the City at the time of planting.
    - b) Notify the City prior to bidding of difficulties locating certain species.

- 3) Weed seed
  - c) Not exceed ten percent by weight of the total of pure live seed (PLS) and other material in the mixture
  - d) Seed not allowed:
    - i. Johnsongrass
    - ii. Nutgrass seed
- 4) Harvest seed within 1-year prior to planting
- b. Non-native Grass Seed

1) Plant between April 15 and September 10

Lbs. PLS/ Acre	Common Name	Botanical Name	Purity (percent)	Germination (percent)
25	Bermuda (unhulled)	<i>cynodon dactylon</i>	85	90
75	Bermuda (hulled)	<i>cynodon dactylon</i>	95	90

2) Plant between September 10 and April 15

Lbs. PLS/ Acre	Common Name	Botanical Name	Purity (percent)	Germination (percent)
220	Rye Grass	<i>lolium multiflorum</i>	85	90
75	Bermuda (unhulled)	<i>cynodon dactylon</i>	95	90

c. Native Grass Seed

1) Plant between February 1 and October 1.

Lbs. PLS/Acre	Common Name	Botanical Name
1.6	Green Sprangletop	<i>Leptochloa dubia</i>
5.5	Sideoats Grama*	<i>Bouteloua curtipendula</i>
3.7	Little Bluestem*	<i>Schizachyrium scoparium</i>
17.0	Buffalograss	<i>Buchloe dactyloides</i>
1.8	Indian Grass*	<i>Sorghastrum nutans</i>
0.5	Sand Lovegrass*	<i>Eragrostis trichodes</i>
6.0	Big Bluestem	<i>Andropogon gerardii</i>
8.0	Eastern Grama	<i>Tripsacum dactyloides</i>
1.2	Blue Grama	<i>Bouteloua gracilis</i>
1.8	Switchgrass	<i>Panicum virgatum</i>
10.0	Prairie Wildrye*	<i>Elymus canadensis</i>



d. Wildflower Seed

1) Plant between the following:

e) March 5 and May 31

f) September 1 and December 1

Lbs. PLS/Acre	Common Name	Botanical Name
3.0	Bush Sunflower	<i>Sinsia calva</i>
5.0	Butterfly Weed	<i>Asclepias tuberosa</i>
2.0	Clasping Coneflower*	<i>Rudbeckia amplexicaulis</i>
3.0	Golden - Wave	<i>Coreopsis basalis</i>
13.4	Illinois Bundleflower	<i>Desmanthus illinoensis</i>
13.6	Partridge Pea	<i>Cassia fasciculata</i>
2.0	Prairie Verbena	<i>Verbena bipinnatifida</i>
8.0	Texas Yellow Star	<i>Lindheimeri texana</i>
8.0	Winecup	<i>Callirhoe involucrata</i>
2.0	Black-eyed Susan	<i>Rudbeckia hirta</i>
18.0	Cutleaf Daisy	<i>Engelmannia pinnatifida</i>
2.0	Obedient Plant	<i>Physostegia intermedia</i>
3.0	Pitcher Sage	<i>Salvia azurea</i>
2.0	Plains Coreopsis	<i>Coreopsis tinctoria</i>
8.0	Scarlet Sage	<i>Salvia coccinea</i>

\*not to be planted within ten feet of a road or parking lot or within three feet of a walkway

e. Temporary Erosion Control Seed

1) Consist of the sowing of cool season plant seeds.

3. Mulch

- a. For use with conventional mechanical or hydraulic planting of seed.
- b. Wood cellulose fiber produced from virgin wood or recycled paper-by-products (waste products from paper mills or recycled newspaper).
- c. No growth or germination inhibiting factors.
- d. No more than ten percent moisture, air dry weight basis.
- e. Additives: binder in powder form.
- f. Form a strong moisture retaining mat.

4. Fertilizer

- a. Acceptable condition for distribution
- b. Applied uniformly over the planted area

- c. Analysis
  - 1) 16-20-0
  - 2) 16-8-8
- d. Fertilizer rate:
  - 1) Not required for wildflower seeding
  - 2) Newly established seeding areas - 100 pounds of nitrogen per acre
  - 3) Established seeding areas - 150 pounds of nitrogen per acre
- e. Topsoil: See Section 32 91 19.
- f. Water: clean and free of industrial wastes or other substances harmful to the germination of the seed or to the growth of the vegetation.
- g. Soil Retention Blanket
  - 1) "Curlex I" from American Excelsior, 900 Ave. H East, Post Office Box 5624, Arlington, Texas 76001, 1-800-777-SOIL or approved equal.

**2.3 ACCESSORIES [NOT USED]**

**2.4 SOURCE QUALITY CONTROL [NOT USED]**

**3.0 EXECUTION**

**3.1 INSTALLERS [NOT USED]**

**3.2 EXAMINATION [NOT USED]**

**3.3 PREPARATION**

- A. Surface Preparation: clear surface of all material including:
  - 1. Stumps, stones, and other objects larger than one inch.
  - 2. Roots, brush, wire, stakes, etc.
  - 3. Any objects that may interfere with seeding or maintenance.
- B. Tilling
  - 1. Compacted areas: till 1 inch deep
  - 2. Areas sloped greater than 3:1: run a tractor parallel to slope to provide less seed/water run-off
  - 3. Areas near trees: Do not till deeper than 1/2 inch inside "drip line" of trees.

**3.4 INSTALLATION**

- A. Block Sodding
  - 1. General
    - a. Place sod between curb and walk and on terraces that is the same type grass as adjacent grass or existing lawn.
    - b. Plant between the average last freeze date in the spring and 6 weeks prior to the average first freeze in the fall.
  - 2. Installation

- a. Plant sod specified after the area has been completed to the lines and grades shown on the Drawings with 6 inches of topsoil.
- b. Use care to retain native soil on the roots of the sod during the process of excavating, hauling and planting.
- c. Keep sod material moist from the time it is dug until planted.
- d. Place sod so that the entire area designated for sodding is covered.
- e. Fill voids left in the solid sodding with additional sod and tamp.
- f. Roll and tamp sod so that sod is in complete contact with topsoil at a uniform slope.
- g. Peg sod with wooden pegs (or wire staple) driven through the sod block to the firm earth in areas that may slide due to the height or slope of the surface or nature of the soil.

3. Watering and Finishing

- a. Furnish water as an ancillary cost to Contractor by means of temporary metering / irrigation, water truck or by any other method necessary to achieve an acceptable stand of turf as defined in 3.13.B.
- b. Thoroughly water sod immediately after planted.
- c. Water until established.
- d. Generally, an amount of water that is equal to the average amount of rainfall plus 1/2 inch per week should be applied until accepted. If applicable, plant large areas by irrigation zones to ensure areas are watered as soon as they are planted.

B. Seeding

1. General

- a. Seed only those areas indicated on the Drawings and areas disturbed by construction.
- b. Mark each area to be seeded in the field prior to seeding for City approval.

2. Broadcast Seeding

- a. Broadcast seed in 2 directions at right angles to each other.
- b. Harrow or rake lightly to cover seed.
- c. Never cover seed with more soil than twice its diameter.
- d. For wildflower plantings:
  - 1) Scalp existing grasses to 1 inch
  - 2) Remove grass clippings, so seed can make contact with the soil.

1. Mechanically Seeding (Drilling):

- a. Uniformly distribute seed over the areas shown on the Drawings or as directed.
- b. All varieties of seed and fertilizer may be distributed at the same time provided that each component is uniformly applied at the specified rate.
- c. Drill seed at a depth of 1/4 inch to 3/8 inch utilizing a pasture or rangeland type drill.
- d. Drill on the contour of slopes

- e. After planting roll with a roller integral to the seed drill, or a corrugated roller of the "Cultipacker" type.
  - f. Roll slope areas on the contour.
2. Hydromulching
- a. Mixing: Seed, mulch, fertilizer and water may be mixed provided that:
    - 1) Mixture is uniformly suspended to form a homogenous slurry.
    - 2) Mixture forms a blotter-like ground cover impregnated uniformly with grass seed.
    - 3) Mixture is applied within 30 minutes after placed in the equipment.
  - b. Placing
    - 1) Uniformly distribute in the quantity specified over the areas shown on the Drawings or as directed.
3. Fertilizing: uniformly apply fertilizer over seeded area.
4. Watering
- a. Furnish water by means of temporary metering / irrigation, water truck or by any other method necessary to achieve an acceptable stand of turf as defined in 3.13.B.
  - b. Water soil to a minimum depth of 4 inches within 48 hours of seeding.
  - c. Water as direct by the City at least twice daily for 14 days after seeding in such a manner as to prevent washing of the slopes or dislodgement of the seed.
  - d. Water until final acceptance.
  - e. Generally, an amount of water that is equal to the average amount of rainfall plus 1/2 inch per week should be applied until accepted.

**3.5 REPAIR/RESTORATION [NOT USED]**

**3.6 RE-INSTALLATION [NOT USED]**

**3.7 FIELD QUALITY CONTROL [NOT USED]**

**3.8 SYSTEM STARTUP [NOT USED]**

**3.9 ADJUSTING [NOT USED]**

**3.10 CLEANING [NOT USED]**

**3.11 CLOSEOUT ACTIVITIES**

**3.12 PROTECTION [NOT USED]**

**3.13 MAINTENANCE**

A. Block Sodding

- 1. Water and mow sod until completion and final acceptance of the Project or as directed by the City.
- 2. Sod shall not be considered finally accepted until the sod has started to peg down (roots growing into the soil) and is free from dead blocks of sod.

B. Seeding

- 1. Water and mow sod until completion and final acceptance of the Project or as directed by the City.

2. Maintain the seeded area until each of the following is achieved:
    - a. Vegetation is evenly distributed
    - b. Vegetation is free from bare areas
  3. Turf will be accepted once fully established.
    - a. Seeded area must have 100 percent growth to a height of 3 inches with 1 mow cycle performed by the Contractor prior to consideration of acceptance by the City.
- C. Rejection
4. City may reject block sod or seeded area on the basis of weed populations.

**3.14 ATTACHMENTS [NOT USED]**

**END OF SECTION**

**1.0 GENERAL****1.1 SUMMARY**

## A. Description

1. This work shall consist of furnishing, installing, and maintaining tree protection for trees to be protected from construction activities.
2. No trees or cultured plants shall be cut, trimmed, or removed unless clearly shown on the Drawings or marked by the Engineer. All trees and other vegetation which are so shown or marked and must be removed to perform the work, shall be removed, and disposed of by the Contractor. On-site burning shall be permitted only when allowed by local authorities.
3. All protection of trees, trimming, root cutting, and repair of trees and plants shall be performed by qualified nurserymen or horticulturist.
4. All trees shown on these Drawings to be retained shall be protected during all phases of demolition/construction with temporary fencing.
5. Tree protection fences shall be installed prior to the commencement of any site preparation work.
6. The Contractor shall not be required to replace trees within existing easements except as noted on Drawings. All reasonable effort will be made to save existing trees in accordance with this Section.

## B. Related Sections

**PART 2 PRODUCTS****2.0 MATERIALS**

## A. Tree Protection Fencing

1. Fencing Post:  
Fencing posts shall be standard 6'-0" metal T-Post.
2. Fencing:  
Fencing shall be standard plastic safety fencing "orange" in color per Texas Department of Transportation Standard Specifications.

**PART 3 EXECUTION****3.0 ASSEMBLY**

Fencing posts shall be installed at 6'-0" on center. Safety fencing shall be installed and fastened securely to the T-Post with steel tie-wire and/or plastic tie-wraps.

**3.1** Tree protection fencing shall be installed 5'-0" outside the drip line of the tree. See details in Drawings.

**PART 4 MEASUREMENT AND PAYMENT**

4.00 The quantity to be paid for tree protection and pruning shall be the lump sum price per the bid proposal. The lump sum price for tree protection & pruning shall include all labor, equipment, materials, and other appurtenances for the complete protection of all trees as designated on the Drawings.

**END OF SECTION**

**DIVISION 33**  
**UTILITIES**





**PART 1 - GENERAL****1.1 SUMMARY**

- A. Section Includes:
  - 1. Testing for sanitary sewer pipe and manholes prior to placing in service
    - a. Low Pressure Air Test and Deflection (Mandrel) Test
      - 1) Excludes pipe with flow.
      - 2) Hydrostatic Testing is not allowed.
    - b. Vacuum Testing for sanitary sewer manholes
  - 2. Before any newly constructed sanitary sewer pipe and manholes are placed into service it shall be cleaned and tested.
  - 3. Pipe testing will include low pressure air test and deflection (mandrel) test for 36-inch pipe and smaller.
  - 4. Hydrostatic testing is not allowed.
  - 5. Manhole testing will include vacuum test.
- B. Deviations from this Standard Specification
  - 1. None.
- C. Related Specification Sections include, but are not necessarily limited to:
  - 1. Division 0 – Bidding Requirements, Contract Forms, and Conditions of the Contract
  - 2. Division 1 – General Requirements
  - 3. Section 03 80 00 – Modifications to Existing Concrete Structures
  - 4. Section 33 01 30.41-42 – Cleaning of Sewers and Manholes

**1.2 PRICE AND PAYMENT PROCEDURES**

- A. Measurement and Payment
  - 1. Pipe Testing
    - a. Measurement
      - 1) This Item is considered subsidiary to the sanitary sewer main (pipe) completed in place.
    - b. Payment
      - 1) The work performed and the materials furnishing in accordance with this Item are subsidiary to the unit price bid per linear foot of sanitary sewer main (pipe) complete in place, and no other compensation will be allowed.
  - 2. Manhole Testing
    - a. Measurement
      - 1) Measurement for testing manholes shall be per each vacuum test.
    - b. Payment
      - 1) The work performed and the materials furnished in accordance with this Item shall be paid for at the unit price bid per each vacuum test completed.
    - c. The price bid shall include:
      - 1) Mobilization
      - 2) Plugs
      - 3) Clean-up

**1.3 REFERENCES [NOT USED]**

**1.4 ADMINISTRATIVE REQUIREMENTS [NOT USED]**

**1.5 SUBMITTALS**

- A. Submittals shall be in accordance with Section 01 33 00.
- B. All submittals shall be approved by the City prior to delivery.

**1.6 ACTION SUBMITTALS/INFORMATIONAL SUBMITTALS [NOT USED]**

**1.7 CLOSEOUT SUBMITTALS**

- A. Test and Evaluation Reports
  - 1. All test reports generated during testing (pass and fail)

**1.8 MAINTENANCE MATERIAL SUBMITTALS [NOT USED]**

**1.9 QUALITY ASSURANCE**

- A. Certifications
  - 1. Mandrel Equipment
    - a. If requested by City, provide Quality Assurance certification that the equipment used has been designed and manufactured in accordance to the required specifications.

**1.10 DELIVERY, STORAGE, AND HANDLING [NOT USED]**

**1.11 FIELD [SITE] CONDITIONS [NOT USED]**

**1.12 WARRANTY [NOT USED]**

**PART 2 - PRODUCTS [NOT USED]**

**PART 3 - EXECUTION**

**3.1 INSTALLERS [NOT USED]**

**3.2 EXAMINATION [NOT USED]**

**3.3 PREPARATION**

- A. Low Pressure Air Test (Pipe)
  - 1. Clean the sewer main before testing, as outlined in Section 33 01 30.41-42.
  - 2. Plug ends of all branches, laterals, tees, wyes, and stubs to be included in test.
- B. Deflection (mandrel) test (Pipe)
  - 1. Perform as last work item before final inspection.
  - 2. Clean the sewer main and inspect for offset and obstruction prior to testing.
  - 3. Materials
    - a. Mandrel used for deflection test
      - 1) Use of an uncertified mandrel or a mandrel altered or modified after certification will invalidate the deflection test.
      - 2) Mandrel requirements
        - a) Odd number of legs with 9 legs minimum
        - b) Effective length not less than its nominal diameter

- c) Fabricated of rigid and nonadjustable steel
- d) Fitted with pulling rings and each end
- e) Stamped or engraved on some segment other than a runner indicating the following:
  - (1) Pipe material specification
  - (2) Nominal size
  - (3) Mandrel outside diameter (OD)
- f) Mandrel diameter must be 95 percent of inside diameter (ID) of pipe.

C. Vacuum test (Manhole)

1. Plug lifting holes and exterior joints.
2. Plug pipes and stubouts entering the manhole.
3. Secure stubouts, manhole boots, and pipe plugs to prevent movement while vacuum is drawn.
4. Plug pipes with drop connections beyond drop.
5. Place test head inside the frame at the top of the manhole.

**3.4 INSTALLATION**

A. Low pressure air test (Pipe)

1. Install plug with inlet tap.
2. Connect air hose to inlet tap and a portable air control source.
3. After the stabilization period (3.5 psig minimum pressure) start the stop watch.
4. Determine time in seconds that is required for the internal air pressure to reach 2.5 psig. Minimum permissible pressure holding time per diameter per length of pipe is computed from the following equation:

$$T = \frac{0.0850 \cdot D \cdot K}{Q}$$

Where:

- T = shortest time, seconds, allowed for air pressure to drop to 1.0 psig
- K =  $0.000419 \cdot D \cdot L$ , but not less than 1.0
- D = nominal pipe diameter, inches
- L = length of pipe being tested (by pipe size), feet
- Q = 0.0015, cubic feet per minute per square foot of internal surface

5. UNI-B-6, Table 1 provides required time for given lengths of pipe for sizes 4-inch through 60-inch based on the equation above.
6. Stop test if no pressure loss has occurred during the first 25 percent of the calculated testing time.

B. Deflection (mandrel) test (Pipe)

1. For pipe 36 inches and smaller, the mandrel is pulled through the pipe by hand to ensure that maximum allowable deflection is not exceeded.
2. Maximum percent deflection by pipe size is as follows:

Nominal Pipe Size Inches	Percent Deflection Allowed
12 and smaller	5.0
15 through 30	4.0
Greater than 30	3.0

C. Vacuum test (Manhole)

1. Draw a vacuum of 10 inches of mercury and turn off the pump.
2. With the valve closed, read the level vacuum level after the required test time.
3. Minimum time required for vacuum drop of 1 inch of mercury is as follows:

Depth of Manhole, feet	4-foot Dia Seconds	5-foot Dia Seconds	6-foot Dia Seconds
8	20	26	33
10	25	33	41
12	30	39	49
14	35	45	57
16	40	52	67
18	40	59	73
**	T=5	T=6.5	T=8

\*\* For manholes over 18 feet deep, add "T" seconds as shown for each respective diameter for each 2 feet of additional depth of manhole to the time shown for 18 foot depth. (Example: A 30 foot deep, 4-foot diameter. Total test time would be 70 seconds.  $40+6(5)=70$  seconds)

4. Manhole vacuum levels observed to drop greater than 1 inch of mercury will have failed the test.

**3.5 REPAIR / RESTORATION [NOT USED]**

**3.6 RE-INSTALLATION [NOT USED]**

**3.7 FIELD QUALITY CONTROL**

A. Non-Conforming Work

1. Low pressure air test
  - a. Should the air test fail, find and repair leak(s) and retest.
2. Deflection (mandrel) test (Pipe)
  - a. Should the mandrel fail to pass, the pipe is considered overdeflected.
  - b. Uncover overdeflected pipe. Reinstall if not damaged.
  - c. If damaged, remove and replace.
3. Vacuum test (Manhole)
  - a. Should the vacuum test fail, repair suspect area and retest.
    - 1) External repairs required for leaks at pipe connection to manhole.
      - a) Shall be in accordance with Section 03 80 00.
    - 2) Leaks within the manhole structure may be repaired internally or externally.

- 3.8 SYSTEM STARTUP [NOT USED]
- 3.9 ADJUSTING [NOT USED]
- 3.10 CLEANING [NOT USED]
- 3.11 CLOSEOUT ACTIVITIES [NOT USED]
- 3.12 PROTECTION [NOT USED]
- 3.13 MAINTENANCE [NOT USED]
- 3.14 ATTACHMENTS [NOT USED]

END OF SECTION

**PART 1 - GENERAL**

**1.1 SUMMARY**

- A. Section Includes:
  - 1. Requirements and procedures for Closed Circuit Television (CCTV) Inspection of sanitary sewer or storm sewer mains
- B. Related Specification Sections include, but are not necessarily limited to:
  - 1. Division 0 – Procurement and Contracting Requirements
  - 2. Division 1 – General Requirements
  - 3. Section 33 03 10 – Bypass Pumping of Existing Sewer Systems
  - 4. Section 33 01 30.41 & 42 – Cleaning of Sewers and Manholes

**1.2 PRICE AND PAYMENT PROCEDURES**

- A. Pre-CCTV Inspection
  - 1. Measurement
    - a. Measurement for this Item will be by the linear foot of line televised for CCTV Inspection performed for CIPP or slipline segments prior to any line modification or replacement determined from the distance recorded on the video tape log.
  - 2. Payment
    - a. The work performed and materials furnished in accordance with this Item and measured as provided under “Measurement” will be paid for at the unit price bid per linear foot for “Pre-CCTV Inspection”.
      - 1) Contractor will not be paid for unaccepted video.
  - 3. The price bid shall include:
    - a. Mobilization
    - b. Cleaning
    - c. Documentation
- B. Post-CCTV Inspection
  - 1. Measurement
    - a. Measurement for this Item will be by the linear foot of line televised for CCTV Inspection performed following repair or installation determined from the distance recorded on the digital media log.
  - 2. Payment
    - a. The work performed and materials furnished in accordance with this Item and measured as provided under “Measurement” will be paid for at the unit price bid per linear foot for “Post-CCTV Inspection”.
      - 1) Contractor will not be paid for unaccepted video.
  - 3. The price bid shall include:
    - a. Mobilization
    - b. Cleaning
    - c. Documentation

**1.3 REFERENCES**

- A. Reference Standards
  - 1. Reference standards cited in this Specification refer to the current reference standard published at the time of the latest revision date logged at the end of this Specification, unless a date is specifically cited.

2. National Association of Sewer Service Companies (NASSCO): Pipeline Assessment Certification Program (PACP).
3. Occupational Safety and Health Act (OSHA).

**1.4 ADMINISTRATIVE REQUIREMENTS [NOT USED]**

**1.5 SUBMITTALS**

- A. Submittals shall be in accordance with Section 01 33 00.
- B. All submittals shall be approved by the City prior to delivery.

**1.6 INFORMATIONAL SUBMITTALS**

- A. Pre-CCTV submittals for sanitary sewer lines 24 inches and larger, if required
  1. Project schedule
  2. Listing of cleaning equipment and procedures
  3. Listing of flow diversion procedures
  4. Catalog of manufacturers' data sheets for television equipment.
  5. Listing of backup and standby equipment
  6. Listing of safety precautions and traffic control measures
  7. Certification that staff to be used for the Work are properly trained in confined space entry and hazardous atmospheres.
  8. Training and inspection plan, seven (7) days prior to manual inspection.
  9. Confined space entry procedures and required permits.
  10. Log of cable footage counter calibration checks.
  11. Listing of actual measured flow depth and times.
  12. Project-specific Safety Plan.

**1.7 CLOSEOUT SUBMITTALS**

- A. Post-CCTV submittals
  1. 2 copies of CCTV video results on DVD
  2. 2 hard copies of Inspection Report



**1.8 MAINTENANCE MATERIAL SUBMITTALS [NOT USED]**

**1.9 QUALITY ASSURANCE [NOT USED]**

**1.10 DELIVERY, STORAGE, AND HANDLING [NOT USED]**

**1.11 FIELD [SITE] CONDITIONS [NOT USED]**

**1.12 WARRANTY [NOT USED]**

**PART 2 - PRODUCTS [NOT USED]**

**PART 3 - EXECUTION**

**3.1 INSTALLERS [NOT USED]**

**3.2 EXAMINATION [NOT USED]**

**3.3 PREPARATION**

A. Sanitary Sewer Lines

1. Transport Platform
  - a. Self-propelled, mounted on skid, or mounted on float.
  - b. Sized for each pipe diameter in accordance with manufacturer's recommendations.
  - c. Cables: 1,000 feet long, minimum.
  - d. Equipped with tag line suitable for pulling camera backwards.
  - e. Equipped with winch, power winch, TV cable, powered rewind, or other devices used to move camera through pipe.
    - 1) When powered and controlled winches are used to pull television camera through line, provide telephones, radios, or other means of communication between the two (2) manholes to ensure communications exist between crewmembers.
  - f. Remote Reading Footage Counter:
    - 1) Accuracy: 0.20 foot over length of section being inspected.
    - 2) Counter display.
    - 3) Marking on cable will not be allowed.
    - 4) Calibration: Perform each day prior to setup.
  - g. Secure cable, chains, and other devices used with camera so as not to obstruct camera view or otherwise interfere with proper documentation of sewer conditions.
2. Temporary Bypass Pumping – Conform to Section 33 03 10.
3. Cleaning – Conform to Section 33 01 30.41-42.

**3.4 INSPECTION (CCTV)**

A. General

1. Begin inspection immediately after cleaning of the main.
2. Move camera through the line in either direction at a moderate rate, stopping when necessary to permit proper documentation of the main's condition.
3. Do not move camera at a speed greater than 30 feet per minute.
4. Use manual winches, power winches, TV cable, and power rewinds that do not obstruct the camera view, allowing for proper evaluation.
5. During investigation stop camera at each defect along the main.
  - a. Record the nature, location and orientation of the defect or infiltration location as defined in NAASCO PACP Guidelines. .
6. Pan and tilt the camera to provide additional detail at:
  - a. Manholes
  - b. Service connections

- c. Joints
  - d. Visible pipe defects such as cracks, broken or deformed pipe, holes, offset joints, obstructions or debris
  - e. Infiltration/Inflow locations
  - f. Pipe material transitions
  - g. Other locations that do not appear to be typical for normal pipe conditions
7. Provide accurate distance measurement.
    - a. The meter device is to be accurate to the nearest 1/10 foot.
  8. CCTV inspections are to be continuous.
    - a. Do not provide a single segment of main on more than 1 DVD.
- B. Pre-Installation Inspection for Sewer Mains to be rehabilitated
1. Perform Pre-CCTV inspection immediately after cleaning of the main and before rehabilitation work.
  2. If, during inspection, the CCTV will not pass through the entire section of main due to blockage or pipe defect, set up so the inspection can be performed from the opposite manhole.
- C. Post-Installation Inspection
1. Complete manhole installation before inspection begins.
  2. Prior to inserting the camera, flush and clean the main in accordance with Section 33 01 30.41-42.
- D. Documentation of CCTV Inspection
1. Sanitary Sewer Lines
    - a. Contactor shall adhere to the NAASCO PACP Guidelines for the inspection video, data logging and reporting.
  2. Storm Sewer Lines
- 3.5 CONTACTOR SHALL ADHERE TO THE NAASCO PACP GUIDELINES FOR THE INSPECTION VIDEO, DATA LOGGING AND REPORTING REPAIR / RESTORATION [NOT USED]**
- 3.6 RE-INSTALLATION [NOT USED]**
- 3.7 FIELD [OR] SITE QUALITY CONTROL [NOT USED]**
- 3.8 SYSTEM STARTUP [NOT USED]**
- 3.9 ADJUSTING [NOT USED]**
- 3.10 CLEANING**
- A. See Section 33 01 30.41-42.
- 3.11 CLOSEOUT ACTIVITIES [NOT USED]**
- 3.12 PROTECTION [NOT USED]**
- 3.13 MAINTENANCE [NOT USED]**
- 3.14 ATTACHMENTS [NOT USED]**

**END OF SECTION**

**PART 1 - GENERAL**

**1.1 SUMMARY**

A. Section Includes

1. Requirements and procedures for cleaning sewer lines and manholes prior to the internal television inspection(s) for new or existing wastewater systems.

B. Related Specification Sections include, but are not necessarily limited to:

1. Division 0 – Procurement and Contracting Requirements
2. Division 1 – General Requirements
3. Section 33 01 30.16 – Closed Circuit Television (CCTV) Inspection of Sewer Pipelines

**1.2 PRICE AND PAYMENT PROCEDURES**

A. Measurement and Payment

1. Measurement

- a. This Item is considered subsidiary to the sewer mains, manholes and junction boxes being cleaned.

2. Payment

- a. The work performed and the materials furnished in accordance with this Item are subsidiary to the unit price bid per linear foot of sewer pipe complete in place, and no other compensation will be allowed.

**1.3 REFERENCES [NOT USED]**

**1.4 ADMINISTRATIVE REQUIREMENTS [NOT USED]**

**1.5 SUBMITTALS [NOT USED]**

**1.6 ACTION SUBMITTALS/INFORMATIONAL SUBMITTALS [NOT USED]**

**1.7 CLOSEOUT SUBMITTALS [NOT USED]**

**1.8 MAINTENANCE MATERIAL SUBMITTALS [NOT USED]**

**1.9 QUALITY ASSURANCE [NOT USED]**

**1.10 DELIVERY, STORAGE, AND HANDLING [NOT USED]**

**1.11 FIELD [SITE] CONDITIONS [NOT USED]**

**1.12 WARRANTY [NOT USED]**

**PART 2 - PRODUCTS [NOT USED]**

**2.1 CITY-FURNISHED [OR] CITY SUPPLIED PRODUCTS**

**2.2 PRODUCT TYPES**

- A. Use only the type of cleaning material which will not create hazards to health or property or affect treatment plant processes.

**2.3 ACCESSORIES**

**2.4 SOURCE QUALITY CONTROL**

**PART 3 - EXECUTION**

**3.1 INSTALLERS [NOT USED]**

**3.2 EXAMINATION [NOT USED]**

**3.3 PREPARATION [NOT USED]**

**3.4 ERECTION/INSTALLATION/APPLICATION [NOT USED]**

**3.5 REPAIR/RESTORATION [NOT USED]**

**3.6 RE-INSTALLATION [NOT USED]**

**3.7 FIELD [OR] SITE QUALITY CONTROL [NOT USED]**

**3.8 SYSTEM STARTUP [NOT USED]**

**3.9 ADJUSTING [NOT USED]**

**3.10 CLEANING**

A. General

1. All materials, equipment, and personnel necessary to complete the cleaning of the sanitary sewer main and manholes must be present on the jobsite prior to isolating the sewer manhole or line segment and beginning the cleaning process.
2. Maintain clean work and surrounding premises within the work limits so as to comply with Federal, State, and local environmental and anti-pollution laws, ordinances, codes, and regulations when cleaning and disposing of waste materials, debris, and rubbish.
3. Keep the work and surrounding premises within work limits free of accumulations of dirt, dust, waste materials, debris, and rubbish.
4. Suitable containers for storage of waste materials, debris, and rubbish shall be provided until time of disposal.
  - a. It is the sole responsibility of the Contractor to secure a licensed legal dump site for the disposal of this material.
  - b. Under no circumstances shall sewage or solids removed from the main or manhole be dumped onto streets or into ditches, catch basins, storm drains, or sanitary sewers.

5. The cleaning process shall remove all grease, sand, silts, solids, rags, debris, etc. from each sewer segment, including the manhole(s) and junction boxes.
6. Selection of cleaning equipment and the method for cleaning shall be based on the condition of the sanitary sewer mains at the time work commences and will be subject to approval by the City .
7. All cleaning equipment and devices shall be operated by experienced personnel.
8. Satisfactory precautions shall be taken to protect the sanitary sewer mains and manholes from damage that might be inflicted by the improper use of the cleaning process or equipment.
9. Any damages done to a sewer main and/or structure by the Contractor shall be repaired by the Contractor at no additional cost and to the satisfaction of the City.
10. Cleaning shall also include the manhole wall and junction box wall washing by high pressure water jet.
11. The Contractor may be required to demonstrate the performance capabilities of the cleaning equipment proposed for use on the project.
  - a. If the results obtained by the proposed sanitary sewer cleaning equipment are not satisfactory, the Contractor shall use different equipment and/or attachments, as required, to meet the requirements of the contract documents.
  - b. More than one type of equipment/attachments may be required at a location.
12. When hydraulic or high velocity cleaning equipment is used, a suitable sand trap, weir, dam, or suction shall be constructed in the downstream manhole in such a manner that all the solids and debris are trapped for removal.
13. Whenever hydraulically propelled cleaning tools which depend upon water pressure to provide their cleaning force, or any tool which retard the flow of water in the sanitary sewer lines are used, precautions shall be taken to insure that the water pressure created does not cause any damage or flooding to public or private property being served by the manhole section involved.
14. Any damage of property, as a result of flooding, shall be the liability and responsibility of the Contractor.
15. The flow of wastewater present in the sanitary sewer main shall be utilized to provide necessary fluid for hydraulic cleaning devices whenever possible.
16. When additional quantities of water from fire hydrants are necessary to avoid delay in normal working procedures, the water shall be conserved and not used unnecessarily.
  - a. No fire hydrant shall be obstructed or used when there is a fire in the area.
  - b. It is the responsibility of the Contractor to obtain the fire hydrant, water meter and all related charges for the set-up, including the water usage bills from respective water purveyor agency.

- c. All expenses shall be considered incidental to the cleaning of the existing sanitary sewer mains.

B. Methods

1. Hydraulic Cleaning

- a. Hydraulic-propelled devices which require a head of water to operate must utilize a collapsible dam.
- b. The dam must be easily collapsible to prevent damage to the sewer main, property, etc.
- c. When using hydraulically propelled devices, precautions shall be taken to insure that the water pressure created does not cause damage or flood public or private property.
- d. Do not increase the hydraulic gradient of the sanitary sewers beyond the elevation that could cause overflow of sewage into area waterways or laterals.
- e. The flow of wastewater present in the sanitary sewer main shall be utilized to provide necessary fluid for hydraulic cleaning devices whenever possible.

2. High-Velocity Cleaning

- a. Cleaning equipment that uses a high velocity water jet for removing debris shall be capable of producing a minimum volume of 50 gpm, with a pressure of 1,500 psi, for the sanitary sewer line and 3,500 psi for the (manhole) structure at the pump.
  - 1) Any variations to this pumping rate must be approved, in advance, by the City.
  - 2) To prevent damage to older sewer mains and property, a pressure less than 1500 psi can be used.
  - 3) A working pressure gauge shall be used on the discharge of all high-pressure water pumps.
  - 4) For sewers 18 inches and larger in diameter, in addition to conventional nozzles, use a nozzle which directs the cleaning force to the bottom of the pipe.
  - 5) Operate the equipment so that the pressurized nozzle continues to move at all times.
  - 6) The pressurized nozzle shall be turned off or reduced anytime the hose is on hold or delayed in order to prevent damage to the line.

3. Mechanical Cleaning

- a. Mechanical cleaning, in addition to normal cleaning when required, shall be with approved equipment and accessories driven by power winching devices.

- b. Submit the equipment manufacturer's operational manual and guidelines to the City, which shall be followed strictly unless modified by the City.
- c. All equipment and devices shall be operated by experienced operators so that they do not damage the pipe in the process of cleaning.
- d. Buckets, scrapers, scooters, porcupines, kites, heavy duty brushes, and other debris-removing equipment/accessories shall be used as appropriate and necessary in the field, in conjunction with the approved power machines.
- e. The use of cleaning devices such as rods, metal pigs, porcupines, root saws, snakes, scooters, sewer balls, kites, and other approved equipment, in conjunction with hand winching device, and/or gas, electric rod propelled devices, shall be considered normal cleaning equipment.

**3.11 CLOSEOUT ACTIVITIES [NOT USED]**

**3.12 PROTECTION [NOT USED]**

**3.13 MAINTENANCE [NOT USED]**

**3.14 ATTACHMENTS [NOT USED]**

**END OF SECTION**

**PART 1 - GENERAL**

**1.1 SUMMARY**

- A. Section Includes:
  - 1. Bypass pumping of the existing sewer system, required on 18-inch and larger sewer lines unless otherwise specified in the Contract Documents
- B. Deviations from this Standard Specification
  - 1. None.
- C. Related Specification Sections include, but are not necessarily limited to:
  - 1. Division 0 – Bidding Requirements, Contract Forms, and Conditions of the Contract
  - 2. Division 1 – General Requirements

**1.2 PRICE AND PAYMENT PROCEDURES**

- A. Measurement and Payment
  - 1. Measurement
    - a. Measurement for this Item will be by lump sum.
  - 2. Payment
    - a. The work performed and materials furnished in accordance with this Item will be paid for at the lump sum price bid for “Bypass Pumping”.
  - 3. The price bid shall include:
    - a. Mobilization
    - b. Development of bypass plans
    - c. Transportation and storage
    - d. Setup
    - e. Confined space entry
    - f. Plugging
    - g. Pumping
    - h. Clean up
    - i. Manhole restoration
    - j. Surface restoration
    - k. Temporary Siphons

**1.3 REFERENCES**

- A. Reference Standards
  - 1. Reference standards cited in this Specification refer to the current reference standard published at the time of the latest revision date logged at the end of this Specification unless a date is specifically cited.
  - 2. Occupational Safety and Health Organization (OSHA).

**1.4 ADMINISTRATIVE REQUIREMENTS**

- A. Coordination
  - 1. Schedule meeting with City to review sewer shutdown prior to replacing or rehabilitating any facilities.
  - 2. City reserves the right to delay schedule due to weather conditions, or other unexpected emergency within the sewer system.
  - 3. Review bypass pumping arrangement or layout in the field with City prior to



beginning operations. Facilitate preliminary bypass pumping run with City staff present to affirm the operation is satisfactory to the City.

4. After replacement or rehabilitation of facilities, coordinate the reestablishment of sewer flow with City staff.
5. Provide onsite continuous monitoring during all bypass pumping operations using one of the following methods:
  - a. Personnel on site
  - b. Portable SCADA equipment

## **1.5 SUBMITTALS**

- A. Submittals shall be in accordance with Section 01 33 00.
- B. All submittals shall be approved by the City prior to delivery.

## **1.6 ACTION SUBMITTALS/INFORMATIONAL SUBMITTALS**

- A. For 18-inch and larger sewer lines, submit a detailed plan and description outlining all provisions and precautions that will be taken with regard to the handling of sewer flows. Submit the plan to the City for approval a minimum of 7 days prior to commencing work. Include the following details:
  1. Schedule for installation and maintenance of the bypass pumping system
  2. Staging areas for pumps
  3. Pump sizes, capacity, number of each size, and power requirements
  4. Calculations for static lift, friction losses, and velocity
  5. Pump curves showing operating range and system head curves
  6. Sewer plugging methods
  7. Size, length, material, joint type, and method for installation of suction and discharge piping
  8. Method of noise control for each pump and/or generator, if required
  9. Standby power generator size and location
  10. Suction and discharge piping plan
  11. Emergency action plan identifying the measures taken in the event of a pump failure or sewer spill
  12. Staffing plan for responding to alarm conditions identifying multiple contacts by name and phone numbers (office, mobile)
  13. A contingency plan to implement in the event the replacement or rehabilitation has unexpected delays or problems

## **1.7 CLOSEOUT SUBMITTALS [NOT USED]**

## **1.8 MAINTENANCE MATERIAL SUBMITTALS [NOT USED]**

## **1.9 QUALITY ASSURANCE [NOT USED]**

## **1.10 DELIVERY, STORAGE, AND HANDLING [NOT USED]**

## **1.11 FIELD [SITE] CONDITIONS [NOT USED]**

## **1.12 WARRANTY [NOT USED]**

## **PART 2 - PRODUCTS**

### **2.1 OWNER-FURNISHED [OR] OWNER-SUPPLIED PRODUCTS [NOT USED]**

### **2.2 EQUIPMENT**

- A. Pumping
  - 1. Provide equipment that will convey 100 percent of wet weather peak flow conditions.
  - 2. Provide fully automatic self-priming pumps. Foot-valves or vacuum pumps are not permitted for priming the system.
  - 3. Pumps must be constructed to allow dry running for periods of time to account for the cyclical nature of sewer flow.
  - 4. Provide 1 stand-by pump for each size to be maintained on site. Place backup pumps online, isolated from the primary system by valve.
  - 5. If multiple pumps are required to meet the flow requirements, provide the necessary fittings and connections to incorporate multiple discharges.
  - 6. Noise levels of the pumping system must follow the requirements of the City noise ordinance for gas wells.
- B. Piping
  - 1. Install pipes with joints which prevent the incident of flow spillage.
- C. Plugs or Stop Logs
  - 1. Plugs
    - a. Select a plug that is made for the size and potential pressure head that will be experienced.
    - b. Provide an additional anchor, support or bracing to secure plug when back pressure is present.
    - c. Use accurately calibrated air pressure gauges for monitoring the inflation pressure.
    - d. Place inflation gauge at location outside of confined space area. Keep the inflation gauge and valve a safe distance from the plugs.
    - e. Never over inflate the plug beyond its pressure rating.
  - 2. Stop Logs
    - a. Use stop log devices designed for the manhole or sewer vault structure in use.
    - b. If applicable, obtain stop logs from City that may be used on specific structures.

**2.3 ACCESSORIES [NOT USED]**

**2.4 SOURCE QUALITY CONTROL [NOT USED]**

**PART 3 - EXECUTION**

**3.1 INSTALLERS [NOT USED]**

**3.2 EXAMINATION [NOT USED]**

**3.3 PREPARATION**

- A. Locate the bypass pipelines in area to minimize disturbance to existing utilities and obtain approval of those locations from the City.
- B. Make preparations to comply with OSHA requirements when working in the presence of sewer gases, oxygen-deficient atmospheres and confined spaces.
- C. Do not begin bypass preparation and operation until City approval of the submittals requested per this Specification.

**3.4 INSTALLATION**

- A. Install and operate pumping and piping equipment in accordance to the submittals provided per this Specification.

- B. Sewer flow stoppage
  - 1. Plugging
    - a. Use confined space procedures and equipment during installation when necessary.
    - b. Thoroughly clean the pipe before insertion of the plug.
    - c. Insert the plug seal surface completely so it is fully supported by the pipe.
    - d. Position the plug where there are not sharp edges or protrusions that may damage the plug.
    - e. Use pressure gauges for measuring inflation pressures.
    - f. Minimize upstream pressure head before deflating and removing.
- C. Sewer flow control and monitoring
  - 1. Take sufficient precautions to ensure sewer flow operations do not cause flooding or damage to public or private property. The Contractor is responsible for any damage resulting from bypass pumping operations.
  - 2. Begin continual monitoring of the sewer system as soon as the sewer is plugged or blocked. Be prepared to immediately start bypass pumping if needed due to surcharge conditions.
  - 3. Sewer discharge may be into another sewer manhole or appropriate vehicle or container only. Do not discharge sewer into an open environment such as an open channel or earthen holding facility.
  - 4. Do not construct bypass facilities where vehicular traffic may travel over the piping.
    - a. Provide details in the suction and discharge piping plan that accommodate both the bypass facilities and traffic without disrupting either service.

**3.5 REPAIR / RESTORATION [NOT USED]**

**3.6 RE-INSTALLATION [NOT USED]**

**3.7 FIELD [OR] SITE QUALITY CONTROL**

A. Field [OR] Site Tests and Inspections

- 1. Perform leakage and pressure tests of the bypass pumping pipe and equipment before actual operation begins. Have City staff on site during tests.

**3.8 SYSTEM STARTUP [NOT USED]**

**3.9 ADJUSTING [NOT USED]**

**3.10 CLEANING [NOT USED]**

**3.11 CLOSEOUT ACTIVITIES**

- A. Once plugging or blocking is no longer necessary, remove in such a way that permits the sewer flow to slowly return to normal – preventing surge, surcharging and major downstream disturbance.

**3.12 PROTECTION [NOT USED]**

**3.13 MAINTENANCE [NOT USED]**

**3.14 ATTACHMENTS [NOT USED]**

**END OF SECTION**

## 33 04 13 SPECIFICATIONS FOR SANITARY SEWER TESTING

### PART 1 – GENERAL

#### 1.1 DESCRIPTION

- A. Acceptance testing criteria and procedures for sanitary sewers below are mandatory:
  - 1. Visual inspection of sewer pipes.
  - 2. Mandrel testing for flexible sewer pipes.
  - 3. Leakage testing of sewer pipes.
  - 4. Leakage testing of manholes.
  - 5. Smoke testing of point repairs.
  - 6. Cleaning and Television Inspection of rehabilitated sanitary sewer (See TVI Specifications)
- B. Tests listed in this Section are required on this Project. Required test is named in other Sections which refer to this Section for testing criteria and procedures.

#### 1.2 UNIT PRICES

- A. No payment will be made for Acceptance Testing for Sanitary Sewers under this section.
- B. Payment for work performed as described under this section is included in the unit price bid for applicable work items.

#### 1.3 PERFORMANCE REQUIREMENTS

- A. Gravity flow sanitary sewers are required to have a straight alignment and uniform grade between manholes.
- B. Flexible pipe, including “semi-rigid” pipe, is required to show no more than 5 percent deflection.
- C. Test pipe no sooner than 30 days after backfilling a line segment but before final acceptance using a standard mandrel to verify that installed pipe is within specified deflection tolerances.
- D. Maximum allowable leakage for infiltration or exfiltration:
  - 1. The total exfiltration, as determined by a hydrostatic head test, must not exceed 50 gallons per inch diameter per mile of pipe per 24 hours at a minimum test head of 2 feet above the crown of the pipe at the upstream manhole or 2 feet above the groundwater elevation, whichever is greater.
  - 2. When pipes are installed more than 2 feet below the groundwater level, use an infiltration test in lieu of the exfiltration test. The total infiltration must not exceed 50 gallons per inch diameter per mile of pipe per 24 hours. Groundwater elevation must be at least 2 feet above the crown of the pipe at the upstream manhole.
  - 3. Refer to Table 02732-1, Water Test Allowable Leakage, at the end of this Section, for measuring leakage in sewers. Perform leakage testing to verify that leakage criteria are met.
- E. Perform air testing in accordance with requirements of this Section and the Texas Commission on Environmental Quality requirements. Refer to Table 02732-2, Time Allowed for Pressure Loss from 3.5 psig to 2.5 psig, Table 02732-3, Minimum testing Times for Low Pressure Air Test, and Table 02732-4, Vacuum Test Timetable, at the end of this Section.

#### **1.4 SUBMITTALS**

- A. Submittals must conform to all provisions and sections of these specifications.
- B. Test Plan:
  - 1. Before testing begins and in adequate time to obtain approval through the submittal process, prepare and submit a test plan for approval by the City.
  - 2. Include testing procedures, methods, equipment, and tentative schedule.
  - 3. Obtain advance written approval for deviations from the Drawings and Specifications.
- C. Test Reports:
  - 1. Submit test reports for each test on each segment of sanitary sewer within 7 days after testing on that segment was performed.
  - 2. Contractor will comply with all warranty requirements as specified in the General Conditions, other applicable parts of the Contract Documents, and as specified herein.

#### **1.5 GRAVITY SANITARY SEWER QUALITY ASSURANCE**

- A. Remove, replace, and retest manholes or sections of pipe which fail to meet specified requirements when tested.
- B. Provide testing reports within seven (7) days after completion.

#### **1.6 SEQUENCING AND SCHEDULING**

- A. Perform testing as work progresses.
- B. Schedule testing so that no more than 1000 linear feet of installed sewer remains untested at any one time.
- C. Coordinate testing schedules with the City Inspector.
- D. Perform testing under observation of the City Inspector.

### **PART 2 – PRODUCTS**

#### **2.1 DEFLECTION MANDREL**

- A. Mandrel Sizing.
  - 1. The outside diameter (OD) of the rigid mandrel will be equal to 95 percent of the inside diameter (I.D.) of the pipe.
  - 2. The inside diameter of the pipe, for the purpose of determining the outside diameter of the mandrel, is the average outside diameter minus two minimum wall thicknesses for O.D. controlled pipe and the average inside diameter for I.D. controlled pipe.
  - 3. Dimensions will be per appropriate standard.
  - 4. Do not consider statistical or other “tolerance package” in mandrel sizing.
- B. Mandrel Design.
  - 1. Construct the rigid mandrel of a metal or a rigid plastic material that can withstand 200 psi without being deformed.
  - 2. The mandrel must have nine or more “runners” or “legs” as long as the total number of legs is an odd number.
  - 3. The barrel section of the mandrel shall have a length of at least 75 percent of the inside diameter of the pipe.

4. The rigid mandrel must not have adjustable or collapsible legs which would allow reduction in mandrel diameter during testing.
  5. Provide and use a proving ring for verifying each size mandrel.
- C. Proving Ring.
1. Furnish a "proving ring" with each mandrel.
  2. Fabricate the ring of 2-inch-thick, 3-inch-wide bar steel to a diameter 0.02-inches larger than approved mandrel diameter.
- D. Mandrel Dimensions (5% allowance).
1. Average inside diameter and minimum mandrel diameter are specified in Table 02732-5, Pipe vs. Mandrel Diameter, at the end of this Section.
  2. Mandrels for higher strength, thicker wall pipe or another pipe not listed in the table may be used when approved by the City.

## **2.2 EXFILTRATION TEST**

- A. Test Equipment:
1. Pipe plugs.
  2. Pipe risers where the manhole cone is less than 2 feet above highest point in pipe or service lead.
  3. Use Lansas Multi-Size Domehead Back and Front Plugs Model 050 Series Manhole vacuum test Plugs, or equal.

## **2.3 INFILTRATION TEST**

- A. Test Equipment:
1. Calibrated 90° V-notch weir.
  2. Pipe plugs.

## **2.4 LOW PRESSURE AIR TEST**

- A. Minimum Requirements for Equipment:
1. Control panel.
  2. Low-pressure air supply connected to control panel.
  3. Pneumatic plugs:
    - 1) Acceptable size for diameter of pipe to be tested.
    - 2) Capable of withstanding internal test pressure without leaking or requiring external bracing.
  4. Air hoses from control panel to:
    - a. Air supply
    - b. Pneumatic plugs
    - c. Sealed line for pressuring
    - d. Sealed line for monitoring internal pressure
- B. Testing Pneumatic Plugs:
1. Place a pneumatic plug in each end of a length of pipe on the ground.
  2. Pressurize plugs to 25 psig; then pressurize sealed pipe to 5 psig.

3. Plugs are acceptable if they remain in place against the test pressure without external aids.

## **2.5 GROUND WATER DETERMINATION**

### **A. Equipment:**

1. Pipe probe or small diameter casing for ground water elevation determination.

## **2.6 SMOKE TESTING**

### **A. Equipment:**

1. Pneumatic plugs.
2. Smoke generator as supplied by Superior Signal Company, or an approved equal.
3. Blowers producing 2500 scfm minimum.

## **PART 3 – EXECUTION**

### **3.1 PREPARATION**

- A. Provide labor, equipment, tools, test plugs, risers, air compressor, air hose, pressure meters, pipe probe, calibrated weirs, or any other device necessary for proper testing and inspection.
- B. Select test methods and pressures for gravity sanitary sewers based on ground water elevation.
- C. Determine ground water elevation using equipment and procedures conforming to Section 01563-Control of Ground Water and Surface Water.

### **3.2 VISUAL INSPECTION OF GRAVITY SANITARY SEWERS**

- A. Check pipe alignment visually by flashing a light between structures.
- B. Verify alignment is true and there are no misplaced pipes.
- C. In case of misalignment or damaged pipe, remove and re-lay or replace pipe segment.

### **3.3 MANDREL TESTING FOR GRAVITY SANITARY SEWERS**

- A. Perform deflection testing on flexible and semi-rigid pipe to confirm pipe has no more than 5 percent deflection.
- B. Mandrel testing shall conform to ASTM D 3034.
- C. Perform testing no sooner than 30 days after backfilling the line segment, but before final acceptance testing of the line segment.
- D. Pull the approved mandrel by hand through sewer sections.
- E. Replace any section of sewer not passing the mandrel.
- F. Mandrel testing is not required for stubs.
- G. Retest repaired or replaced sewer sections.

### **3.4 LEAKAGE TESTING FOR GRAVITY SANITARY SEWERS**

#### **A. Test Options:**

1. Test gravity sanitary sewer pipes for leakage by either exfiltration or infiltration methods, as appropriate, or with low pressure air testing.
2. Unless otherwise specified, the Contractor will furnish and pay for water for testing in accordance with the General Conditions and other applicable parts of the Contract Documents.

3. Test new or rehabilitated sanitary sewer manholes with water or low-pressure air.
  4. Manholes tested with low-pressure air shall undergo a physical inspection before testing.
  5. Perform leakage testing after backfilling of a line segment, and before service connection tie-in.
  6. If no installed piezometer is within 500 feet of the sewer segment, Contractor will provide a temporary piezometer for this purpose.
- B. Compensating for Ground Water Pressure:
1. Where ground water exists, install a pipe nipple at the same time sewer line is placed.
  2. Use a ½ - inch capped pipe nipple approximately 10 inches long.
  3. Make the installation through manhole wall on top of the sewer line where line enters manhole.
  4. Immediately before performing line acceptance test, remove cap, clear pipe nipple with air pressure, and connect a clear plastic tube to nipple.
  5. Support tube vertically and allow water to rise in the tube.
  6. After water stops rising, measure height (in feet) of water over invert of the pipe.
  7. Divide this height by 2.3 feet/psi to determine the ground water pressure to be used in line testing.
- C. Exfiltration test:
1. Determine ground water elevation.
  2. Plug sewer in downstream manhole.
  3. Plug incoming pipes in upstream manhole.
  4. Install riser pipe in outgoing pipe of upstream manhole if highest point in service lead (house service) is less than 2 feet below bottom of manhole cone.
  5. Fill sewer pipe and manhole or pipe riser, if used, with water to a point 2-1/2 feet above highest point in sewer pipe, house lead, or ground water table, whichever is highest.
  6. Allow water to stabilize for one to two hours.
  7. Take water level reading to determine drop of water surface (in inches) over a one-hour period and calculate water loss (1 inch of water in 4 feet diameter manhole equals 8.22 gallons) or measure the quantity of water required to keep water at same level.
  8. Loss shall not exceed that calculated from allowable leakage according to Table 02732-1 at the end of this section.
- D. Infiltration test:
1. Ground water elevation must be not less than 2.0 feet above highest point of sewer pipe or service lead (house service).
  2. Determine ground water elevation.
  3. Plug incoming pipes in upstream manhole.
  4. Insert calibrated 90° V-notch weir in pipe on downstream manhole.
  5. Allow water to rise and flow over weir until it stabilizes.
  6. Take five readings of accumulated volume over a period of 2 hours and use average for infiltration.



7. The average must not exceed that calculated for 2 hours from allowable leakage according to the Table 02732-1 at the end of this Section.
- E. Low Air Pressure Test:
1. When using this test, conform to ASTM C 828, ASTM C 924, or ASTM F 1417, as applicable, with holding time not less than that listed in Table 02732-2.
  2. Air testing for sections of pipe shall be limited to lines less than 36-inch average inside diameter.
  3. Lines 36-inch average inside diameter and larger shall be "joint" tested at each joint.
    - a. The minimum time allowable for the pressure to drop from 3.5 pounds per square inch gauge to 2.5 pounds per square inch during a joint test shall be 10 seconds, regardless of pipe size.
    - b. Conduct "Joint Test" as follows:
      - 1) Each joint must be tested successfully.
      - 2) Set the Joint Tester over joint to be tested so that the two inflation tubes straddle the joint.
      - 3) Inflate "inflation tubes" to 25 psig to seal off joint to be tested.
      - 4) Apply air pressure into void between inflation tubes until pressure reaches 4 psig.
      - 5) After pressure has stabilized, bleed air pressure back to 3.5 psig.
      - 6) Record time required for pressure to drop from 3.5 psig to 2.5 psig.
      - 7) If the time in seconds for the air pressure to decrease from 3.5 psig to 2.5 psig is greater than 10 seconds, the joint is presumed to be free from defect.
      - 8) When the time is less than 10 seconds pipe breakage, joint leakage or leaking tester seals are indicated and an inspection must be made to determine the cause. The contractor shall make such repairs as may be required to accomplish a successful air joint test.
      - 9) Air test the joint before the pipe has been backfilled.
      - 10) Perform air testing as pipe installation progresses.
  4. For pipe sections less than 36-inch average inside diameter:
    - a. Determine ground water level.
    - b. Plug both ends of pipe.
    - c. After a manhole-to-manhole section of sanitary sewer main has been sliplined and prior to any service lines being connected to new liner, plug liner at each manhole with pneumatic plugs.
    - d. Pressurize pipe to 4.0 psig.
    - e. Increase pressure 1.0 psi for each 2.3 feet of ground water over highest point in the system.
    - f. Allow pressure to stabilize for 2 to 4 minutes.
    - g. Adjust pressure to start at 3.5 psig (plus adjustment for ground water table). See Table 02732-2 at the end of this Section.
    - h. To determine air loss, measure the time interval for pressure to drop to 2.5 psig.

- i. The time must exceed that listed in the Table 02732-2 at the end of this Section for pipe diameter and length.
  - j. For sliplining, use diameter of carrier pipe.
- F. Retest: Any section of pipe which fails to meet requirements shall be repaired and retested.

**3.5 TEST CRITERIA TABLES**

A. Exfiltration and Infiltration Water Tests:

Refer to Table 02732-1, Water Test Allowable Leakage, at the end of this Section.

B. Low Pressure Air Test:

- 1. Times in Table 02732-2, Time Allowed for Pressure Loss From 3.5 psig to 2.5 psig, at the end of this Section, are based on the equation from Texas Commission on Environmental Quality (TCEQ) Design Criteria 317.2(a)(4)(B).

$$T = 0.0850 (D) (K) / (Q)$$

where:

T = time for pressure to drop 1.0 pounds per square inch gauge in seconds

K = 0.000419 DL, but not less than 1.0

D = average inside diameter in inches

L = length of line of same pipe size in feet

Q = rate of loss, 0.0015 ft<sup>3</sup> /min./sq. ft. internal surface

- 2. Because a K value of less than 1.0 cannot be used, there are minimum testing times for each pipe diameter as given in Table 02732-3, Minimum Testing Times for Low Pressure Air Test.
- 3. Notes:
  - a. When two pipe sizes are involved, compute the time by the ratio of lengths involved.
  - b. Lines with 27-inch average inside diameter and larger may be air tested at each joint.
  - c. Line with an average inside diameter greater than 36 inches must be air tested for leakage at each joint.
  - d. If the joint test is used, perform a visual inspection of the joint immediately after testing.
  - e. For joint test, the pipe is to be pressurized to 3.5 psi greater than the pressure exerted by groundwater above the pipe. Once the pressure has stabilized, the minimum times allowable for the pressure to drop from 3.5 pounds per square inch gauge to 2.5 pounds per square inch gauge shall be 10 seconds.

**3.6 LEAKAGE TESTING FOR MANHOLES**

- A. After finishing manhole construction, wall sealing, or rehabilitation, but before backfilling, test manholes for water tightness using hydrostatic or vacuum testing procedures.
- B. Plug influent and effluent lines, including service lines, with suitably sized pneumatic or mechanical plugs. Ensure plugs are properly rated for pressures required for test; follow manufacturer's safety and installation recommendations.
- C. Place plugs a minimum of 6 inches outside of manhole walls. Brace inverts to prevent lines from being dislodged if lines entering manhole have not been backfilled.
- D. Vacuum Testing:

1. Install vacuum tester head assembly at top access point of manhole and adjust proper seal on straight top section of manhole structure.
  2. Following manufacturer's instructions and safety precautions, inflate sealing element to the recommended maximum inflation pressure; do not overinflate.
  3. Evacuate manhole with vacuum pump to 10 inches mercury (Hg), disconnect pump, and monitor vacuum for the time specified in Table 02732-4, Vacuum Test Timetable.
  4. If the drop in vacuum exceeds 1 inch Hg over the specified time tabulated above, locate leaks, complete repairs necessary to seal manhole and repeat test procedure until satisfactory results are obtained.
- E. Hydrostatic Exfiltration Testing: Hydrostatic exfiltration testing shall be performed as follows:
1. Seal wastewater lines coming into the manhole with an internal pipe plug. Then, fill the manhole with water and maintain it full for at least one hour.
  2. The maximum leakage for hydrostatic testing shall be 0.025 gallons per foot of manhole diameter per foot of manhole depth per hour.
  3. If water loss exceeds amount tabulated above, locate leaks, complete repairs necessary to seal manhole and repeat test procedure until satisfactory results are obtained.

### **3.7 SMOKE TEST PROCEDURE FOR POINT REPAIRS**

A. Application: Perform smoke test to:

1. Locate points of line failure for point repair.
2. Determine if point repairs are properly made.
3. Determine if service connections have been reconnected to the rehabilitated sewer.
4. Check integrity of connections to newly replaced service taps to liners and to existing private service connections.

B. Limitations:

1. Do not backfill service taps until completion of this test.
2. Test only those taps in a single manhole section at any one time.
3. Keep the number of open excavations to a minimum.

C. Preparation:

1. Provide written notice to residents a minimum of 2 days, maximum of 7 days, before smoke testing.
2. Notify City Police and Fire Departments 24 hours before actual smoke testing.

D. Isolate Section:

1. Isolate manhole section to be tested from adjacent manhole sections to keep smoke localized.
2. Temporarily seal the annular space at manhole for sliplined sections.

E. Smoke Introduction:

1. Operate equipment according to manufacturer's recommendation and as approved by City Inspector.
2. Conduct test by forcing smoke from smoke generators through sanitary sewer main and service connections.
3. Operate smoke generators for a minimum of 5 minutes.

4. Introduce smoke into upstream and downstream manholes as appropriate.
  5. Monitor the tap/connection for smoke leaks.
  6. Note sources of leaks.
- F. Repair and Retest:
1. Repair and replace any taps or connections noted as leaking and then retest.
  2. Taps and connections may be left exposed in only one manhole section at a time.
  3. If repair or replacement, testing or retesting, and backfilling of the excavation is not completed within one workday, properly barricade, and cover each excavation as approved by City Representative.
- G. Service Connections:
1. On houses where smoke does not release from plumbing vent stacks to confirm sewer service reconnection to the newly installed liner pipe, perform a dye test to confirm reconnection.
  2. Introduce dye into the service line through a plumbing fixture inside the structure or a sewer cleanout immediately outside the structure and flush with water.
  3. Observe flow at service reconnection or downstream manhole.
  4. Detection of dye confirms a reconnection.

**TABLE SST-1 WATER TEST ALLOWABLE LEAKAGE**

DIAMETER OF RISER OR STACK IN INCHES	VOLUME PER INCH OF DEPTH		ALLOWANCE LEAKAGE	
	INCH	GALLONS	PIPE SIZE (IN)	GPM/100FT.
1	0.7854	0.0034	6	0.0039
2	3.1416	0.0136	8	0.0053
2.5	4.9087	0.0212	10	0.0066
3	7.0686	0.0306	12	0.0079
4	12.5664	0.0306	15	0.0099
5	19.6350	0.0544	18	0.0118
6	28.2743	0.1224	21	0.0138
8	50.2655	0.2176	24	0.0158
			27	0.0177
			30	0.0197
			36	0.0237
			42	0.0276
For other diameters, multiply square of diameters by value for 1" diameter			Equivalent to 50 gallons per inch of inside diameter per mile per 24 hours.	

\* Allowable leakage rate shall be reduced to 10 gallons per inch of inside diameter per mile per 24 hours, when sewer is identified as located within the 25-year flood plain.

**TABLE SST-2 TIME ALLOWED FOR PRESSURE LOSS FROM 3.5 PSIG TO 2.5 PSIG**

PIPE DIAMETER (IN)	MIN. TIME (MIN:SEC)	LENGTH FOR MIN. TIME (FT)	TIME FOR LONGER LENGTH (SEC/FT)	SPECIFICATION TIME FOR LENGTH (L, IN FEET) SHOWN (MIN:SEC)										
				100	150	200	250	300	350	400	450	500	550	600
6	5:40	398	0.8548	5:40	5:40	5:40	5:40	5:40	5:40	5:42	6:25	7:07	7:50	8:33
8	7:33	298	1.5196	7:33	7:33	7:33	7:33	7:36	8:52	10:08	11:24	12:40	13:56	15:12
10	9:27	239	2.3743	9:27	9:27	9:27	9:54	11:52	13:51	15:50	17:48	19:47	21:46	23:45
12	11:20	199	3.4190	11:20	11:20	11:20	14:15	17:06	19:57	22:48	25:39	28:30	31:20	34:11
15	14:10	159	5.3423	14:10	14:10	17:48	22:16	26:43	31:10	35:37	40:04	44:31	48:58	53:25
18	17:00	133	7.6928	17:00	19:14	25:39	32:03	38:28	44:52	51:17	57:42	64:06	70:31	76:56
21	19:50	114	10.4708	19:50	26:11	34:54	43:38	52:21	61:05	69:48	78:32	87:15	95:59	104:42
24	22:40	99	13.6762	22:48	34:11	45:35	56:59	68:23	79:47	91:10	102:34	113:58	125:22	136:46
27	25:30	88	17.3089	28:51	43:16	57:42	72:07	86:33	100:58	115:24	129:49	144:14	158:40	173:05
30	28:20	80	21.3690	35:37	53:25	71:14	89:02	106:51	124:39	142:28	160:16	178:05	195:53	213:41
33	31:10	72	25.8565	43:06	64:38	86:11	107:44	129:17	150:50	172:23	193:55	215:28	237:01	258:34

**TABLE SST-3 MINIMUM TESTING TIMES FOR LOW PRESSURE AIR TEST**

<b>PIPE DIAMETER (inches)</b>	<b>MINIMUM TIME (seconds)</b>	<b>LENGTH FOR MINIMUM TIME</b>	<b>TIME FOR LONGER LENGTH (seconds)</b>
6	340	398	0.855 (L)
8	454	298	1.520 (L)
10	567	239	2.374 (L)
12	680	199	3.419 (L)
15	850	159	5.342 (L)
18	1020	133	7.693 (L)
21	1190	114	10.471 (L)
24	1360	100	13.676 (L)
27	1530	88	17.309 (L)
30	1700	80	21.369 (L)
33	1870	72	25.856 (L)

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**TABLE SST-4 VACUUM TEST TIME**

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<b>DEPTH IN FEET</b>	<b>TIME IN SECONDS BY PIPE DIAMETER</b>		
	<b>48"</b>	<b>60"</b>	<b>72"</b>
<b>4</b>	10	13	16
<b>8</b>	20	26	32
<b>12</b>	30	39	48
<b>16</b>	40	52	64
<b>20</b>	50	65	80
<b>24</b>	60	78	96
<b>*(T)*</b>	5.0	6.5	8.0
* Add T times for each additional 2-foot depth. (The values listed above have been extrapolated from ASTM C 924-85)			



**TABLE SST-5 PIPE VS. MANDREL DIAMETER**

<b>Material and Wall Construction</b>	<b>Nominal Size (Inches)</b>	<b>Average I.D. (Inches)</b>	<b>Minimum Mandrel Diameter</b>
PVC-Solid (SDR 26)	6	5.764	5.476
	8	7.715	7.329
	10	9.646	9.162
PVC-Solid (SDR 35)	12	11.737	11.150
	15	14.374	13.655
	18	17.629	16.748
	21	20.783	19.744
	24	23.381	22.120
	27	26.351	25.033
Fiberglass-Centrifugally	12	12.850	11.822
	18	18.660	17.727
	20	20.680	19.646
	24	24.720	23.484
	30	30.680	29.146
	36	36.740	34.903
	42	42.700	40.565
	48	48.760	46.322
	54	54.820	52.079
60	60.380	57.361	

**END OF SECTION**

**33 04 30      TEMPORARY WATER SERVICES**

**PART 1 - GENERAL**

**1.1 SUMMARY**

- A. Section Includes:
  - 1. Temporary Water Service needed to maintain service during water main replacement project.
- B. Deviations from this Standard Specification
  - 1. None.
- C. Products Installed But Not Furnished Under This Section
  - 1. Fire Hydrant Meters
- D. Related Specification Sections include, but are not necessarily limited to:
  - 1. Division 0 – Bidding Requirements, Contract Forms, and Conditions of the Contract
  - 2. Division 1 – General Requirements
  - 3. Specification 32 12 16 – Asphalt Paving
  - 4. Specification 33 05 10 – Utility Trench Excavation, Embedment and Backfill
  - 5. Specification 33 04 40 – Cleaning and Acceptance Testing of Water Mains
  - 6. Specification 33 12 10 – Water Services 1-inch to 2-inch

**1.2 PRICE AND PAYMENT PROCEDURES**

- A. Measurement and Payment
  - 1. Measurement
    - a. Measurement for Temporary Water Services will be measured by:
      - 1) Lump sum or
      - 2) Per linear foot of Temporary Water Main for Miscellaneous Projects only
  - 2. Payment
    - a. The work performed and materials furnished in accordance with this Item and measured under “Measurement” will be paid for at the unit price bid for “Temporary Water Service” of the type specified.
  - 3. The price bid shall include:
    - a. Temporary water service line
    - b. Connections
    - c. Fittings
    - d. Valves
    - e. Corporation stops
    - f. Temporary asphalt for crossings
    - g. Traffic Control
    - h. Disinfection
    - i. Removal of temporary services

**1.3 REFERENCES**

- A. Reference Standards
  - 1. Reference standards cited in this Specification refer to the current reference standard published at the time of the latest revision date logged at the end of this Specification, unless a date is specifically cited.

- 2. NSF International
  - a. 61, Drinking Water System Components – Health Effects
- 3. ASTM International (ASTM):
  - a. D3035, Standard Specification for Polyethylene (PE) Plastic Pipe (DR-PR) Based on Controlled Outside Diameter

**1.4 ADMINISTRATIVE REQUIREMENTS**

- A. Scheduling
  - 1. Provide advance notice for service interruption and meet requirements of Division 1.

**1.5 SUBMITTALS [NOT USED]**

**1.6 ACTION SUBMITTALS/INFORMATIONAL SUBMITTALS [NOT USED]**

**1.7 CLOSEOUT SUBMITTALS [NOT USED]**

**1.8 MAINTENANCE MATERIAL SUBMITTALS [NOT USED]**

**1.9 QUALITY ASSURANCE [NOT USED]**

**1.10 DELIVERY, STORAGE, AND HANDLING [NOT USED]**

**1.11 FIELD [SITE] CONDITIONS [NOT USED]**

**1.12 WARRANTY [NOT USED]**

**PART 2 - PRODUCTS**

**2.1 OWNER-FURNISHED PRODUCTS**

- A. Fire Hydrant Meters

**2.2 EQUIPMENT, PRODUCT TYPE, AND MATERIALS**

- A. Description
  - 1. Regulatory Requirements
    - a. All Temporary Water Service components in contact with potable water shall conform to the requirements of NSF 61.
- B. Materials
  - 1. Service Couplings, Fittings, and Corporation Stops
    - a. Conform to Section 33 12 10.
  - 2. Service lines
    - a. Polyethylene tubing
    - b. Conform to ASTM D3035 and SDR 11
  - 3. Temporary Water Service Main
    - a. Galvanized steel pipe
    - b. Conform to Schedule 40.
  - 4. Driveway Approach
    - a. Asphalt
      - 1) Type B Asphalt in accordance with Section 32 12 16
- C. Design Criteria
  - 1. Service lines
    - a. ¾-inch minimum pipe size

- b. Minimum flow rate of 5 GPM at a dynamic pressure of 35 psi
- 2. Temporary Water Service Main
  - a. 2-inch minimum pipe size

**2.3 ACCESSORIES [NOT USED]**

**2.4 SOURCE QUALITY CONTROL [NOT USED]**

**PART 3 - EXECUTION**

**3.1 INSTALLERS [NOT USED]**

**3.2 EXAMINATION [NOT USED]**

**3.3 PREPARATION [NOT USED]**

**3.4 INSTALLATION**

A. General

- 1. Install Temporary Water Services in accordance with provisions herein and in accordance with City Standard Details.
- 2. Perform disinfection test of temporary water service main and water services in accordance with Section 33 04 40.

B. Temporary Water Service Installation

- 1. Connect to existing water supply
  - a. Fire hydrant
    - 1) Connect to fire hydrant with hydrant meter and 2-inch gate valve.
  - b. If a fire hydrant is not available, tap existing water main.
    - 1) Connect to water main with 2-inch service tap and a corporation stop in accordance with Section 33 12 10.
    - 2) Record water usage with a hydrant meter.
    - 3) Do not tap existing water main, unless approved by the City.
- 2. Water service
  - a. Connect ¾-inch water service to 2-inch temporary water service main.
  - b. Remove existing meters, tag with address and provide to City Inspector.
  - c. Connect ¾-inch temporary water service to existing private service.
  - d. Cover domestic meter box with protective guard or barricade.

C. Intersection and Driveway Approach Crossing for Temporary Water Service

- 1. Crossing for Temporary Water Service Main
  - a. Cover temporary service line with sufficient asphalt to protect service line and to provide a driveable crossing.
  - b. If required to bury temporary service line due to high volume traffic, or other reasons required by the City, excavate, embed and backfill in accordance with Section 33 05 10.

**3.5 REPAIR / RESTORATION [NOT USED]**

**3.6 RE-INSTALLATION [NOT USED]**

**3.7 FIELD [OR] SITE QUALITY CONTROL**

A. Field Tests and Inspections

- 1. Check each water service installation for leaks with full flow through the curb stop at the time the main is tested in accordance with Section 33 04 40.

- 3.8 SYSTEM STARTUP [NOT USED]
- 3.9 ADJUSTING [NOT USED]
- 3.10 CLEANING [NOT USED]
- 3.11 CLOSEOUT ACTIVITIES [NOT USED]
- 3.12 PROTECTION [NOT USED]
- 3.13 MAINTENANCE [NOT USED]
- 3.14 ATTACHMENTS [NOT USED]

END OF SECTION

**PART 1 - GENERAL****1.1 SUMMARY**

## A. General

1. Before any newly constructed potable water mains will be permitted to be placed into service in the Lewisville Water Department's Water Distribution System, it shall be cleaned (purged) and tested, or cleaned, disinfected, and tested until the bacteria count within the water main meets the standards established by the Lewisville Water Department and the requirements of Chapter 290 of the Texas Administrative Code (TAC) established by the Texas Commission on Environmental Quality (TCEQ).

## B. Deviations from this Standard Specification

1. None.

## C. Related Specification Sections include, but are not necessarily limited to:

1. Division 0 – Bidding Requirements, Contract Forms, and Conditions of the Contract
2. Division 1 – General Requirements
3. Section 33 01 31 – Closed Circuit Television (CCTV) Inspection

**1.2 PRICE AND PAYMENT PROCEDURES**

## A. Measurement and Payment

## 1. Measurement

- a. This Item is considered subsidiary to the water main being Cleaned and Tested.

## 2. Payment

- a. The work performed and the materials furnished in accordance with this Item are subsidiary to cleaning, disinfection, hydrostatic testing, and bacteriological testing and shall be subsidiary to the unit price bid per linear foot of water pipe complete in place, and no other compensation will be allowed.

**1.3 REFERENCES**

## A. Reference Standards

1. Reference standards cited in this Specification refer to the current reference standard published at the time of the latest revision date logged at the end of this Specification, unless a date is specifically cited.
2. American Water Works Association/American (AWWA):
  - a. C301, Prestressed Concrete Pressure Pipe, Steel-Cylinder Type.
  - b. C303, Concrete Pressure Pipe, Bar-Wrapped, Steel-Cylinder Type.
  - c. C651, Disinfecting Water Mains.
  - d. C655, Field De-Chlorination.

#### **1.4 ADMINISTRATIVE REQUIREMENTS [NOT USED]**

#### **1.5 SUBMITTALS**

##### **A. Submittals**

For 24-inch and larger water mains, provide the following:

1. Cleaning Plan – Prior to the start of construction, submit a water main cleaning plan detailing the methods and schedule, including:
  - a. A detailed description of cleaning procedures
  - b. Pigging entry and exit ports
  - c. Flushing procedures
  - d. Plans and hydraulic calculations to demonstrate adequate flushing velocities
  - e. Control of water
  - f. Disposal
2. Disinfection Plan – prior to the start of construction submit a disinfection plan including:
  - a. The method mixing and introducing chlorine
  - b. Flushing
  - c. De-chlorination
  - d. Sampling

**1.6 ACTION SUBMITTALS/INFORMATIONAL SUBMITTALS [NOT USED]**

**1.7 CLOSEOUT SUBMITTALS [NOT USED]**

**1.8 MAINTENANCE MATERIAL SUBMITTALS [NOT USED]**

**1.9 QUALITY ASSURANCE [NOT USED]**

**1.10 DELIVERY, STORAGE, AND HANDLING [NOT USED]**

**1.11 FIELD [SITE] CONDITIONS [NOT USED]**

**1.12 WARRANTY [NOT USED]**

**PART 2 - PRODUCTS**

**2.1 OWNER-FURNISHED [OR] OWNER-SUPPLIED PRODUCTS [NOT USED]**

**2.2 PRODUCT TYPES**

A. Pigs

1. Open cell polyurethane foam body
2. Densities between 2 pounds per cubic foot up to 8 pounds per cubic foot
3. May be wrapped with polyurethane spiral bands
4. Abrasives are not permitted, unless expressly approved by the City in writing for the particular application.
5. Must pass through a reduction up to 65 percent of the cross sectional area of the nominal pipe diameter
6. Pigs shall be able to traverse standard piping arrangements such as 90 degree bends, tees, crosses, wyes, and gate valves.



**2.3 ACCESSORIES [NOT USED]**

**2.4 SOURCE QUALITY CONTROL [NOT USED]**

**PART 3 - EXECUTION**

**3.1 INSTALLERS [NOT USED]**

**3.2 EXAMINATION [NOT USED]**

**3.3 PREPARATION [NOT USED]**

**3.4 ERECTION/INSTALLATION/APPLICATION [NOT USED]**

**3.5 REPAIR/RESTORATION [NOT USED]**

**3.6 RE-INSTALLATION [NOT USED]**

**3.7 FIELD [OR] SITE QUALITY CONTROL [NOT USED]**

**3.8 SYSTEM STARTUP [NOT USED]**

**3.9 ADJUSTING [NOT USED]**

**3.10 CLEANING**

A. General

1. All water mains shall be cleaned prior to bacteriological testing.
  - a. Pig all 36-inch and smaller water mains.
  - b. Pig or manually sweep 42-inch and larger mains.
  - c. Flushing is only permitted when specially designated in the Drawings, or if pigging is not practical and approved by the City.

B. Pigging Method

1. If the method of pigging is to be used, prepare the main for the installation and removal of a pig, including:
  - a. Furnish all equipment, material and labor to satisfactorily expose cleaning wye, remove cleaning wye covers, etc.
  - b. Where expulsion of the pig is required through a dead-ended conduit:
    - 1) Prevent backflow of purged water into the main after passage of the pig.
    - 2) Install a mechanical joint to provide a riser out of the trench on 12-inch and smaller mains to prevent backwater re-entry into the main.
    - 3) Additional excavation of the trench may be performed on mains over 12 inches, to prevent backwater re-entry into the main.

- 4) Flush any backflow water that inadvertently enters the main.
- c. Flush short dead-end pipe sections not swabbed by a pig.
- d. Once pigging is complete:
  - 1) Pigging wyes shall remain in place unless otherwise specified in the Contract Documents.
  - 2) Install cleaning wye, blind flanges or mechanical joint plugs.
  - 3) Plug and place blocking at other openings.
  - 4) Backfill
  - 5) Complete all appurtenant work necessary to secure the system and proceed with disinfection.

C. Flushing Method

- 1. Prepare the main by installing blow-offs at appropriate locations, of sufficient sizes and numbers, and with adequate flushing to achieve a minimum velocity in the main of 2.5 feet per second.
  - a. Minimum blow-off sizes for various main sizes are as follows:
    - 1) 4-inch through 8-inch main – ¾-inch blow-off
    - 2) 10-inch through 12-inch main – 1-inch blow-off
    - 3) 16-inch and greater main – 2-inch blow-off
  - b. Flushing shall be subject to the following limitations:
    - 1) Limit the volume of water for flushing to 3 times the volume of the water main.
    - 2) Do not unlawfully discharge chlorinated water.
    - 3) Do not damage private property.
    - 4) Do not create a traffic hazard.
  - c. Once Flushing is complete:
    - 1) Corporations stops used for flushing shall be plugged.

D. Daily main cleaning

- 1. Wipe joints and then inspect for proper installation.
- 2. Sweep each joint and keep clean during construction.
- 3. Install a temporary plug on all exposed mains at the end of each working day or an extended period of work stoppage.

## E. Hydrostatic Testing

1. All water main that is to be under pressure, shall be hydrostatically tested to meet the following criteria:
  - a. Furnish and install corporations for proper testing of the main.
    - 1) Furnish adequate and satisfactory equipment and supplies necessary to make such hydrostatic tests.
    - 2) The section of line to be tested shall be gradually filled with water, carefully expelling the air and the specified pressure applied.
  - b. The City will furnish water required for the testing at its nearest City line.
  - c. Expel air from the pipe before applying the required test pressure.
  - d. Test Pressure
    - 1) Test pressures should meet the following criteria:
      - a) Not less than 1.25 (187 psi minimum) times the stated working pressure of the pipeline measured at the highest elevation along the test section.
      - b) Not less than 1.5 (225 psi minimum) times the stated working pressure at the lowest elevation of the test section.
  - e. Test Conditions
    - 1) Must be at least 2 hour duration
    - 2) Add water as necessary to sustain the required test pressure.
    - 3) Test fire hydrants to the fire hydrant valve.
      - a) Leave the isolation valve on the fire hydrant lead line open during the hydrostatic testing.
    - 4) Test service lines to curb stop
      - a) Leave the corporation stop on the service line open during the hydrostatic testing.
    - 5) Close isolation valves for air release valves.
    - 6) Makeup water must come from a container of fixed 55 gallon container that does not have a water source.
  - f. Measure all water used in the pressure test through an approved meter, or measure the difference in volume within a 55 gallon container.
    - 1) Do not test against existing water distribution valves unless expressly provided for in the Drawings, or approved by the City.

- 2) If the City denies approval to test against existing water distribution system valve, then make arrangements to plug and test the pipe at no additional cost.

2. Allowable Leakage

- a. No pipe installation should be accepted if the amount of makeup water is greater than that determined using the following formula:

In inch-pound units,

$$L = \frac{SD \sqrt{P}}{148,000}$$

Where:

L = testing allowance (make up water), gallons per hour

S = length of pipe tested, ft.

D = nominal diameter of pipe, in.

P = average test pressure during the hydrostatic test, psi

- b. For any pipeline that fails to pass hydrostatic test:
  - 1) Identify the cause
  - 2) Repair the leak
  - 3) Restore the trench and surface
  - 4) Retest
- c. All costs associated with repairing the pipeline to pass the hydrostatic test is the sole responsibility of the Contractor and included in the price per linear foot of pipe.
- d. If the City determines that an existing system valve is responsible for the hydrostatic test to fail, the Contractor shall make provisions to test the pipeline without the use of the system valve.
- e. There shall be no additional payment to the Contractor if the existing valve is unable to sustain the hydrostatic test and shall be included in the price per linear foot of pipe.

F. Disinfection

1. General

- a. Disinfection of the main shall be accomplished by the "continuous feed" method or the "slug" method as determined by the Contractor.

- b. The free chlorine amounts shown are minimums. The Contractor may require higher rates.
  - 1) Calcium hypochlorite granules shall be used as the source of chlorine.
- c. Continuous Feed Method
  - 1) Apply water at a constant rate in the newly laid main.
    - a) Use the existing distribution system or other approved source of supply.
  - 2) At a point not more than 10 feet downstream from the beginning of the new main, water entering the new main shall receive a dose of chlorine.
    - a) Free chlorine concentration: 50 mg/L minimum, or as required by TCEQ, whichever is greater.
    - b) Chlorine applications shall not cease until the entire conduit is filled with heavily chlorinated water.
  - 3) Retain chlorinated water in the main for at least 24 hours.
    - a) Operate valves and hydrants in the section treated in order to disinfect the appurtenances.
    - b) Prevent the flow of chlorinated water into mains in active service.
    - c) Residual at the end of the 24-hour period: 10 mg /L free chlorine, minimum, for the treated water in all portions of the main.
  - 4) Flush the heavily chlorinated water from the main and dispose of in a manner and at a location accepted by the City.
  - 5) Test the chlorine residual prior to flushing operations.
    - a) If the chlorine residual exceeds 4 mg/L, the water shall remain in the new main until the chlorine residual is less the 4 mg/L.
    - b) The Contractor may choose to evacuate the water into water trucks, or other approved storage facility, and treat the water with Sodium Bisulfate, or another de-chlorination chemical, or method appropriate for potable water and approved by the City until the chlorine residual is reduced to 4 mg/L or less.
    - c) After the specified chlorine residual is obtained, the water may then be discharged into the drainage system or utilized by the Contractor.
- d. Slug Method
  - 1) Water from the existing distribution system or other approved source of supply shall be made to flow at a constant rate in the newly laid main.
  - 2) At a point not more than 10 feet downstream from the beginning of the new main, water entering the new main shall receive a dose of chlorine.
    - a) Free chlorine concentration: 100 mg/L minimum, or as required by TCEQ, whichever is greater.

- b) The chlorine shall be applied continuously and for a sufficient time to develop a solid column or “slug” of chlorinated water that shall expose all interior surfaces to the “slug” for at least 3 hours.
- 3) Operate the fittings and valves as the chlorinated water flows past to disinfect the appurtenances.
- 4) Prevent the flow of chlorinated water into mains in active service.
- 5) Flush the heavily chlorinated water from the main and dispose of in a manner and at a location accepted by the City.
- 6) Upon completion, test the chlorine residual remaining in the main.
  - a) Chlorine levels of 4 mg/l or less should be maintained.

2. Contractor Requirements

- a. Furnish all equipment, material and labor to satisfactorily prepare the main for the disinfection method approved by the City with adequate provisions for sampling.
- b. Make all necessary taps into the main to accomplish chlorination of a new line, unless otherwise specified in the Contract Documents.
- c. After satisfactory completion of the disinfection operation, as determined by the City, remove surplus pipe at the chlorination and sampling points, plug the remaining pipe, backfill and complete all appurtenant work necessary to secure the main.

G. Dechlorination

- 1. General. All chlorinated water shall be de-chlorinated before discharge to the environment. Chemical amounts, as listed in ANSI/AWWA C651: “Disinfecting Water Mains”, shall be used to neutralize the residual chlorine concentrations using de-chlorination procedures listed in ANSI/AWWA C655: “Field De-Chlorination”. De-Chlorination shall continue until chlorine residual is non-detectable.
- 2. Testing. Contractor shall continuously test for the chlorine residual level immediately downstream of the de-chlorination process, during the entire discharge of the chlorinated water. Contractor shall periodically conduct chlorine residual testing and check for possible fish kills at locations where discharged water enters the existing watershed.
- 3. Fish Kill. If a fish kill occurs associated with the discharge of water from the distribution system or any other construction activities:
  - a. The Contract shall immediately alter activities to prevent further fish kills.
  - b. The Contractor shall immediately notify Water Department Field Operations Dispatch.
  - c. The Contractor shall coordinate with City to properly notify TCEQ.

- d. Any fines assessed by the TCEQ (or local, state or federal agencies) for fish kills shall be the responsibility of the Contractor.

H. Bacteriological Testing (Water Sampling)

1. General

- a. Notify the City when the main is suitable for sampling.
- b. The City shall then take water samples from a suitable tap for analysis by the City's laboratory, unless otherwise specified in the Contract Documents.
  - 1) No hose or fire hydrant shall be used in the collection of samples.

2. Water Sampling

- a. Complete microbiological sampling prior to connecting the new main into the existing distribution system in accordance with AWWA C651.
- b. Collect samples for bacteriological analysis in sterile bottles treated with sodium thiosulfate.
- c. Collect 2 consecutive sets of acceptable samples, taken at least 24 hours apart, from the new main.
- d. Collect at least 1 set of samples from every 1,000 linear feet of the new main (or at the next available sampling point beyond 1,000 linear feet as designated by the City), plus 1 set from the end of the line and at least 1 set from each branch.
- e. If trench water has entered the new main during construction or, if in the opinion of the City, excessive quantities of dirt or debris have entered the new main, obtain bacteriological samples at intervals of approximately 200 linear feet.
- f. Obtain samples from water that has stood in the new main for at least 16 hours after formal flushing.

3. Repetition of Sampling

- a. Unsatisfactory test results require a repeat of the disinfection process and re-sampling as required above until a satisfactory sample is obtained.

**3.11 CLOSEOUT ACTIVITIES [NOT USED]**

**3.12 PROTECTION [NOT USED]**

**3.13 MAINTENANCE [NOT USED]**

**3.14 ATTACHMENTS [NOT USED]**

**END OF SECTION**

**33 05 10 UTILITY TRENCH EXCAVATION, EMBEDMENT AND BACKFILL**

**PART 1 - GENERAL**

**1.1 SUMMARY**

- A. Section Includes:
  - 1. Excavation, Embedment and Backfill for:
    - a. Pressure Applications
      - 1) Water Distribution or Transmission Main
      - 2) Wastewater Force Main
      - 3) Reclaimed Water Main
    - b. Gravity Applications
      - 1) Wastewater Gravity Mains
      - 2) Storm Sewer Pipe and Culverts
      - 3) Storm Sewer Precast Box and Culverts
  - 2. Including:
    - a. Excavation of all material encountered, including rock and unsuitable materials
    - b. Disposal of excess unsuitable material
    - c. Site specific trench safety
    - d. Pumping and dewatering
    - e. Embedment
    - f. Concrete encasement for utility lines
    - g. Backfill
    - h. Compaction
- B. Deviations from this Standard Specification
  - 1. None.
- C. Related Specification Sections include, but are not necessarily limited to:
  - 1. Division 0 – Bidding Requirements, Contract Forms, and Conditions of the Contract
  - 2. Division 1 – General Requirements
  - 3. Section 02 41 13 – Selective Site Demolition
  - 4. Section 02 41 14 – Utility Removal/Abandonment
  - 5. Section 02 41 15 – Paving Removal
  - 6. Section 03 30 00 – Cast-in-place Concrete
  - 7. Section 03 34 13 – Controlled Low Strength Material (CLSM)
  - 8. Section 31 10 00 – Site Clearing
  - 9. Section 31 25 00 – Erosion and Sediment Control
  - 10. Section 33 05 26 – Utility Markers/Locators
  - 11. Section 34 71 13 – Traffic Control

**1.2 PRICE AND PAYMENT PROCEDURES**

- A. Measurement and Payment
  - 1. Trench Excavation, Embedment and Backfill associated with the installation of an underground utility or excavation
    - a. Measurement
      - 1) This Item is considered subsidiary to the installation of the utility pipeline as designated in the Drawings.



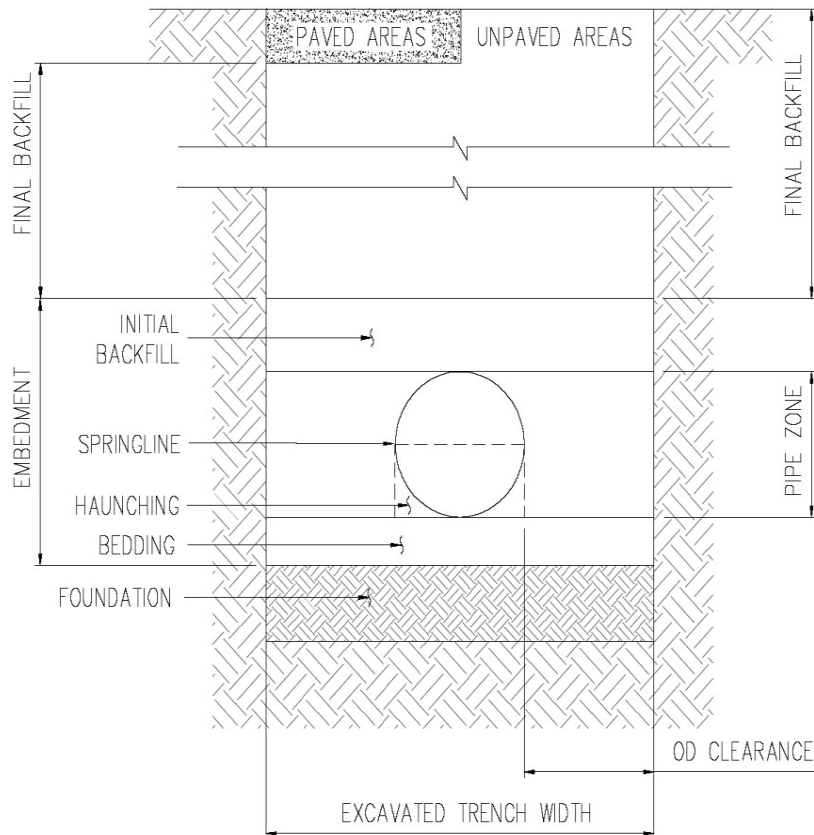
- b. Payment
  - 1) The work performed and the materials furnished in accordance with this Item are considered subsidiary to the installation of the utility pipe for the type of embedment and backfill as indicated on the plans. No other compensation will be allowed.
- 2. Imported Embedment or Backfill
  - a. Measurement
    - 1) Measured by the cubic yard as delivered to the site and recorded by truck ticket provided to the City
  - b. Payment
    - 1) Imported fill shall only be paid when using materials for embedment and backfill other than those identified in the Drawings. The work performed and materials furnished in accordance with pre-bid item and measured as provided under "Measurement" will be paid for at the unit price bid per cubic yard of "Imported Embedment/Backfill" delivered to the Site for:
      - a) Various embedment/backfill materials
  - c. The price bid shall include:
    - 1) Furnishing backfill or embedment as specified by this Specification
    - 2) Hauling to the site
    - 3) Placement and compaction of backfill or embedment
- 3. Concrete Encasement for Utility Lines
  - a. Measurement
    - 1) Measured by the cubic yard per plan quantity.
  - b. Payment
    - 1) The work performed and materials furnished in accordance with this Item and measured as provided under "Measurement" will be paid for at the unit price bid per cubic yard of "Concrete Encasement for Utility Lines" per plan quantity.
  - c. The price bid shall include:
    - 1) Furnishing, hauling, placing and finishing concrete in accordance with Section 03 30 00
    - 2) Clean-up
- 4. Ground Water Control
  - a. Measurement
    - 1) Measurement shall be lump sum when a ground water control plan is specifically required by the Contract Documents.
  - b. Payment
    - 1) Payment shall be per the lump sum price bid for "Ground Water Control" including:
      - a) Submittals
      - b) Additional Testing
      - c) Ground water control system installation
      - d) Ground water control system operations and maintenance
      - e) Disposal of water
      - f) Removal of ground water control system
- 5. Trench Safety
  - a. Measurement
    - 1) Measured per linear foot of excavation for all trenches that require trench safety in accordance with OSHA excavation safety standards (29 CFR Part 1926 Subpart P Safety and Health regulations for Construction)
  - b. Payment
    - 1) The work performed and materials furnished in accordance with this Item

and measured as provided under "Measurement" will be paid for at the unit price bid per linear foot of excavation to comply with OSHA excavation safety standards (29 CFR Part 1926.650 Subpart P), including, but not limited to, all submittals, labor and equipment.

### 1.3 REFERENCES

#### A. Definitions

1. General – Definitions used in this section are in accordance with Terminologies ASTM F412 and ASTM D8 and Terminology ASTM D653, unless otherwise noted.
2. Definitions for trench width, backfill, embedment, initial backfill, pipe zone, haunching bedding, springline, pipe zone and foundation are defined as shown in the following schematic:



3. Deleterious materials – Harmful materials such as clay lumps, silts and organic material
4. Excavated Trench Depth – Distance from the surface to the bottom of the bedding or the trench foundation
5. Final Backfill Depth
  - a. Unpaved Areas – The depth of the final backfill measured from the top of the initial backfill to the surface
  - b. Paved Areas – The depth of the final backfill measured from the top of the initial backfill to bottom of permanent or temporary pavement repair

#### B. Reference Standards

1. Reference standards cited in this Specification refer to the current reference

standard published at the time of the latest revision date logged at the end of this Specification unless a date is specifically cited.

2. ASTM Standards:
  - a. ASTM C33-08 Standard Specifications for Concrete Aggregates
  - b. ASTM C88-05 Soundness of Aggregate by Use of Sodium Sulfate or Magnesium Sulfate
  - c. ASTM C136-01 Test Method for Sieve Analysis of Fine and Coarse Aggregate
  - d. ASTM D448-08 Standard Classification for Sizes of Aggregate for Road and Bridge Construction.
  - e. ASTM C535-09 Standard Test Method for Resistance to Degradation of Large-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine
  - f. ASTM D588 – Standard Test method for Moisture-Density Relations of Soil-Cement Mixture
  - g. ASTM D698-07 Test Method for Laboratory Compaction Characteristics of Soil Using Stand Efforts (12,400 ft-lb/ft<sup>3</sup> 600Kn-m/M<sup>3</sup>).
  - h. ASTM 1556 Standard Test Methods for Density and Unit Weight of Soils in Place by Sand Cone Method.
  - i. ASTM 2487 – 10 Standard Classification of Soils for Engineering Purposes (Unified Soil Classification System)
  - j. ASTM 2321-09 Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications
  - k. ASTM D2922 – Standard Test Methods for Density of Soils and Soil Aggregate in Place by Nuclear Methods (Shallow Depth)
  - l. ASTM 3017 - Standard Test Method for Water Content of Soil and Rock in place by Nuclear Methods (Shallow Depth)
  - m. ASTM D4254 - Standard Test Method for Minimum Index Density and Unit Weight of Soils and Calculations of Relative Density
3. OSHA
  - a. Occupational Safety and Health Administration CFR 29, Part 1926-Safety Regulations for Construction, Subpart P - Excavations

#### **1.4 ADMINISTRATIVE REQUIREMENTS**

##### **A. Coordination**

1. Utility Company Notification
  - a. Notify area utility companies at least 48 hours in advance, excluding weekends and holidays, before starting excavation.

- b. Request the location of buried lines and cables in the vicinity of the proposed work.
- B. Sequencing
  - 1. Sequence work for each section of the pipe installed to complete the embedment and backfill placement on the day the pipe foundation is complete.
  - 2. Sequence work such that proctors are complete in accordance with ASTM D698 prior to commencement of construction activities.

### **1.5 SUBMITTALS**

- A. Submittals shall be in accordance with Section 01 33 00.
- B. All submittals shall be approved by the City prior to construction.

### **1.6 ACTION SUBMITTALS/INFORMATIONAL SUBMITTALS**

- A. Shop Drawings
  - 1. Provide detailed drawings and explanation for ground water and surface water control, if required.
  - 2. Trench Safety Plan in accordance with Occupational Safety and Health Administration CFR 29, Part 1926-Safety Regulations for Construction, Subpart P-Excavations
  - 3. Stockpiled excavation and/or backfill material
    - a. Provide a description of the storage of the excavated material only if the Contract Documents do not allow storage of materials in the right-of-way of the easement.

### **1.7 CLOSEOUT SUBMITTALS [NOT USED]**

### **1.8 MAINTENANCE MATERIAL SUBMITTALS [NOT USED]**

### **1.9 QUALITY ASSURANCE [NOT USED]**

### **1.10 DELIVERY, STORAGE, AND HANDLING**

- A. Storage
  - 1. Within Existing Rights-of-Way (ROW)
    - a. Spoil imported embedment and backfill materials may be stored within existing ROW, easements or temporary construction easements, unless specifically disallowed in the Contract Documents.
    - b. Do not block drainage ways, inlets or driveways.
    - c. Provide erosion control in accordance with Section 31 25 00.
    - d. Store materials only in areas barricaded as provided in the traffic control plans.
    - e. In non-paved areas, do not store material on the root zone of any trees or in landscaped areas.
  - 2. Designated Storage Areas
    - a. If the Contract Documents do not allow the storage of spoils, embedment or backfill materials within the ROW, easement or temporary construction easement, then secure and maintain an adequate storage location.
    - b. Provide an affidavit that rights have been secured to store the materials on private property.
    - c. Provide erosion control in accordance with Section 31 25 00.

- d. Do not block drainage ways.
- e. Only materials used for 1 working day will be allowed to be stored in the work zone.

B. Deliveries and haul-off - Coordinate all deliveries and haul-off.

**1.11 FIELD [SITE] CONDITIONS**

A. Existing Conditions

- 1. Any data which has been or may be provided on subsurface conditions is not intended as a representation or warranty of accuracy or continuity between soils. It is expressly understood that neither the City nor the Engineer will be responsible for interpretations or conclusions drawn there from by the Contractor.
- 2. Data is made available for the convenience of the Contractor.

**1.12 WARRANTY [NOT USED]**

**PART 2 - PRODUCTS**

**2.1 OWNER-FURNISHED [OR] OWNER-SUPPLIED PRODUCTS**

**2.2 MATERIALS**

A. Materials

- 1. Utility Sand
  - a. Granular and free flowing
  - b. Generally, meets or exceeds the limits on deleterious substances per Table 1 for fine aggregate according to ASTM C 33
  - c. Reasonably free of organic material
  - d. Gradation: sand material consisting of durable particles, free of thin or elongated pieces, lumps of clay, loam or vegetable matter and meets the following gradation may be used for utility sand embedment/backfill and graded with following limits when tested in accordance with ASTM C136.

<u>Sieve Size</u>	<u>Percent Retained</u>
1/2"	0
1/4"	0-5
#4	0-10
#16	0-20
#50	20-70
#100	60-90
#200	90-100

- 2. Crushed Rock
  - a. Durable crushed rock or recycled concrete
  - b. Meets the gradation of ASTM D448 size numbers 56, 57 or 67
  - c. May be unwashed
  - d. Free from significant silt clay or unsuitable materials
  - e. Percentage of wear not more than 40 percent per ASTM C131 or C535
  - f. Not more than a 12 percent maximum loss when subjective to 5 cycles of sodium sulfate soundness per ASTM C88

3. Fine Crushed Rock
  - a. Durable crushed rock
  - b. Meets the gradation of ASTM D448 size numbers 8 or 89
  - c. May be unwashed
  - d. Free from significant silt clay or unsuitable materials.
  - e. Have a percentage of wear not more than 40 percent per ASTM C131 or C535
  - f. Not more than a 12 percent maximum loss when subjective to 5 cycles of sodium sulfate soundness per ASTM C88
4. Ballast Stone
  - a. Stone ranging from 3 inches to 6 inches in greatest dimension.
  - b. May be unwashed
  - c. Free from significant silt clay or unsuitable materials
  - d. Percentage of wear not more than 40 percent per ASTM C131 or C535
  - e. Not more than a 12 percent maximum loss when subjected to 5 cycles of sodium sulfate soundness per ASTM C88
5. Acceptable Backfill Material
  - a. In-situ or imported soils classified as CL, CH, SC or GC in accordance with ASTM D2487
  - b. Free from deleterious materials, boulders over 6 inches in size and organics
  - c. Can be placed free from voids
  - d. Must have 20 percent passing the number 200 sieve
6. Blended Backfill Material
  - a. In-situ soils classified as SP, SM, GP or GM in accordance with ASTM D2487
  - b. Blended with in-situ or imported acceptable backfill material to meet the requirements of an Acceptable Backfill Material
  - c. Free from deleterious materials, boulders over 6 inches in size and organics
  - d. Must have 20 percent passing the number 200 sieve
7. Unacceptable Backfill Material
  - a. In-situ soils classified as ML, MH, PT, OL or OH in accordance with ASTM D2487
8. Select Fill
  - a. Classified as SC or CL in accordance with ASTM D2487
  - b. Liquid limit less than 35
  - c. Plasticity index between 8 and 20
9. Cement Stabilized Sand (CSS)
  - a. Sand
    - 1) Shall be clean, durable sand meeting grading requirements for fine aggregates of ASTM C33 and the following requirements:
      - a) Classified as SW, SP, or SM by the United Soil Classification System of ASTM D2487
      - b) Deleterious materials
        - (1) Clay lumps, ASTM C142, less than 0.5 percent
        - (2) Lightweight pieces, ASTM C123, less than 5.0 percent
        - (3) Organic impurities, ASTM C40, color no darker than standard color
        - (4) Plasticity index of 4 or less when tested in accordance with ASTM D4318.
  - b. Minimum of 4 percent cement content of Type I/II Portland cement
  - c. Water

- 1) Potable water, free of soils, acids, alkalis, organic matter or other deleterious substances, meeting requirements of ASTM C94
- d. Mix in a stationary pug mill, weigh-batch or continuous mixing plant.
- e. Strength
  - 1) 50 to 150 psi compressive strength at 2 days in accordance with ASTM D1633, Method A
  - 2) 200 to 250 psi compressive strength at 28 days in accordance with ASTM D1633, Method A
  - 3) The maximum compressive strength in 7 days shall be 400 psi. Backfill that exceeds the maximum compressive strength shall be removed by the Contractor for no additional compensation.
- f. Random samples of delivered product will be taken in the field at point of delivery for each day of placement in the work area. Specimens will be prepared in accordance with ASTM D1632.
- 10. Controlled Low Strength Material (CLSM)
  - a. Conform to Section 03 34 13
- 11. Trench Geotextile Fabric
  - a. Soils other than ML or OH in accordance with ASTM D2487
    - 1) Needle punch, nonwoven geotextile composed of polypropylene fibers
    - 2) Fibers shall retain their relative position
    - 3) Inert to biological degradation
    - 4) Resist naturally occurring chemicals
    - 5) UV Resistant
    - 6) Mirafi 140N by Tencate, or approved equal
  - b. Soils Classified as ML or OH in accordance with ASTM D2487
    - 1) High-tenacity monofilament polypropylene woven yarn
    - 2) Percent open area of 8 percent to 10 percent
    - 3) Fibers shall retain their relative position
    - 4) Inert to biological degradation
    - 5) Resist naturally occurring chemicals
    - 6) UV Resistant
    - 7) Mirafi FW402 by Tencate, or approved equal
- 12. Concrete Encasement
  - a. Conform to Section 03 30 00.

**2.3 ACCESSORIES [NOT USED]**

**2.4 SOURCE QUALITY CONTROL [NOT USED]**

**PART 3 - EXECUTION**

**3.1 INSTALLERS [NOT USED]**

**3.2 EXAMINATION**

- A. Verification of Conditions
  - 1. Review all known, identified or marked utilities, whether public or private, prior to excavation.
  - 2. Locate and protect all known, identified and marked utilities or underground facilities as excavation progresses.
  - 3. Notify all utility owners within the project limits 48 hours prior to beginning

- excavation.
- 4. The information and data shown in the Drawings with respect to utilities is approximate and based on record information or on physical appurtenances observed within the project limits.
- 5. Coordinate with the Owner(s) of underground facilities.
- 6. Immediately notify any utility owner of damages to underground facilities resulting from construction activities.
- 7. Repair any damages resulting from the construction activities.
- B. Notify the City immediately of any changed condition that impacts excavation and installation of the proposed utility.

### 3.3 PREPARATION

#### A. Protection of In-Place Conditions

- 1. Pavement
  - a. Conduct activities in such a way that does not damage existing pavement that is designated to remain.
    - 1) Where desired to move equipment not licensed for operation on public roads or across pavement, provide means to protect the pavement from all damage.
  - b. Repair or replace any pavement damaged due to the negligence of the contractor outside the limits designated for pavement removal at no additional cost to the City.
- 2. Drainage
  - a. Maintain positive drainage during construction and re-establish drainage for all swales and culverts affected by construction.
- 3. Trees
  - a. When operating outside of existing ROW, stake permanent and temporary construction easements.
  - b. Restrict all construction activities to the designated easements and ROW.
  - c. Flag and protect all trees designated to remain in accordance with Section 31 10 00.
  - d. Conduct excavation, embedment and backfill in a manner such that there is no damage to the tree canopy.
  - e. Prune or trim tree limbs as specifically allowed by the Drawings or as specifically allowed by the City.
    - 1) Pruning or trimming may only be accomplished with equipment specifically designed for tree pruning or trimming.
  - f. Remove trees specifically designated to be removed in the Drawings in accordance with Section 31 10 00.
- 4. Above ground Structures
  - a. Protect all above ground structures adjacent to the construction.
  - b. Remove above ground structures designated for removal in the Drawings in accordance with Section 02 41 13
- 5. Traffic
  - a. Maintain existing traffic, except as modified by the traffic control plan, and in accordance with Section 34 71 13.
  - b. Do not block access to driveways or alleys for extended periods of time unless:
    - 1) Alternative access has been provided
    - 2) Proper notification has been provided to the property owner or resident
    - 3) It is specifically allowed in the traffic control plan
  - c. Use traffic rated plates to maintain access until access is restored.



6. Traffic Signal – Poles, Mast Arms, Pull boxes, Detector loops
  - a. Notify the City’s Traffic Services Division a minimum of 48 hours prior to any excavation that could impact the operations of an existing traffic signal.
  - b. Protect all traffic signal poles, mast arms, pull boxes, traffic cabinets, conduit and detector loops.
  - c. Immediately notify the City’s Traffic Services Division if any damage occurs to any component of the traffic signal due to the contractor’s activities.
  - d. Repair any damage to the traffic signal poles, mast arms, pull boxes, traffic cabinets, conduit and detector loops as a result of the construction activities.
7. Fences
  - a. Protect all fences designated to remain.
  - b. Leave fence in the equal or better condition as prior to construction.

### 3.4 INSTALLATION

#### A. Excavation

1. Excavate to a depth indicated on the Drawings.
2. Trench excavations are defined as unclassified. No additional payment shall be granted for rock or other in-situ materials encountered in the trench.
3. Excavate to a width sufficient for laying the pipe in accordance with the Drawings and bracing in accordance with the Excavation Safety Plan.
4. The bottom of the excavation shall be firm and free from standing water.
  - a. Notify the City immediately if the water and/or the in-situ soils do not provide for a firm trench bottom.
  - b. The City will determine if any changes are required in the pipe foundation or bedding.
5. Unless otherwise permitted by the Drawings or by the City, the limits of the excavation shall not advance beyond the pipe placement so that the trench may be backfilled in the same day.
6. Over Excavation
  - a. Fill over excavated areas with the specified bedding material as specified for the specific pipe to be installed.
  - b. No additional payment will be made for over excavation or additional bedding material.
7. Unacceptable Backfill Materials
  - a. In-situ soils classified as unacceptable backfill material shall be separated from acceptable backfill materials.
  - b. If the unacceptable backfill material is to be blended in accordance with this Specification, then store material in a suitable location until the material is blended.
  - c. Remove all unacceptable material from the project site that is not intended to be blended or modified.
8. Rock – No additional compensation will be paid for rock excavation or other changed field conditions.

#### B. Shoring, Sheet piling and Bracing

1. Engage a Licensed Professional Engineer in the State of Texas to design a site-specific excavation safety system in accordance with Federal and State requirements.
2. Excavation protection systems shall be designed according to the space limitations as indicated in the Drawings.

3. Furnish, put in place and maintain a trench safety system in accordance with the Excavation Safety Plan and required by Federal, State or local safety requirements.
  4. If soil or water conditions are encountered that are not addressed by the current Excavation Safety Plan, engage a Licensed Professional Engineer in the State of Texas to modify the Excavation Safety Plan and provide a revised submittal to the City.
  5. Do not allow soil, or water containing soil, to migrate through the Excavation Safety System in sufficient quantities to adversely affect the suitability of the Excavation Protection System. Movable bracing, shoring plates or trench boxes used to support the sides of the trench excavation shall not:
    - a. Disturb the embedment located in the pipe zone or lower
    - b. Alter the pipe's line and grade after the Excavation Protection System is removed
    - c. Compromise the compaction of the embedment located below the spring line of the pipe and in the haunching
- C. Water Control
1. Surface Water
    - a. Furnish all materials and equipment and perform all incidental work required to direct surface water away from the excavation.
  2. Ground Water
    - a. Furnish all materials and equipment to dewater ground water by a method which preserves the undisturbed state of the subgrade soils.
    - b. Do not allow the pipe to be submerged within 24 hours after placement.
    - c. Do not allow water to flow over concrete until it has sufficiently cured.
    - d. Engage a Licensed Engineer in the State of Texas to prepare a Ground Water Control Plan if any of the following conditions are encountered:
      - 1) A Ground Water Control Plan is specifically required by the Contract Documents
      - 2) If in the sole judgment of the City, ground water is so severe that an Engineered Ground Water Control Plan is required to protect the trench or the installation of the pipe which may include:
        - a) Ground water levels in the trench are unable to be maintained below the top of the bedding
        - b) A firm trench bottom cannot be maintained due to groundwater
        - c) Ground water entering the excavation undermines the stability of the excavation.
        - d) Ground water entering the excavation is transporting unacceptable quantities of soils through the Excavation Safety System.

- e. In the event that there is no bid item for a Ground Water Control and the City requires an Engineered Ground Water Control Plan due to conditions discovered at the site, the contractor will be eligible to submit a change order.
- f. Control of ground water shall be considered subsidiary to the excavation when:
  - 1) No Ground Water Control Plan is specifically identified and required in the Contract Documents
- g. Ground Water Control Plan installation, operation and maintenance
  - 1) Furnish all materials and equipment necessary to implement, operate and maintain the Ground Water Control Plan.
  - 2) Once the excavation is complete, remove all ground water control equipment not called to be incorporated into the work.
- h. Water Disposal
  - 1) Dispose of ground water in accordance with City policy or Ordinance.
  - 2) Do not discharge ground water onto or across private property without written permission.
  - 3) Permission from the City is required prior to disposal into the Sanitary Sewer.
  - 4) Disposal shall not violate any Federal, State or local regulations.

D. Embedment and Pipe Placement

- 1. Water Lines less than, or equal to, 12 inches in diameter:
  - a. The entire embedment zone shall be of uniform material.
  - b. Utility sand shall be generally used for embedment.
  - c. If ground water is in sufficient quantity to cause sand to pump, then use crushed rock as embedment.
    - 1) If crushed rock is not specifically identified in the Contract Documents, then crushed rock shall be paid by the pre-bid unitprice.
  - d. Place evenly spread bedding material on a firm trench bottom.
  - e. Provide firm, uniform bedding.
  - f. Place pipe on the bedding in accordance with the alignment of the Drawings.
  - g. In no case shall the top of the pipe be less than 42 inches from the surface of the proposed grade, unless specifically called for in the Drawings.
  - h. Place embedment, including initial backfill, to a minimum of 6 inches, but not more than 12 inches, above the pipe.
  - i. Where gate valves are present, the initial backfill shall extend to 6 inches above the elevation of the valve nut.
  - j. Form all blocking against undisturbed trench wall to the dimensions in the Drawings.
  - k. Compact embedment and initial backfill.
  - l. Place marker tape on top of the initial trench backfill in accordance with Section 33 05 26.
- 2. Water Lines 16-inches through 24-inches in diameter:
  - a. The entire embedment zone shall be of uniform material.
  - b. Utility sand may be used for embedment when the excavated trench depth is less than 15 feet deep.
  - c. Crushed rock or fine crushed rock shall be used for embedment for excavated trench depths 15 feet, or greater.
  - d. Crushed rock shall be used for embedment for steel pipe.
  - e. Provide trench geotextile fabric at any location where crushed rock or fine crushed rock come into contact with utility sand

- f. Place evenly spread bedding material on a firm trench bottom.
  - g. Provide firm, uniform bedding.
    - 1) Additional bedding may be required if ground water is present in the trench.
    - 2) If additional crushed rock is required not specifically identified in the Contract Documents, then crushed rock shall be paid by the pre-bid unit price.
  - h. Place pipe on the bedding according to the alignment shown on the Drawings.
  - i. The pipeline shall be within:
    - 1)  $\pm 3$  inches of the elevation on the Drawings for 16-inch and 24-inch water lines
  - j. Place and compact embedment material to adequately support haunches in accordance with the pipe manufacturer's recommendations.
  - k. Place remaining embedment including initial backfill to a minimum of 6 inches, but not more than 12 inches, above the pipe.
  - l. Where gate valves are present, the initial backfill shall extend to up to the valve nut.
  - m. Compact the embedment and initial backfill to 95 percent Standard Proctor ASTM D 698.
  - n. Density test may be performed by City to verify that the compaction of embedment meets requirements.
  - o. Place trench geotextile fabric on top of the initial backfill.
  - p. Place marker tape on top of the trench geotextile fabric in accordance with Section 33 05 26.
3. Water Lines 30-inches and greater in diameter
- a. The entire embedment zone shall be of uniform material.
  - b. Crushed rock shall be used for embedment.
  - c. Provide trench geotextile fabric at any location where crushed rock or fine crushed rock come into contact with utility sand.
  - d. Place evenly spread bedding material on a firm trench bottom.
  - e. Provide firm, uniform bedding.
    - 1) Additional bedding may be required if ground water is present in the trench.
    - 2) If additional crushed rock is required which is not specifically identified in the Contract Documents, then crushed rock shall be paid by the pre-bid unit price.
  - f. Place pipe on the bedding according to the alignment shown on the Drawings.
  - g. The pipeline shall be within:
    - 1)  $\pm 1$  inch of the elevation on the Drawings for 30-inch and larger water lines
  - h. Place and compact embedment material to adequately support haunches in accordance with the pipe manufacturer's recommendations.
  - i. For steel pipe greater than 30 inches in diameter, the initial embedment lift shall not exceed the spring line prior to compaction.
  - j. Place remaining embedment, including initial backfill, to a minimum of 6 inches, but not more than 12 inches, above the pipe.
  - k. Where gate valves are present, the initial backfill shall extend to up to the valve nut.
  - l. Compact the embedment and initial backfill to 95 percent Standard Proctor ASTM D 698.

- m. Density test may be performed by City to verify that the compaction of embedment meets requirements.
  - n. Place trench geotextile fabric on top of the initial backfill.
  - o. Place marker tape on top of the trench geotextile fabric in accordance with Section 33 05 26.
4. Sanitary Sewer Lines and Storm Sewer Lines (HDPE)
- a. The entire embedment zone shall be of uniform material.
  - b. Crushed rock shall be used for embedment.
  - c. Place evenly spread bedding material on a firm trench bottom.
  - d. Spread bedding so that lines and grades are maintained and that there are no sags in the sanitary sewer pipeline.
  - e. Provide firm, uniform bedding.
    - 1) Additional bedding may be required if ground water is present in the trench.
    - 2) If additional crushed rock is required which is not specifically identified in the Contract Documents, then crushed rock shall be paid by the pre-bid unit price.
  - f. Place pipe on the bedding according to the alignment shown in the Drawings.
  - g. The pipeline shall be within  $\pm 0.1$  inches of the elevation and be consistent with the grade shown on the Drawings.
  - h. Place and compact embedment material to adequately support haunches in accordance with the pipe manufacturer's recommendations.
  - i. For sewer lines greater than 30 inches in diameter, the embedment lift shall not exceed the spring line prior to compaction.
  - j. Place remaining embedment including initial backfill to a minimum of 6 inches, but not more than 12 inches, above the pipe.
  - k. Compact the embedment and initial backfill to 95 percent Standard Proctor ASTM D 698.
  - l. Density test may be performed by City to verify that the compaction of embedment meets requirements.
  - m. Place trench geotextile fabric on top of the initial backfill.
  - n. Place marker tape on top of the trench geotextile fabric in accordance with Section 33 05 26.
5. Storm Sewer (RCP)
- a. The bedding and the pipe zone up to the spring line shall be of uniform material.
  - b. Crushed rock shall be used for embedment up to the spring line.
  - c. The specified backfill material may be used above the spring line.
  - d. Place evenly spread bedding material on a firm trench bottom.
  - e. Spread bedding so that lines and grades are maintained and that there are no sags in the storm sewer pipeline.
  - f. Provide firm, uniform bedding.
    - 1) Additional bedding may be required if ground water is present in the trench.
    - 2) If additional crushed rock is required which is not specifically identified in the Contract Documents, then crushed rock shall be paid by the pre-bid unit price.
  - g. Place pipe on the bedding according to the alignment of the Drawings.

- h. The pipeline shall be within  $\pm 0.1$  inches of the elevation, and be consistent with the grade, shown on the Drawings.
  - i. Place embedment material up to the spring line.
    - 1) Place embedment to ensure that adequate support is obtained in the haunch.
  - j. Compact the embedment and initial backfill to 95 percent Standard Proctor ASTM D 698.
  - k. Density test may be performed by City to verify that the compaction of embedment meets requirements.
  - l. Place trench geotextile fabric on top of pipe and crushed rock.
6. Storm Sewer Reinforced Concrete Box
- a. Crushed rock shall be used for bedding.
  - b. The pipe zone and the initial backfill shall be:
    - 1) Crushed rock, or
    - 2) Acceptable backfill material compacted to 95 percent Standard Proctor density
  - c. Place evenly spread compacted bedding material on a firm trench bottom.
  - d. Spread bedding so that lines and grades are maintained and that there are no sags in the storm sewer pipeline.
  - e. Provide firm, uniform bedding.
    - 1) Additional bedding may be required if ground water is present in the trench.
    - 2) If additional crushed rock is required which is not specifically identified in the Contract Documents, then crushed rock shall be paid by the pre-bid unit price.
  - f. Fill the annular space between multiple boxes with crushed rock, CLSM according to 03 34 13.
  - g. Place pipe on the bedding according to the alignment of the Drawings.
  - h. The pipe shall be within  $\pm 0.1$  inches of the elevation, and be consistent with the grade, shown on the Drawings.
  - i. Compact the embedment initial backfill to 95 percent Standard Proctor ASTM D698.
7. Water Services (Less than 2 Inches in Diameter)
- a. The entire embedment zone shall be of uniform material.
  - b. Utility sand shall be generally used for embedment.
  - c. Place evenly spread bedding material on a firm trench bottom.
  - d. Provide firm, uniform bedding.
  - e. Place pipe on the bedding according to the alignment of the Plans.
  - f. Compact the initial backfill to 95 percent Standard Proctor ASTM D698.
8. Sanitary Sewer Services
- a. The entire embedment zone shall be of uniform material.
  - b. Crushed rock shall be used for embedment.
  - c. Place evenly spread bedding material on a firm trench bottom.
  - d. Spread bedding so that lines and grades are maintained and that there are no sags in the sanitary sewer pipeline.
  - e. Provide firm, uniform bedding.
    - 1) Additional bedding may be required if ground water is present in the trench.
    - 2) If additional crushed rock is required which is not specifically identified in the Contract Documents, then crushed rock shall be paid by the pre-bid unit price.
  - f. Place pipe on the bedding according to the alignment of the Drawings.
  - g. Place remaining embedment, including initial backfill, to a minimum of 6

inches, but not more than 12 inches, above the pipe.

- h. Compact the initial backfill to 95 percent Standard Proctor ASTM D698.
- i. Density test may be required to verify that the compaction meets the density requirements.

E. Trench Backfill

- 1. At a minimum, place backfill in such a manner that the required in-place density and moisture content is obtained, and so that there will be no damage to the surface, pavement or structures due to any trench settlement or trench movement.
  - a. Meeting the requirement herein does not relieve the responsibility to damages associated with the Work.
- 2. Backfill Material
  - a. Final backfill depth less than 15 feet
    - 1) Backfill with:
      - a) Acceptable backfill material
      - b) Blended backfill material, or
      - c) Select backfill material, CSS, or CLSM when specifically required
  - b. Final backfill depth 15 feet or greater: (under pavement or future pavement)
    - 1) Backfill depth from 0 to 15 feet deep
      - a) Backfill with:
        - (1) Acceptable backfill material
        - (2) Blended backfill material, or
        - (3) Select backfill material, CSS, or CLSM when specifically required
    - 2) Backfill depth from 15 feet and greater
      - a) Backfill with:
        - (1) Select Fill
        - (2) CSS, or
        - (3) CLSM when specifically required
  - c. Final backfill depth 15 feet or greater: (not under pavement or future pavement)
    - 1) Backfill with:
      - a) Acceptable backfill material, or
      - b) Blended backfill material
  - d. Backfill for service lines:
    - 1) Backfill for water or sewer service lines shall be the same as the requirement of the main that the service is connected to.
- 3. Required Compaction and Density
  - a. Final backfill (depths less than 15 feet)
    - 1) Compact acceptable backfill material, blended backfill material or select backfill to a minimum of 95 percent Standard Proctor per ASTM D698 at moisture content within -2 to +5 percent of the optimum moisture.
    - 2) CSS or CLSM requires no compaction.
  - b. Final backfill (depths 15 feet and greater/under existing or future pavement)
    - 1) Compact select backfill to a minimum of 98 percent Standard Proctor per ASTM D 698 at moisture content within -2 to +5 percent of the optimum moisture.
    - 2) CSS or CLSM requires no compaction.
  - c. Final backfill (depths 15 feet and greater/not under existing or future pavement)
    - 1) Compact acceptable backfill material blended backfill material or select backfill to a minimum of 95 percent Standard Proctor per ASTM D 698 at moisture content within -2 to +5 percent of the optimum moisture.

4. Saturated Soils

- a. If in-situ soils consistently demonstrate that they are greater than 5 percent over optimum moisture content, the soils are considered saturated.
  - b. Flooding the trench or water jetting is strictly prohibited.
  - c. If saturated soils are identified in the Drawings or Geotechnical Report in the Appendix, Contractor shall proceed with Work following all backfill procedures outlined in the Drawings for areas of soil saturation greater than 5 percent.
  - d. If saturated soils are encountered during Work but not identified in Drawings or Geotechnical Report in the Appendix:
    - 1) The Contractor shall:
      - a) Immediately notify the City.
      - b) Submit a Contract Claim for Extra Work associated with direction from City.
    - 2) The City shall:
      - a) Investigate soils and determine if Work can proceed in the identified location.
      - b) Direct the Contractor of changed backfill procedures associated with the saturated soils that may include:
        - (1) Imported backfill
        - (2) A site specific backfill design
5. Placement of Backfill
- a. Use only compaction equipment specifically designed for compaction of a particular soil type and within the space and depth limitation experienced in the trench.
  - b. Flooding the trench or water setting is strictly prohibited.
  - c. Place in loose lifts not to exceed 12 inches.
  - d. Compact to specified densities.
  - e. Compact only on top of initial backfill, undisturbed trench or previously compacted backfill.
  - f. Remove any loose materials due to the movement of any trench box or shoring or due to sloughing of the trench wall.
  - g. Install appropriate tracking balls for water and sanitary sewer trenches in accordance with Section 33 05 26.
6. Backfill Means and Methods Demonstration
- a. Notify the City in writing with sufficient time for the City to obtain samples and perform standard proctor test in accordance with ASTM D698.
  - b. The results of the standard proctor test must be received prior to beginning excavation.
  - c. Upon commencing of backfill placement for the project the Contractor shall demonstrate means and methods to obtain the required densities.
  - d. Demonstrate Means and Methods for compaction including:
    - 1) Depth of lifts for backfill which shall not exceed 12 inches
    - 2) Method of moisture control for excessively dry or wet backfill
    - 3) Placement and moving trench box, if used
    - 4) Compaction techniques in an open trench
    - 5) Compaction techniques around structure
  - e. Provide a testing trench box to provide access to the recently backfilled material.
  - f. The City will provide a qualified testing lab full time during this period to randomly test density and moisture content.
    - 1) The testing lab will provide results as available on the jobsite.

7. Varying Ground Conditions



- a. Notify the City of varying ground conditions and the need for additional proctors.
- b. Request additional proctors when soil conditions change.
- c. The City may acquire additional proctors at its discretion.
- d. Significant changes in soil conditions will require an additional Means and Methods demonstration.

**3.5 REPAIR [NOT USED]**

**3.6 RE-INSTALLATION [NOT USED]**

**3.7 FIELD QUALITY CONTROL**

A. Field Tests and Inspections

1. Proctors

- a. The City will perform Proctors in accordance with ASTM D698.
- b. Test results will generally be available to within 4 calendar days and distributed to:
  - 1) Contractor
  - 2) City Project Manager
  - 3) City Inspector
  - 4) Engineer
- c. Notify the City if the characteristic of the soil changes.
- d. City will perform new proctors for varying soils:
  - 1) When indicated in the geotechnical investigation in the Appendix
  - 2) If notified by the Contractor
  - 3) At the convenience of the City
- e. Trenches where different soil types are present at different depths, the proctors shall be based on the mixture of those soils.

2. Density Testing of Backfill

- a. Density Tests shall be in conformance with ASTM D2922.
- b. Provide a testing trench protection for trench depths in excess of 5 feet.
- c. Place, move and remove testing trench protection as necessary to facilitate all test conducted by the City.
- d. For final backfill depths less than 15 feet and trenches of any depth not under existing or future pavement:
  - 1) The City will perform density testing twice per working day when backfilling operations are being conducted.
  - 2) The testing lab shall take a minimum of 3 density tests of the current lift in the available trench.
- e. For final backfill depths 15 feet and greater deep and under existing or future pavement:
  - 1) The City will perform density testing twice per working day when backfilling operations are being conducted.
  - 2) The testing lab shall take a minimum of 3 density tests of the current lift in the available trench.
  - 3) The testing lab will remain onsite sufficient time to test 2 additional lifts.
- f. Make the excavation available for testing.
- g. The City will determine the location of the test.
- h. The City testing lab will provide results to Contractor and the City's Inspector upon completion of the testing.
- i. A formal report will be posted to the City's Buzzsaw site within 48 hours.
- j. Test reports shall include:

- 1) Location of test by station number
  - 2) Time and date of test
  - 3) Depth of testing
  - 4) Field moisture
  - 5) Dry density
  - 6) Proctor identifier
  - 7) Percent Proctor Density
3. Density of Embedment
- a. Storm sewer boxes that are embedded with acceptable backfill material, blended backfill material, cement modified backfill material or select material will follow the same testing procedure as backfill.
  - b. The City may test fine crushed rock or crushed rock embedment in accordance with ASTM D2922 or ASTM 1556.
- B. Non-Conforming Work
1. All non-conforming work shall be removed and replaced.

**3.8 SYSTEM STARTUP [NOT USED]**

**3.9 ADJUSTING [NOT USED]**

**3.10 CLEANING [NOT USED]**

**3.11 CLOSEOUT ACTIVITIES [NOT USED]**

**3.12 PROTECTION [NOT USED]**

**3.13 MAINTENANCE [NOT USED]**

**3.14 ATTACHMENTS [NOT USED]**

**END OF SECTION**

**PART 1 GENERAL****1.1 SUMMARY**

- A. Description
  - 1. This section specifies construction of sanitary sewer manholes.
- B. Related sections
  - 1. Section 01 33 00 – Submittals
  - 2. Section 33 39 60 – Epoxy Liners for Sanitary Sewer Structures

**1.2 SUBMITTALS**

- A. Make submittals in conformance with Section 01 33 00 - Submittals.
- B. Provide submittals to show conformance with this specification for the following items.
  - 1. Manhole Risers
  - 2. Manhole Frames and Covers
  - 3. Joint Seal Material
  - 4. Precast manhole section information if precast sections are used.
  - 5. Manhole to pipe interface – boot or gasket

**1.3 REFERENCES**

- A. ASTM A48-83 - Specification for Gray Iron Castings.
- B. ASTM A185 - Steel Welded Wire Fabric, Plain, for Concrete Reinforcement.
- C. ASTM A325 - Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength.
- D. ASTM A615 - Deformed and Plain Billet-Steel Bars for Concrete Reinforcement.
- E. ASTM C109 – Compressive Strength Hydraulic Cement Mortars.
- F. ASTM C191 - Time of Setting of Hydraulic Cement by Vicat Needle.
- G. ASTM C425 – Compression Joints for Vitrified Clay Pipe and Fittings
- H. ASTM C443 – Standard Specification for Circular Concrete Sewer and Culvert Pipe, Using Rubber Gaskets.
- I. ASTM C478 - Specification for Precast Reinforced Concrete Manholes Sections.
- J. ASTM C827 - Standard Test Method for Change in Height at Early Stages of Cylindrical Specimens from Cementitious Mixtures.
- K. ASTM D1056 – Standard Specification for Flexible Cellular Materials – Sponge or Expanded Rubber.

**PART 2 PRODUCTS****2.1 MANHOLE RISERS AND SECTIONS**

- A. ASTM C478.

## 2.2 MANHOLE FRAMES AND COVERS

- A. Material shall be cast iron, gray iron, or ductile iron conforming to ASTM A48-83, Class 35 or better. The frame shall exhibit a tensile strength of not less than 35,000 psi, and conform to the following:
1. Frame and Cover Design.
    - a. Designed to support H-20 traffic loading.
    - b. Bearing surfaces between the ring and cover shall be machine finished or ground to assure non-rocking fit in any position, and interchangeability.
    - c. Covers shall set flush with the rim of the frame and shall have no larger than a 1/8-inch gap between the frame and cover.
    - d. The cover shall form a water-resistant seal between the frame and manhole cover surface. The cover shall have concealed pick holes and a machined bearing surface on the bottom of the casting. The cover shall conform to ASTM A 48-83, Class 35 or better, for Gray Iron. The cover shall have a tensile strength of 35,000 psi.
  2. Marking.
    - a. The manhole lid shall have "Sanitary Sewer" on top.
  3. Frame Size.
    - a. Sized to fit a nominal 24-inch manhole opening.
  4. Minimum Cover Opening.
    - a. 20 inches.
  5. Locking Type Cover.
    - a. Locking mechanism - 3 cams connected to and equally spaced around the circumference of the cover.
    - b. Cams released by unlocking hooks.
    - c. Provide at least 2 hooks for every 6 covers.
  6. Watertight Type Cover.
    - a. The bolts for bolt down covers shall be ASTM A325 or better. They shall meet or exceed the manufacturer's recommendations as bolts for the frame and cover.
    - b. Provide a full circle rubber gasket for installation between manhole frame and cover.
    - c. Supply at least 2 operating wrenches for every 6 covers.
  7. Hinged Cover and Frame
    - a. Hinged frame and cover shall be manufactured of ductile iron and meet or exceed AASHTO H-20 loading and shall be Pamrex or approved equal.
    - b. The lid shall open to a minimum of 130 degrees, and block at 90 degrees when closing.
    - c. The frame shall be fitted with an Elastomer gasket to prevent inflow/infiltration.

- d. The lid shall be fitted with a locking device that requires a specially manufactured key for removal and will not open under pressure from surcharge.
- e. At a minimum, provide two keys for every six covers.
- 8. Non-Locking Type Cover.
  - a. "Standard," vented, designed to support AASHTO H20 traffic loadings.
- 9. Manhole Couplings.
  - a. Rubber ring, Fernco or approved equal; Lawson Davis or approved equal.
- 10. Watertight Manhole Inserts
  - a. The manhole insert body shall be manufactured from 304 stainless steel with a thickness of not less than 18 gage and be Rainstopper or approved equal.
  - b. The insert shall have a straight side design to allow a loose fit for easy removal and have no fewer than three (3) ribs stamped in the bottom for added strength.
  - c. The manufacturer shall supply a load test, showing a load test failure in excess of 3000 lbs.
  - d. The manhole insert shall have a gasket that provides positive seal in wet or dry conditions. The gasket shall be made of closed cell neoprene rubber and meet the requirement of ASTM D1056, or equal.
  - e. The manhole insert shall have a strap for removing the insert. The strap shall be made of minimum 1" wide woven polypropylene or nylon webbing, with the ends treated to prevent unravelling, the strap shall be attached with #6 high grade stainless steel rivets and washers to securely attach strap to the insert. The strap shall be capable of withstanding at least 500 pounds of force before failure.
  - f. The manhole insert shall have a valve to release gases at a pressure of 0.5 to 1.5 psi and allow water inflow at a rate no greater than 5 gallons per 24 hours.
  - g. All manhole frame and covers shall be fitted with a watertight manhole insert except a hinged cover and frame as specified in paragraph 7. above.

**2.3 PRECAST CONCRETE SECTIONS AND BASE**

- A. Precast concrete manholes will be allowed. Manholes and sections shall conform to the requirements of ASTM C 478 and as specified herein.
  - 1. Wall thickness shall be minimum 6" for all precast sections.
  - 2. Concentric or eccentric cones may be utilized when manhole depth exceeds six feet. The clear opening of the cone shall be 26 inches.
  - 3. Reinforced concrete flat-top sections shall have a minimum 26-inch diameter opening and be a minimum eight inches thick in non-traffic areas and a minimum ten inches thick in traffic areas (designed for H-20 loading). Reinforce flat-top sections with #4 bars at 12-inch centers each way. Tie and place reinforcing steel below the mid-point. The minimum cover over the

reinforcement shall be two (2) inches. The top or bottom of the flattop shall be clearly labeled or marked.

4. Preformed and trowelable bitumastic joint sealants shall be Kent-seal, Ram-Nek, EZ-STIK, or approved equal, ASTM C443. The minimum dimension of preformed material shall be one-half (1/2) inch square.
5. Do not deliver precast concrete sections to the job until representative concrete cylinders have attained a strength of at least 80 percent of the specified minimum. Inspect precast concrete sections when delivered. Cracked or otherwise visibly defective units will be rejected.
6. The maximum depth of lifting holes shall be no more than one-half the manhole wall thickness. After placement of the manhole, the lifting holes shall be sealed with a non-shrink grout.
7. Contractor is responsible for verifying all manhole depths and sewer pipe flowlines prior to delivery of precast manholes. The Contractor will be responsible for removing and replacing any manhole that is not properly fitted to the sewer grades at the existing site.

## **2.4 CAST IN PLACE (MONOLITHIC) CONCRETE MANHOLES**

- A. The design of standard manholes shall be the responsibility of the Contractor. Shallow manholes shall be constructed as detailed on the Drawings. Sketches of all manholes indicating complete details of the proposed design shall be submitted to the Engineer for review prior to ordering material and/or construction. Cast in place construction will be considered for circular manholes only unless appropriately designed with reinforcing steel. The concrete for circular manholes shall be reinforced with wire mesh conforming with this document. The minimum sidewall thickness shall be 6 inches or one-eighth the inside diameter whichever is greater. The base thickness of manhole below the underside of flow channel shall vary, depending on the diameter, the depth of manhole, and on the type of joint occurring between base slab and wall. The minimum base thickness shall be 8 inches or 1/8 the manhole diameter plus 1/30th of the manhole depth, whichever is greater.
  1. Foundations of manholes for sanitary sewer shall be concrete of a minimum compressive strength of 4000 psi at 28 days. The invert channels shall be smooth, accurately shaped, and in accordance with the drawings. Where changing line sizes occur, the crowns (top insides) of the pipe shall be matched unless otherwise approved by the Engineer. The invert of the manholes shall be shaped and smooth so that no projections will exist. Flow channels shall be formed in the inverts so that the manhole will be self-cleaning and free of areas where solids may be deposited as sewage flows through the manhole from all inlet pipes to all outlet pipes. Where the pipe can be laid continuously through the manhole, the pipe can be placed in the base. After the construction of the manhole, the pipe can be trimmed by cutting out the top half after the concrete base is constructed and has cured sufficiently. If it is not possible to lay the pipe continuously through the manhole base, the invert may be poured and formed directly in the concrete of the manhole base. The invert floor shall have a minimum slope of 1 inch per foot unless noted otherwise. The manhole invert shall extend from wall to wall. The minimum thickness for all bases shall be eight (8) inches. Reinforce bases with #4 bars at 12-inch centers each way. Tie and place reinforcing steel above the midpoint. The minimum cover over the reinforcement shall be two (2) inches. When the connecting pipelines are required to have concrete embedment, extend the embedment reinforcing steel not less than twenty (20) bar diameters into the manhole base.

2. Pipe extending from the manhole shall be cradled in concrete to the first pipe joint in the same pour as the manhole foundation. Embedment of reinforcing steel shall extend not less than twenty (20) bar diameters into manhole base.
3. A minimum of six (6) inches rock cushion shall be used beneath manhole foundations. Where trench has been over excavated, the void created shall be completely filled with a rock cushion to the underside of the manhole base.
4. In the event that ground water is present during the pouring of a cast-in-place manhole foundation, a pump shall be used to remove the ground water. Prior to pouring, the subgrade shall be stable, free from muck and groundwater. After the concrete foundation has been placed, the pump shall continue to run for at least two (2) hours to enable the concrete to attain its initial set.
5. Cast-in-place concrete manholes shall have a minimum inside diameter at the base of four (4') feet and an inside diameter at the top of the cone section of not less than twenty-four (24") inches unless specified otherwise herein. The manhole shall be smooth having no form marks on the interior wall or exterior wall of the manhole exceeding one quarter (1/4") inch in depth. Concrete used for the manhole barrel and cone section shall be a minimum compressive strength of 4000 psi at 28 days, with a slump of five (5") inches to seven (7") inches during the placement. Concrete shall not be so dry as to cause extensive honeycombing. During the placement of the concrete in the manhole barrel forms, thorough vibrating shall be completed at two (2') foot intervals. If cold joints are necessary because of a time lapse of more than one hour between placements, then a concrete bonding adhesive shall be applied to the existing concrete. A concrete collar at least four (4") inches thick shall extend a minimum of eight (8") inches above and below the new joint around the outside of the manhole. If honeycombing of the barrel of the manhole is found to be present after removal of the forms, such honeycombing shall be repaired as directed by the Engineer. Any form marks on the inside wall shall be smoothed and grouted as directed. Curing compounds or covers shall be used to protect the concrete to prevent cracking during the curing process and to protect the manhole during freezing temperatures. The manhole shall not be backfilled for at least two (2) working days after forms have been removed or a minimum of three (3) working days after the concrete has been placed.
6. Reinforcing steel used in reinforced manhole foundations shall conform to ASTM A615, Grade 60, deformed bars.
7. Welded steel wire fabrics for cast-in-place manholes shall conform to ASTM 185.
8. Manholes bases shall be integral cast. The diameter of the integral base pad shall be eight (8) inches greater than outside diameter of the manhole.

## **2.5 PIPE TO MANHOLE CONNECTOR**

- A. Openings for each connecting pipe shall be circular with a compression type flexible rubber gasket cast integrally into the manhole wall. Flexible gaskets shall be manufactured in accordance with rubber joint specification ASTM C 443 and shall meet the performance and test requirements of ASTM C 425 for compression joints. Flexible gaskets shall include a coupling with O-Ring Gasket, A-Lok, Presswedge, or equal.

## **2.6 COATINGS**

- A. Manhole interior epoxy coating according to Section 33 39 60 – Epoxy Liners for Sanitary Sewer Structures.

- B. Exterior manhole coating - coal tar epoxy paint, Kop Coat "Bitumastic Black Solution", Tnemec, "46-450 Heavy Tnemecol", or equal.

**2.7 NON-SHRINK GROUT**

- A. Grout shall be non-shrink in the plastic state and show no expansion after set as tested in accordance with ASTM C 827 and shall develop compressive strength not less than 3,000 psi with a trowelable mix within 24 hours per ASTM C 109. The placement time shall be not less than 45 minutes based on initial set per ASTM C 191. Test results shall be furnished by the manufacturer and submitted to the Engineer.

**PART 3 EXECUTION**

**3.1 GENERAL**

- A. Install manholes of the respective types at the designated locations with flowlines at elevations to match existing.
- B. Interior manhole diameters unless otherwise noted shall be 48 inches for pipe between 6 inches and 24 inches in diameter, 60 inches in diameter for pipe between 27 inches and 36 inches in diameter, and 84 inches in diameter for pipe between 42 and 48 inches in diameter.

**3.2 PREPARATION**

- A. Compaction of Earth Under Manholes.
  - 1. Prior to construction of the manhole, compact the ground underlying the manhole base, using a mechanical tamper, with 3 passes minimum over the entire surface.
- B. Placement of Bedding Material.
  - 1. Compact bedding material with a minimum of 3 passes over the entire surface with a mechanical tamper.

**3.3 CONSTRUCTION**

- A. Forming of Gravity Manhole Base and Invert.
  - 1. Form benches with mortar material and steel-trowel to produce a dense, smooth finish and shape to form a "U"- shaped channel extending to the crown of the pipe encompassing the full cross section of the connecting pipelines. Provide smooth transitions for pipes of different sizes, different elevations, and/or at different angles. Also form benches to provide self-cleaning by sloping normally two (2) inches from manhole wall to edge of "U" channel with a smooth finish. Apply final grout coat to the manhole base with a sack finish.
  - 2. Drop connections shall be constructed where indicated on the construction plans, and in accordance with the construction details.
  - 3. Apply Portland Cement grout to the joint between the sewer pipe and the manhole wall inside and out to insure a watertight seal.
- B. Connections
  - 1. Construct connections to existing manholes in conformance with this section. Excavate around the existing manhole so as not to disturb the manhole. The manhole wall shall be removed for no greater diameter than required to insert new pipe. Reshape manhole invert and channel to accept the flows from the new pipe. Chip the existing invert to a rough new surface and install a new channel and invert the entire side where the new pipe enters. Take care to



prevent brick or other foreign material from entering the existing downstream sewer. Retrieve such debris. After the new pipe is installed, completely fill, and render permanently watertight the void around the new pipe with a grout conforming to the material specifications herein.

- C. Manhole Adjustments
  - 1. Provide new manholes with a maximum of one (1) foot of adjustment ring(s) underneath the casting. Seal adjustment ring joints as specified in this section.

### **3.4 INSTALLATION**

- A. For cast-in-place manhole bases, place the first manhole riser section before the concrete base has taken its initial set. Bed the ring into the concrete. Apply Portland Cement grout inside and out to ensure a watertight seal.
- B. For precast or cast-in-place manhole bases, place the manhole riser and cone sections together using full bed of Portland Joint compound or rubber gasket to ensure a watertight joint.
- C. When using rubber gasket material, prime both ends of manhole cone and risers. Apply primer to clean and dry concrete. Install rubber gasket in accordance with manufacturer's recommendations.
- D. Use flat slab top for manholes 5 feet or less in height, and eccentric cone section for manholes over 5 feet in height. Height, measured from centerline invert to rim elevation, will be used to determine manhole top configuration. 72-inch manholes shall have a base section that extends above the invert a minimum of five (5) feet, a reducer to 48-inches, and then an eccentric cone. Where there is insufficient depth, the manhole may be fitted with flat top. All manhole openings shall be 26-inches.

### **3.5 COATINGS**

- A. Coat all manhole interiors with epoxy according to Section 33 39 60 – Epoxy Liners for Sanitary Sewer Structures.
- B. Exterior surfaces of all manholes shall be coated with two mop coats of coal tar epoxy paint. Dry film thickness shall be a minimum of 14.0 mils per coat. Recoating shall be done in accordance with manufacturer's recommendations. All exterior manhole joints (including joints between grade adjustments) shall be sealed with an external rubber sleeve similar to the Infi-Shield Gator Wrap as manufactured by Sealing Systems Inc. (763-478-2057). No separate pay item.
- C. Manholes on line segments smaller than 12-inches, not on the interceptor, will not be epoxy coated on the interior.

### **3.6 SEALING PROCEDURES**

- A. Wire brush manhole frame and exposed manhole surfaces to remove dirt and loose debris. Coat exposed manhole surfaces with an approved bonding agent followed with an application of a quick setting hydraulic cement to provide a smooth working surface as thin as possible.
- B. Joint surfaces between the frame, adjustments, and cone section shall be free of dirt, stones, debris, and voids to ensure a watertight seal. Place a flexible gasket joint material, minimum 1/2 inch thick, in two concentric rings along the inside and outside edge of each joint. Position the butt joint for each length of joint material on opposite sides of the manhole. No steel shims, wood, stones, or any material not specifically accepted by the Engineer may be used to obtain final surface elevation of the manhole frame.

- C. When precast concrete grade adjustment rings are placed on the manhole structure to obtain proper grade, no more than 24 vertical inches may be used, unless approved by the Engineer.
- D. Seal the rubber manhole adjusting ring to the precast concrete adjusting ring and the manhole frame as shown on the drawings.
- E. In paved areas or future paved areas, castings shall be installed by using a straight edge not less than ten (10) feet long so that the top of casting will conform to the slope and finish elevation of the paved surface. The top of the casting shall be 1/8 inch below the finished elevation. Allowances for the compression of the joint material shall be made to assure a proper final grade elevation.
- F. Manhole rims in parkways, lawns and other improved lands shall be at an elevation not more than one (1) nor less than one-half (1/2) inch above the surrounding ground. Backfill shall provide a uniform slope from the top of manhole casting for not less than three (3) feet each direction to existing finish grade of the ground. The grade of all surfaces shall be checked for proper slope and grade by string lining the entire area re-graded near the manhole.
- G. Manholes in open fields, unimproved land, or drainage courses shall be set as required by the Engineer.
- H. On non-paved manholes, exterior surfaces of all exposed grade adjustments and four inches below sound structure shall be cleaned with a wire brush and then waterproofed with trowelable bitumastic gasket material in accordance with the manufacturer's specifications. A protective polyethylene cover shall be placed over the waterproofing material when backfilling, following sealing of the frame and grade adjustment.

**3.7 INSPECTION AND APPROVAL**

- A. Test manholes in accordance with Section 33 01 30.02 – Manhole Testing.
- B. Do not begin backfill until pipeline installation is accepted in writing by the Engineer.

**3.8 MANHOLE FRAMES AND COVERS**

- A. Install only frames and covers of iron material, unhinged, in streets and traffic areas.
- B. Manhole frames and covers in grass easement areas may be of iron material, unhinged, or the Pamrex hinged covers.
- C. Manholes with tops elevated two feet or more above grade shall use Pamrex hinged covers.
- D. Watertight covers shall be used on all manholes in areas subject to flooding.

**PART 4 - MEASUREMENT AND PAYMENT**

**4.1 METHOD OF MEASUREMENT**

- A. Manhole measurement will be of each standard or drop inlet manhole accepted according to the depth classes shown. Depth measurement will be the vertical distance from the rim elevation to the centerline invert.

**4.2 BASIS OF PAYMENT**

- A. Manholes shall be paid for each type manhole installed, by diameter of manhole for a depth of 6 feet. Price shall be unit price per each which includes all labor, material, and equipment required to install manhole, drop inlet for drop manholes, frame, cover, base, extension rings, couplings, connectors, excavation, backfill, coatings, watertight inserts, and connections to manhole according to these specifications and as shown on the construction Drawings or identified in the field. Payment will be made only

after the manhole passes applicable tests. Both vacuum tests and dye tests are required on all manholes.

- B. Manholes greater than six (6) feet in depth shall be paid per vertical linear foot of manhole greater than six (6) feet deep by manhole diameter. Measurements shall be to the nearest 0.1 foot. No differentiation will be made for extra depth between standard or drop manholes, or for type of ring and cover.

**END OF SECTION**

**33 05 16 CONCRETE WATER VAULTS**

**PART 1 - GENERAL**

**1.1 SUMMARY**

A. Section Includes:

1. Concrete vaults to be used in water utility applications.

B. Deviations from this Standard Specification

1. None.

C. Related Specification Sections include, but are not necessarily limited to:

1. Division 0 – Bidding Requirements, Contract Forms, and Conditions of the Contract
2. Division 1 – General Requirements
3. Section 03 30 00 – Cast-In-Place Concrete
4. Section 03 80 00 – Modifications to Existing Concrete Structures
5. Section 33 05 10 – Utility Trench Excavation, Embedment and Backfill

**1.2 PRICE AND PAYMENT PROCEDURES**

A. Measurement and Payment

1. Measurement

- a. This Item is considered subsidiary to Water Meter and Vault.

2. Payment

- a. The work performed and materials furnished in accordance with this Item are subsidiary to the unit price bid per each “Water Meter and Vault” complete in place and no other compensation will be allowed.

**1.3 REFERENCES**

A. Reference Standards

1. Reference standards cited in this Specification refer to the current reference standard published at the time of the latest revision date logged at the end of this Specification, unless a date is specifically cited.
2. American Association of State Highway and Transportation Officials (AASHTO).

3. American Concrete Institute (ACI):
  - a. 350, Code Requirements for Environmental Engineering Concrete Structures and Commentary.
4. ASTM International (ASTM):
  - a. A615, Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement.
  - b. C857, Standard Practice for Minimum Structural Design Loading for Underground Precast Concrete Utility Structures
  - c. C858, Standard Specification for Underground Precast Concrete Utility Structures
  - d. C891, Standard Practice for Installation of Underground Precast Concrete Utility Structures.
  - e. C923, Standard Specification for Resilient Connectors Between Reinforced Concrete Manholes Structures, Pipes, and Laterals.
5. Occupational Safety and Health Administration (OSHA)
  - a. 1910.23, Guarding Floor and Wall Openings and Holes

#### **1.4 ADMINISTRATIVE REQUIREMENTS [NOT USED]**

#### **1.5 SUBMITTALS**

- A. Submittals shall be in accordance with Section 01 33 00.
- B. All submittals shall be approved by the City prior to delivery.

#### **1.6 ACTION SUBMITTALS/INFORMATIONAL SUBMITTALS**

- A. Product Data
  1. Precast Concrete Vault
  2. Connection materials
  3. Pipe connections at vault walls
  4. Stubs and stub plugs
  5. Grade ring
  6. Ladder
  7. External coating material

**1.7 CLOSEOUT SUBMITTALS [NOT USED]**

**1.8 MAINTENANCE MATERIAL SUBMITTALS [NOT USED]**

**1.9 QUALITY ASSURANCE**

A. Qualifications

1. Meet the requirements of ACI 318.

**1.10 DELIVERY, STORAGE, AND HANDLING**

- A. Deliver vault or panels (units) to project site in such quantity to assure continuity of installation.
- B. Store units at the project site in a manner which prevents cracking, distortion, staining or other physical damage.
- C. Lift units by designed lifting points or supports.

**1.11 FIELD [SITE] CONDITIONS [NOT USED]**

**1.12 WARRANTY**

A. Manufacturer Warranty

1. Manufacturer's Warranty shall be in accordance with Division 1.

**PART 2 - PRODUCTS**

**2.1 OWNER-FURNISHED [OR] OWNER-SUPPLIED PRODUCTS [NOT USED]**

**2.2 EQUIPMENT, PRODUCT TYPES, MATERIALS**

A. Manufacturers

1. Only the manufacturers as listed on the City's Standard Products List will be considered as shown in Section 01 60 00.
  - a. The manufacturer must comply with this Specification and related Sections.
2. Any product that is not listed on the Standard Products List is considered a substitution and shall be submitted in accordance with Section 01 25 00.

B. Performance / Design Criteria

1. Vault
  - a. Vault dimensions per the Drawings
  - b. Opening per the Drawings

- c. Incorporate a sump into the base or floor of the vault.
    - 1) Avoid conflicts with piping.
    - 2) Do not locate directly under the access location if applicable.
  - d. Place floor on a minimum 2 percent slope towards the sump.
2. Water Pipe Penetrations
- a. Use adjustable-linked rubber seal devices or grout, as shown in Drawings, to provide seals around pipe penetrations.
3. Vault Access
- a. Cover / Door
    - 1) For non-traffic areas – non H-20 loading 30-inch x 36-inch steel single leaf door, Bilco Type J model or approved equal
    - 2) For traffic areas – 32-inch hinged ductile iron frame and cover or as shown in manhole lid assembly in Drawings
    - 3) With steel door, provide an automatic hold-open arm with release handle and locking device.
    - 4) Provide Bilco type fall protection grating under aluminum door that meets OSHA 29 CFR 1910.23 requirements or approved equal.
    - 5) Incorporate a drain gutter with an outlet routed to the exterior of the vault lid.
  - b. Ladder
    - 1) Provide aluminum ladder by Heron Industries or approved equal.
    - 2) Provide ladder to dimensions shown on Drawings.

C. Materials

- 1. Concrete for utility construction – Conform to Section 03 30 00.
- 2. Frame and Cover – Conform to Section 33 05 13.
- 3. Grade Ring – Conform to Section 33 05 13 and ASTM C 478.
- 4. Reinforcing Steel – Conform to Section 03 30 00.
- 5. Sewer Pipe Connections – Conform to ASTM C923 or ASTM C1628.
- 6. Adjustable-linked rubber seal devices
  - a. Manufactured by Link-Seal or approved equal
- 7. Interior Coating or Liner – Conform to Section 33 39 60.

8. Exterior Coating
  - a. Coal Tar Bitumastic for below grade damp proofing
  - b. Dry film thickness (DFT) no less than 12 mils and no greater than 30 mils
  - c. Solids content is 68 percent by volume  $\pm$  2 percent.

**2.3 ACCESSORIES [NOT USED]**

**2.4 SOURCE QUALITY CONTROL [NOT USED]**

**PART 3 - EXECUTION**

**3.1 INSTALLERS [NOT USED]**

**3.2 EXAMINATION**

A. Evaluation and Assessment

1. Verify lines and grades are in accordance to the Drawings.

**3.3 PREPARATION [NOT USED]**

**3.4 INSTALLATION**

A. General

1. Vault
  - a. Perform installation in accordance to ASTM C891.
  - b. Construct vault to dimensions shown on Drawings.
  - c. Precast Sections
    - 1) Clean bell spigot and gaskets
      - a) Lubricate and join
    - 2) Minimize number of segments.
  - d. Vault Base
    - 1) Place vault base on 6-inch minimum base of compacted crushed rock (per Section 33 05 10) over undisturbed soils and grade level to elevation shown on the Drawings.
2. Water Pipe Penetrations
  - a. Install adjustable-linked rubber seal devices around pipe penetrations in accordance with the manufacturer's recommendation.
3. Modifications and pipe penetrations into vaults shall conform to Section 03 80 00.



- 3.5 REPAIR / RESTORATION [NOT USED]
- 3.6 RE-INSTALLATION [NOT USED]
- 3.7 FIELD QUALITY CONTROL [NOT USED]
- 3.8 SYSTEM STARTUP [NOT USED]
- 3.9 ADJUSTING [NOT USED]
- 3.10 CLEANING [NOT USED]
- 3.11 CLOSEOUT ACTIVITIES [NOT USED]
- 3.12 PROTECTION [NOT USED]
- 3.13 MAINTENANCE [NOT USED]
- 3.14 ATTACHMENTS [NOT USED]

**END OF SECTION**

**PART 1 - GENERAL**

**1.1 SUMMARY**

- A. Section Includes:
  - 1. Minimum requirements for manufacturing, furnishing and transporting Tunnel Liner Plate to be used for excavation support as installed By Other than Open Cut at the locations shown on the Drawings
- B. Deviations from this Standard Specification
  - 1. None.
- C. Related Specification Sections include, but are not necessarily limited to:
  - 1. Division 0 – Bidding Requirements, Contract Forms, and Conditions of the Contract
  - 2. Division 1 – General Requirements
  - 3. Section 33 05 23 – Hand Tunneling
  - 4. Section 33 05 24 – Installation of Carrier Pipe in Casing or Tunnel Liner Plate

**1.2 PRICE AND PAYMENT PROCEDURES**

- A. Measurement and Payment
  - a. Measurement
    - 1) Measured horizontally along the surface for the length of Tunnel Liner Plate installed
  - b. Payment
    - 1) The work performed and materials furnished in accordance with this Item and measured as provided under “Measurement” will be paid for at the unit price bid per linear foot of “Casing/Tunnel Liner Plate, By Other than Open Cut” installed for:
      - a) Various Sizes
    - 2) The work performed and materials furnished in accordance with this Item and measured as provided under “Measurement” will be paid for at the unit price bid per linear foot of “Tunnel Liner Plate, By Other than Open Cut” installed for:
      - a) Various Sizes

- c. The price bid shall include:
  - 1) Furnishing and installing Tunnel Liner Plate as specified by the Drawings
  - 2) Mobilization
  - 3) Launching shaft
  - 4) Receiving shaft
  - 5) Pavement removal
  - 6) Excavation
  - 7) Hauling
  - 8) Disposal of excess material
  - 9) Furnishing, placement, and compaction of backfill
  - 10) Clean-up

### **1.3 REFERENCES**

#### **A. Reference Standards**

- 1. Reference standards cited in this Specification refer to the current reference standard published at the time of the latest revision date logged at the end of this Specification, unless a date is specifically cited.
- 2. American Association of State Highway and Transportation Officials (AASHTO)
  - a. LRFD, Bridge Design Manual, Section 12.13
  - b. M190, Bituminous-Coated Corrugated Metal Culvert Pipe and Pipe Arches.
- 3. American Society of Testing and Materials (ASTM):
  - a. A123, Standard Specification for Zinc (Hot- Dip Galvanized) Coating on Iron and Steel Products.
  - b. A153, Standard Specification for Zinc Coating (Hot Dip) on Iron and Steel Hardware.
  - c. A1011, Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength.

### **1.4 ADMINISTRATIVE REQUIREMENTS [NOT USED]**

### **1.5 SUBMITTALS**

- A. Submittals shall be in accordance with Section 01 33 00.
- B. All submittals shall be approved by the City prior to delivery.

**1.6 ACTION SUBMITTALS/INFORMATIONAL SUBMITTALS**

A. Product Data

1. Tunnel Liner Plate and fasteners
  - a. Material data
2. Exterior Coating
  - a. Material data
  - b. Field touch-up procedures
3. Grout Mix
  - a. Material data

B. Shop Drawings

1. Submit calculations for the design of the Tunnel Liner Plate sealed by a Licensed Engineer in the State of Texas.
2. Detailed plan for grouting the void space on the exterior of the Tunnel Liner Plate
3. Grout coupling location and spacing

**1.7 CLOSEOUT SUBMITTALS [NOT USED]**

**1.8 MAINTENANCE MATERIAL SUBMITTALS [NOT USED]**

**1.9 QUALITY ASSURANCE [NOT USED]**

**1.10 DELIVERY, STORAGE, AND HANDLING**

- A. Deliver, handle and store Tunnel Liner Plate in accordance with the Manufacturer's recommendations to protect coating systems.

**1.11 FIELD [SITE] CONDITIONS [NOT USED]**

**1.12 WARRANTY [NOT USED]**

**PART 2 - PRODUCTS [NOT USED]**

**2.1 OWNER-FURNISHED [OR] OWNER-SUPPLIED PRODUCTS [NOT USED]**

**2.2 MATERIALS**

A. Manufacturers

1. Only the manufacturers as listed on the City's Standard Products List will be considered as shown in Section 01 60 00, and/or as specified herein.

- a. The manufacturer must comply with this Specification and related Sections.
  - b. Manufactured by Contech Construction Products, Inc., American Commercial Inc., or approved equal.
2. Any product that is not listed on the Standard Products List is considered a substitution and shall be submitted in accordance with Section 01 2500.

B. Design Criteria

- a. Manufacturer to design Tunnel Liner Plate in accordance with the methods and criteria as specified in AASHTO LRFD, Bridge Design Manual, Section 12.13.
- b. Soil parameters shall be determined by the Tunnel Liner Plate Manufacturer.
- c. Allow a maximum deflection of 3 percent.
- d. Thickness of the Tunnel Liner Plate specified herein is the minimum acceptable and shall be increased as necessary to obtain adequate joint strength, stiffness, buckling strength and resistance to deflection.

C. Materials

1. Tunnel Liner Plate

- a. Provide new, corrugated metal Tunnel Liner Plates made from steel sheets conforming to the requirements of ASTM A1011.
  - 1) Potable and Reclaimed Water carrier pipe
    - a) Galvanized
      - (1) Plate to be galvanized with zinc coating in accordance with ASTM A123 with the following exception:
        - (a) Zinc shall be applied at a rate of 2.0 ounces per square foot on each side.
      - b) Coated
        - (1) Plate to be coated with a bituminous coating meeting the performance requirements of AASHTO M190
        - (2) Uniformly coat pipe inside and out to minimum thickness of 0.05 inches, measured on crests of corrugations.
    - 2) Sanitary Sewer carrier pipe
      - a) Galvanized
        - (1) Plate to be galvanized with zinc coating in accordance with ASTM A123 with the following exception:
          - (a) Zinc shall be applied at a rate of 2.0 ounces per square foot on each side.

- b. Tunnel Liner Plates and fasteners shall comply with the requirements of AASHTO LRFD, Bridge Design Manual, Section 12.13.
- 1) Liner plates shall be punched for bolting on both longitudinal and circumferential seams and fabricated to permit complete erection from the inside of the tunnel.
  - 2) Bolts and nuts shall be galvanized to conform to ASTM A153.
  - 3) Where groundwater is encountered gasketed liner plates shall be used.
  - 4) Plates shall be of uniform fabrication and those intended for 1 size tunnel shall be interchangeable.
  - 5) Field welding of Tunnel Liner Plate, including grout couplings shall not be allowed.
  - 6) The material used for the construction of these plates shall be new, unused and suitable for the purpose intended.
  - 7) Minimum thickness of Tunnel Liner Plate shall be as follows\*:

Tunnel Diameter (inches)	2-Flanged Liner Plate Thickness (gauge)	4-Flanged Liner Plate Thickness (gauge)
	Bury Depth: 8 feet – 16 feet	
48	14	12
54	14	12
60	14	11
66	12	10
72	12	8
Greater than 72	Project Specific Design	Project Specific Design

\*The information in the above table is based on the following assumptions: AASHTO Section 16: "Steel Tunnel Liner Plates", H2O loading angle of 0 and bury depth of 8 feet to 16 feet. For projects not meeting these assumptions, a specific design should be performed to determine the appropriate thickness for the liner plate.

2. Casing Insulators

- a. Casing insulators shall be used for this project in accordance with Section 33 05 24.

**2.3 ACCESSORIES [NOT USED]**

**2.4 SOURCE QUALITY CONTROL [NOT USED]**

**PART 3 - EXECUTION**

**3.1 INSTALLERS [NOT USED]**

**3.2 EXAMINATION [NOT USED]**

**3.3 PREPARATION [NOT USED]**

**3.4 INSTALLATION**

- A. Tunnel Liner Plate shall be installed in accordance with appropriate portions of Section 33 05 23.
- B. Carrier pipe shall be installed inside Tunnel Liner Plate in accordance with Section 33 05 24.
- C. Contact grouting of the annulus outside the Tunnel Liner Plate shall be performed in accordance with Section 33 05 23.

**3.5 REPAIR / RESTORATION [NOT USED]**

**3.6 RE-INSTALLATION [NOT USED]**

**3.7 FIELD [OR] SITE QUALITY CONTROL [NOT USED]**

**3.8 SYSTEM STARTUP [NOT USED]**

**3.9 ADJUSTING [NOT USED]**

**3.10 CLEANING [NOT USED]**

**3.11 CLOSEOUT ACTIVITIES [NOT USED]**

**3.12 PROTECTION [NOT USED]**

**3.13 MAINTENANCE [NOT USED]**

**3.14 ATTACHMENTS [NOT USED]**

**END OF SECTION**

**PART 1 - GENERAL**

**1.1 SUMMARY**

- A. Section Includes:
  - 1. Minimum requirements for manufacturing, furnishing and transporting Steel Casing Pipe to be installed by Open Cut or By Other than Open Cut at the locations shown on the Drawings
  
- B. Deviations from this Standard Specification
  - 1. None.
  
- C. Related Specification Sections include, but are not necessarily limited to:
  - 1. Division 0 – Bidding Requirements, Contract Forms, and Conditions of the Contract
  - 2. Division 1 – General Requirements
  - 3. Section 33 05 10 – Utility Trench Excavation, Embedment and Backfill
  - 4. Section 33 05 20 – Auger Boring
  - 5. Section 33 05 23 – Hand Tunneling
  - 6. Section 33 05 24 – Installation of Carrier Pipe in Casing or Tunnel Liner Plate

**1.2 PRICE AND PAYMENT PROCEDURES**

- A. Measurement and Payment
  - 1. Open Cut
    - a. Measurement
      - 1) Measured horizontally along the surface for length of Steel Casing Pipe installed
    - b. Payment
      - 1) The work performed and materials furnished in accordance with this Item and measured as provided under “Measurement” will be paid for at the unit price bid per linear foot of “Casing, By Open Cut” installed for:
        - a) Various Sizes
    - c. The price bid shall include:



- 1) Furnishing and installing Steel Casing Pipe as specified by the Drawings
  - 2) Mobilization
  - 3) Pavement removal
  - 4) Excavation
  - 5) Hauling
  - 6) Disposal of excess material
  - 7) Furnishing, placement, and compaction of embedment
  - 8) Furnishing, placement, and compaction of backfill
  - 9) Clean-up
2. By Other than Open Cut
- a. Measurement
    - 1) Measured horizontally along the surface for length of Steel Casing Pipe installed
  - b. Payment
    - 1) The work performed and materials furnished in accordance with this Item and measured as provided under "Measurement" will be paid for at the unit price bid per linear foot of "Casing/Tunnel Liner Plate, By Other than Open Cut" installed for:
      - a) Various Sizes
    - 2) The work performed and materials furnished in accordance with this Item and measured as provided under "Measurement" will be paid for at the unit price bid per linear foot of "Casing, By Other than Open Cut" installed for:
      - a) Various Sizes
  - c. The price bid shall include:
    - 1) Furnishing and installing Steel Casing Pipe as specified by the Drawings
    - 2) Mobilization
    - 3) Launching shaft
    - 4) Receiving shaft
    - 5) Pavement removal
    - 6) Excavation
    - 7) Hauling
    - 8) Disposal of excess material

- 9) Furnishing, placement, and compaction of backfill
- 10) Clean-up

### **1.3 REFERENCES**

#### **A. Reference Standards**

- 1. Reference standards cited in this Specification refer to the current reference standard published at the time of the latest revision date logged at the end of this Specification, unless a date is specifically cited.
- 2. ASTM International (ASTM):
  - a. A139, Standard Specification for Electric-Fusion (Arc)-Welded Steel Pipe (NPS Sizes 4 and Over).
- 3. American Water Works Association (AWWA):
  - a. C203, Coal-Tar Protective Coatings and Linings for Steel Water Pipelines - Enamel and Tape - Hot Applied.

### **1.4 ADMINISTRATIVE REQUIREMENTS [NOT USED]**

### **1.5 SUBMITTALS**

- A. Submittals shall be in accordance with Section 01 33 00.
- B. All submittals shall be approved by the City prior to delivery.

### **1.6 ACTION SUBMITTALS/INFORMATIONAL SUBMITTALS**

#### **A. Product Data**

- 1. Exterior Coating
  - a. Material data
  - b. Field touch-up procedures
- 2. Interior Coating
  - a. Material data
  - b. Field touch-up procedures

#### **B. Shop Drawings**

- 1. No shop drawings required for Auger Boring
- 2. For Tunneling, provide the following:
  - a. Furnish details for Steel Casing Pipe outlining the following:

- 1) Grout/lubrication ports
  - 2) Joint details
  - 3) Other miscellaneous items for furnishing and fabricating pipe
- b. Submit calculations in a neat, legible format that is sealed by a Licensed Professional Engineer in Texas, consistent with the information provided in the geotechnical report, and includes:
- 1) Calculations confirming that pipe jacking capacity is adequate to resist the anticipated jacking loads for each crossing with a minimum factor of safety of 2
  - 2) Calculations confirming that pipe capacity is adequate to safely support all other anticipated loads, including earth and groundwater pressures, surcharge loads, and handling loads
  - 3) Calculations confirming that jointing method will support all loading conditions

**1.7 CLOSEOUT SUBMITTALS [NOT USED]**

**1.8 MAINTENANCE MATERIAL SUBMITTALS [NOT USED]**

**1.9 QUALITY ASSURANCE [NOT USED]**

**1.10 DELIVERY, STORAGE, AND HANDLING**

A. Delivery, Handling, and Storage

1. Prior to delivery of the pipe, end/internal bracing shall be furnished and installed, as recommended by the manufacturer, for protection during shipping and storage.
2. Deliver, handle and store pipe in accordance with the Manufacturer's recommendations to protect coating systems.

**1.11 FIELD [SITE] CONDITIONS [NOT USED]**

**1.12 WARRANTY [NOT USED]**

**PART 2 - PRODUCTS**

**2.1 OWNER-FURNISHED [OR] OWNER-SUPPLIED PRODUCTS [NOT USED]**

**2.2 MATERIALS**

A. Design Criteria

1. The Contractor is fully responsible for the design of Steel Casing Pipe that meets or exceeds the design requirements of this Specification and that is specifically designed for installation by the intended trenchless method.

2. For Steel Casing Pipe utilized for tunneling projects, consider the following:
  - a. Design of the casing pipe shall account for all installation and service loads including:
    - 1) Jacking loads
    - 2) External groundwater and earth loads
    - 3) Traffic loads
    - 4) Practical consideration for handling, shipping and other construction operations
    - 5) Any other live or dead loads reasonably anticipated
  - b. Design shall be sealed and signed by a registered Professional Engineer licensed in the State of Texas.
  - c. The allowable jacking capacity shall not exceed 50 percent of the minimum steel yield stress.
3. Steel Casing Pipe shall have a minimum wall thickness as follows:

<b>Casing Pipe Diameter (inches)</b>	<b>Minimum Wall Thickness (inches)</b>
14 – 18	.3125 (5/16)
20 – 24	.375 (3/8)
26 – 32	.5 (1/2)
34 – 42	.625 (5/8)
44 – 48	.6875 (11/16)
Greater than 48	Project specific design

4. Steel Casing Pipe shall be provided with inside diameter sufficient to efficiently install the required carrier pipe with casing spacers as required in Section 33 0524.
  - a. Allowable casing diameters are shown on the Drawings for each crossing.
5. Furnish in lengths that are compatible with Contractor's shaft sizes and allowable work areas.
6. Random segments of pipe will not be permitted for straight runs of casing.
  - a. Closing piece segments, however, shall be acceptable.

7. When required by installation method, provide grout/lubricant ports along the pipe at intervals of 10 feet or less.
  - a. Ports and fittings shall be attached to the pipe in a manner that will not materially affect the strength of the pipe nor interfere with installation of carrier pipe.
  - b. Plugs for sealing the fittings shall be provided by the Contractor and shall be capable of withstanding all external and internal pressures and loads without leaking.

#### B. Materials

1. Provide new, smooth-wall, carbon steel pipe conforming to ASTM A139, Grade B.
2. Dimensional Tolerances
  - a. Furnishing and installing Steel Casing Pipe with dimensional tolerances that are compatible with performance requirements and proposed installation methods that meet or exceed the specific requirements below:
    - 1) Minimum wall thickness at any point shall be at least 87.5 percent of the nominal wall thickness.
    - 2) Outside circumference within 1.0 percent or 3/4 inch of the nominal circumference, whichever is less.
    - 3) Outside diameter of the pipe shall be within 1/8 inch of the nominal outside diameter.
    - 4) Roundness such that the difference between the major and minor outside diameters shall not exceed 0.5 percent of the specified nominal outside diameter or 1/4 inch, whichever is less.
    - 5) Maximum allowable straightness deviation of 1/8 inch in any 10-foot length.
3. All steel pipe shall have square ends.
  - a. The ends of pipe sections shall not vary by more than 1/8 inch at any point from a true plane perpendicular to the axis of the pipe and passing through the center of the pipe at the end.
  - b. When pipe ends have to be beveled for welding, the ends shall be beveled on the outside to an angle of 35 degrees with a tolerance of  $\pm 2\frac{1}{2}$  degrees and with a width of root face 1/16 inch  $\pm$  1/32 inch.
4. Steel Casing Pipe shall be fabricated with longitudinal weld seams.
  - a. All girth weld seams shall be ground flush.

#### C. Finishes

1. Provide inside and outside of Steel Casing Pipe with a coal-tar protective coating in accordance with the requirements of AWWA C203.

- a. Touch up after field welds shall provide coating equal to those specified above.

**2.3 ACCESSORIES [NOT USED]**

**2.4 SOURCE QUALITY CONTROL [NOT USED]**

**PART 3 - EXECUTION**

**3.1 INSTALLERS [NOT USED]**

**3.2 EXAMINATION [NOT USED]**

**3.3 PREPARATION [NOT USED]**

**3.4 INSTALLATION**

- A. Install Steel Casing Pipe for By Other than Open Cut in accordance with Section 33 05 20 or Section 33 05 23. Install Steel Casing Pipe for Open Cut in accordance with Section 33 05 10.
  - 1. Steel Casing Pipe connections shall be achieved by full penetration field butt welding or an integral machine press-fit connection (Permalok or equal) prior to installation of the pipe, depending on the type of carrier pipe.
  - 2. Allowable joint types for each crossing are shown on the Drawings.
  - 3. Field butt welding a square end piece of steel pipe to a 35 degree beveled end of steel pipe is acceptable.
  - 4. Integral machined press-fit connections shall be installed in accordance with the manufacturer's installation procedures and recommendations.
- B. Carrier pipe shall be installed inside Steel Casing Pipe in accordance with Section 33 05 24.
- C. Contact grouting of the annulus outside the casing pipe shall be performed in accordance with Section 33 05 23 or Section 33 05 20.

- 3.5 REPAIR / RESTORATION [NOT USED]
- 3.6 RE-INSTALLATION [NOT USED]
- 3.7 FIELD [OR] SITE QUALITY CONTROL [NOT USED]
- 3.8 SYSTEM STARTUP [NOT USED]
- 3.9 ADJUSTING [NOT USED]
- 3.10 CLEANING [NOT USED]
- 3.11 CLOSEOUT ACTIVITIES [NOT USED]
- 3.12 PROTECTION [NOT USED]
- 3.13 MAINTENANCE [NOT USED]
- 3.14 ATTACHMENTS [NOT USED]

END OF SECTION

## INSTALLATION OF CARRIER PIPE IN CASING OR TUNNEL LINER PLATE

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. Section Includes:
  - 1. Requirements for the installation of carrier pipe into steel casings or tunnel liner plate at locations shown on the Drawings
- B. Deviations from this Standard Specification
  - 1. None.
- C. Related Specification Sections include, but are not necessarily limited to:
  - 1. Division 0 – Bidding Requirements, Contract Forms, and Conditions of the Contract
  - 2. Division 1 – General Requirements
  - 3. Section 33 01 30 – Sewer and Manhole Testing
  - 4. Section 33 11 13 - Concrete Pressure Pipe, Bar-Wrapped, Steel Cylinder Type

#### 1.2 PRICE AND PAYMENT PROCEDURES

- A. Measurement and Payment
  - 1. Installation of Sanitary Sewer Carrier Pipe in Casing/Tunnel Liner Plate
    - a. Measurement
      - 1) Measured horizontally along the surface from centerline to centerline of the beginning of the casing/liner to the end of the casing/liner
    - b. Payment
      - 1) The work performed and materials furnished in accordance with this Item and measured as provided under "Measurement" shall be paid for at the unit price bid per linear foot for "Sewer Carrier Pipe" complete in place for:
        - a) Various Sizes
    - c. The price bid shall include:
      - 1) Furnishing and installing Sanitary Sewer Main (Pipe) in Casing/Tunnel Liner Plate as specified by the Drawings
      - 2) Mobilization
      - 3) Grout
      - 4) Casing Spacers
      - 5) End seals
      - 6) Excavation
      - 7) Hauling
      - 8) Disposal of excess material
      - 9) Clean-up
  - 2. Installation of Water Carrier Pipe in Casing/Tunnel Liner Plate
    - a. Measurement
      - 1) Measured horizontally along the surface from centerline to centerline of the beginning of the casing/liner to the end of the casing/liner Payment
    - b. Payment
      - 1) The work performed and materials furnished in accordance with this Item and measured as provided under "Measurement" shall be paid for at the unit price bid per linear foot for "Water Carrier Pipe" complete in place for:
        - a) Various Sizes
    - c. The price bid shall include:
      - 1) Furnishing and installing Water Main (Pipe) in Casing/Tunnel Liner Plate as specified by the Drawings



- 2) Mobilization
- 3) Grout
- 4) Joint restraint
- 5) Casing Spacers
- 6) End seals
- 7) Excavation
- 8) Hauling
- 9) Disposal of excess material
- 10) Clean-up

### 1.3 REFERENCES

#### A. Definitions

1. Carrier Pipe: Permanent pipe for operational use that is used to convey flows
2. Casing: A steel pipe or tunnel liner installed by trenchless methods that supports the ground and provides a stable underground excavation for installation of the carrier pipe

#### B. Reference Standards

1. Reference standards cited in this Specification refer to the current reference standard published at the time of the latest revision date logged at the end of this Specification, unless a date is specifically cited.
2. American Society of Testing and Materials (ASTM)
  - a. C39, Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens.
  - b. C109, Standard Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2-in or [50 mm] Cube Specimens).
  - c. D638, Standard Test Method for Tensile Properties of Plastics.
3. International Organization for Standardization (ISO):
  - a. 9001, Quality Management Systems - Requirements.
4. Occupational Safety and Health Administration (OSHA)
  - a. OSHA Regulations and Standards for Underground Construction, 29 CFR Part 1926, Subpart S, Underground Construction and Subpart P, Excavation.

### 1.4 ADMINISTRATIVE REQUIREMENTS [NOT USED]

### 1.5 SUBMITTALS

- A. Submittals shall be in accordance with Section 01 33 00.
- B. All submittals shall be approved by the City prior to delivery.

### 1.6 ACTION SUBMITTALS/INFORMATIONAL SUBMITTALS

#### A. Product Data

1. Casing Isolators/Spacers
  - a. Material Data
2. Grout Mix
  - a. Material Data

#### B. Shop Drawings

1. Required for 24-inch and larger pipe installations
2. Submit Work Plan describing the carrier pipe installation equipment, materials and construction methods to be employed.
3. Casing Spacers/Isolators
  - a. Detail drawings and manufacturer's information for the casing isolators/spacers that will be used.

- 1) Include dimension and component materials and documentation of manufacturer's ISO 9001:2000 certification.
  - b. Alternatives to casing spacers/isolators may be allowed by the City on a case-by-case basis.
  - c. For consideration of alternate method, submit a detailed description of method including details.
- 4. End seal or bulkhead designs and locations for casing/liners.
- 5. Annular Space (between casing pipe and casing/tunnel liner plate) Grouting Work Plan and Methods including:
  - a. Grouting methods
  - b. Details of equipment
  - c. Grouting procedures and sequences including:
    - 1) Injection methods
    - 2) Injection pressures
    - 3) Monitoring and recording equipment
    - 4) Pressure gauge calibration data
    - 5) Materials
  - d. Grout mix details including:
    - 1) Proportions
    - 2) Admixtures including:
      - a) Manufacturer's literature
      - b) Laboratory test data verifying the strength of the proposed grout mix
      - c) Proposed grout densities
      - d) Viscosity
      - e) Initial set time of grout
        - (1) Data for these requirements shall be derived from trial batches from an approved testing laboratory.
  - e. Submit a minimum of 3 other similar projects where the proposed grout mix design was used.
  - f. Submit anticipated volumes of grout to be pumped for each application and reach grouted.
  - g. For pipe installations greater than 36-inches, without hold down jacks or a restrained spacer, provide buoyant force calculations during grouting and measures to prevent flotation.
    - 1) Calculations sealed by a licensed Engineer in the State of Texas.
  - h. Description of methods and devices to prevent buckling of carrier pipe during grouting of annular space, if required

**1.7 CLOSEOUT SUBMITTALS [NOT USED]**

**1.8 MAINTENANCE MATERIAL SUBMITTALS [NOT USED]**

**1.9 QUALITY ASSURANCE**

A. Certifications

- 1. Casing isolator/spacer manufacturer shall be certified against the provisions of ISO9001:2000.

**1.10 DELIVERY, STORAGE, AND HANDLING [NOT USED]**

**1.11 FIELD [SITE] CONDITIONS [NOT USED]**

**1.12 WARRANTY [NOT USED]**

**PART 2 - PRODUCTS**

**2.1 OWNER-FURNISHED [OR] OWNER-SUPPLIED PRODUCTS [NOT USED]**

**2.2 MATERIALS**

**A. Manufacturers**

1. Only the manufacturers as listed on the City's Standard Products List will be considered as shown in Section 01 60 00.
  - a. The manufacturer must comply with this Specification and related Sections.
2. Any product that is not listed on the Standard Products List is considered a substitution and shall be submitted in accordance with Section 01 25 00.
3. The Casing Spacers/Isolators shall be new and the product of a manufacturer regularly engaged in the manufacturing of casing spacers/isolators.

**B. Design Criteria and Materials**

1. Carrier pipe shall be installed within the horizontal and vertical tolerances as indicated in PART 3 of this Specification, incorporating all support/insulator dimensions required.

	<b>Diameter (inches)</b>	<b>Material</b>	<b>Specification Reference</b>
<b>Water Line</b>	6-12	DIP (Restrained)	33 11 10
	16-20	DIP (Restrained)	33 11 10
		AWWA C303 (Restrained)	33 11 13
		DIP (Restrained)	33 11 10
	24 and greater	AWWA C303 (Restrained)	33 11 13
		AWWA C301 (Restrained)	33 11 15
<b>Sanitary Sewer Line</b>	8-16	DIP (with Ceramic Epoxy)	33 11 10
		PVC C900 DR14	33 31 20
	18 and greater	DIP (with Ceramic Epoxy)	33 11 10
		Fiberglass	33 31 13

2. Grout of annular space
  - a. For gravity sewer carrier pipe installation:
    - 1) Fill all voids between the carrier pipe and the casing or liner with grout.
    - 2) All exterior carrier pipe surfaces and all interior casing or liner surfaces shall be in contact with the grout.
  - b. For water line installation:
    - 1) No annular space fill will be used.
3. Grout Mixes
  - a. Low Density Cellular Grout (LDCC)
    - 1) Annular space (between sewer carrier pipe and casing/liner) grout shall be LDCC.
    - 2) The LDCC shall be portland cement based grout mix with the addition of a foaming agent designed for this application.
    - 3) Develop 1 or more grout mixes designed to completely fill the annular space based on the following requirements:
      - a) Provide adequate retardation to completely fill the annular space in 1 monolithic pour.

- b) Provide less than 1 percent shrinkage by volume.
  - c) Compressive Strength
    - (1) Minimum strength of 10 psi in 24 hours, 300 psi in 28 days
  - d) Design grout mix with the proper density and use proper methods to prevent floating of the carrier pipe.
  - e) Proportion grout to flow and to completely fill all voids between the carrier pipe and the casing or liner.
4. End Seals
- a. Provide end seals at each end of the casing or liner to contain the grout backfill or to close the casing/liner ends to prevent the inflow of water or soil.
    - 1) For water piping less than 24-inch diameter, use hard rubber seals, Model PL Link Seal as manufactured by the Thunderline Corporation or approved equal.
    - 2) For water piping 24-inch diameter and greater, use pull-on, 1/8 inch thick, synthetic rubber end seals, Model C, as manufactured by Pipeline Seal and Insulator, Inc. or approved equal.
    - 3) For sewer piping, no end seals are required since the annular space between the carrier pipe and the casing will be grouted.
  - b. Design end seals to withstand the anticipated soil or grouting pressure and be watertight to prevent groundwater from entering the casing.
5. Casing Spacers/Insulators
- a. Provide casing spacers/insulators to support the carrier pipe during installation and grouting (where grout is used).
    - 1) For concrete pressure pipe, mortar bands may be allowed in lieu of casing spacers/isolators.
    - 2) Mortar bands shall be in accordance with Section 33 11 13.
  - b. Casing Spacers/Isolators material and properties:
    - 1) Shall be minimum 14 gage
    - 2) For water pipe, utilize Stainless Steel.
    - 3) For sewer pipe, utilize Coated Steel.
    - 4) Suitable for supporting weight of carrier pipe without deformation or collapse during installation
  - c. Provide restrained-style casing spacers to hold all pipes stable during grouting operations and prevent floating or movement.
  - d. Provide dielectric strength sufficient to electrically isolate each component from one another and from the casing.
  - e. Design risers for appropriate loads, and, as a minimum:
    - 1) Provide 10 gage steel risers
      - a) Provide stainless steel bands and risers for water installations.
  - f. Band material and criteria
    - 1) Provide polyvinyl chloride inner liner with:
      - a) Minimum thickness of 0.09 inches
      - b) Durometer "A" of 85-90 hardness
      - c) Minimum dielectric strength of 58,000 volts
  - g. Runner material and criteria
    - 1) Provide pressure-molded glass reinforced polymer or UHMW with:
      - a) Minimum of 2 inches in width and a minimum of 11 inches in length.
    - 2) Attach to the band or riser with 3/8 inch minimum welded steel or stainless steel studs.
    - 3) Runner studs and nuts shall be recessed well below the wearing surface of the runner
      - a) Fill recess with a corrosion inhibiting filler.
  - h. Riser height

- 1) Provide sufficient height with attached runner allow a minimum clearance of 2 inches between the outside of carrier pipe bells or couplings and the inside of the casing liner surface.

### **2.3 ACCESSORIES [NOT USED]**

### **2.4 SOURCE QUALITY CONTROL [NOT USED]**

## **PART 3 - EXECUTION**

### **3.1 INSTALLERS [NOT USED]**

### **3.2 EXAMINATION [NOT USED]**

### **3.3 PREPARATION [NOT USED]**

### **3.4 INSTALLATION**

#### **A. General**

1. Carrier pipe installation shall not begin until the following tasks have been completed:
  - a. All required submittals have been provided, reviewed and accepted.
  - b. All casing/liner joints are watertight and no water is entering casing or liner from any sources.
  - c. All contact grouting is complete.
  - d. Casing/liner alignment record drawings have been submitted and accepted by City to document deviations due to casing/liner installation.
  - e. Site safety representative has prepared a code of safe practices and an emergency plan in accordance with applicable requirements.
2. The carrier pipe shall be installed within the casings or liners between the limits indicated on the Drawings, to the specified lines and grades and utilizing methods which include due regard for safety of workers, adjacent structures and improvements, utilities and the public.

#### **B. Control of Line and Grade**

1. Install Carrier pipe inside the steel casing within the following tolerances:
  - a. Horizontal
    - 1)  $\pm 2$  inches from design line
  - b. Vertical
    - 1)  $\pm 1$  inch from design grade
2. Check line and grade set up prior to beginning carrier pipe installation.
3. Perform survey checks of line-and-grade of carrier pipe during installation operations.
4. The Contractor is fully responsible for the accuracy of the installation and the correction of it, as required.
  - a. Where the carrier pipe installation does not satisfy the specified tolerances, correct the installation, including if necessary, redesign of the pipe or structures at no additional cost to City.

#### **C. Installation of Carrier Pipe**

1. Pipe Installation
  - a. Remove all loose soil from casing or liner.
  - b. Grind smooth all rough welds at casing joints.
2. Installation of Casing Spacers

- a. Provide casing spacers, insulators or other approved devices to prevent flotation, movement or damage to the pipe during installation and grout backfill placement.
  - b. Assemble and securely fasten casing spacers to the pipeline to be installed in casings or tunnels.
  - c. Correctly assemble, evenly tighten and prevent damage during tightening of the insulators and pipe insertion.
  - d. Install spacers in accordance with manufacturer's recommendations.
  - e. Install carrier pipe so that there is no metallic contact between the carrier pipe and the casing.
  - f. Carrier pipe shall be installed without sliding or dragging it on the ground or in the casing/liner in a manner that could damage the pipe or coatings.
    - 1) If guide rails are allowed, place cement mortar on both sides of the rails.
  - g. Coat the casing spacer runners with a non-corrosive/environmentally safe lubricant to minimize friction when installing the carrier pipe.
  - h. The carrier pipe shall be electrically isolated from the carrier pipe and from the casing.
  - i. Grade the bottom of the trench adjacent to each end of the casing to provide a firm, uniform and continuous support for the pipe. If the trench requires some backfill to establish the final trench bottom grade, place the backfill material in 6-inch lifts and compact each layer.
  - j. After the casing or tunnel liner has been placed, pump dry and maintain dry until the casing spacers and end seals are installed.
3. Insulator Spacing
- a. Maximum distance between spacers is to be 6 feet.
  - b. For 18 and 20 foot long joints, install a minimum of 4 spacers.
    - 1) Install 2 spacers within 1 foot on each side of the bell or flange.
    - 2) Remaining 2 spacers shall be spaced equally.
  - c. If the casing or pipe is angled or bent, reduce the spacing.
  - d. The end spacer must be within 6 inches of the end of the casing pipe, regardless of size of casing and pipe or type of spacer used.
  - e. Install spacers on PVC pipe at the insertion line to prevent over-insertion of the spigot into the bell.
4. After installation of the carrier pipe:
- a. Mortar inside and outside of the joints, as applicable
  - b. Verify electrical discontinuity between the water carrier pipe and tunnel liner.
    - 1) If continuity exists, remedy the short, by all means necessary including removing and reinstalling the carrier pipe, prior to applying cellular grout.
  - c. If hold down jacks or casing spacers are used, seal or plug the ends of the casing.
  - d. If steel pipe is used and not welded prior to installation in casing/liner, welding of pipe will only be allowed after grouting of annular space is complete.
- D. Installation of End Seals
- 1. For Water Pipes
    - a. Grout end of casing/liner a minimum of 6 inches and a maximum of 12 inches.
    - b. Place pull-on synthetic rubber end seals on the pipe and pull over the end of the casing. Securely fasten with stainless steel bands.
  - 2. For Sewer Pipes
    - a. Grout annular space between carrier pipe and casing as indicated in this Specification.
- E. Annular Space Grouting (For Sewer Only)
- 1. Prepare pipe as necessary to prevent the pipe from floating during grouting operation as necessary.

2. Mixing of Grout
  - a. Mix material in equipment of sufficient size to provide the desired amount of grout material for each stage in a single operation.
    - 1) The equipment shall be capable of mixing the grout at the required densities for the approved procedure and shall be capable of changing the densities as required by field conditions.
3. Backfill Annular Space with Grout
  - a. Prior to filling of the annular space, test the carrier pipe in accordance with Section 33 01 30.
  - b. Verify the maximum allowable pressure with the carrier pipe manufacturer and do not exceed this pressure.
  - c. After the installation of the carrier pipe, the remaining space (all voids) between the casing/liner and the carrier shall be filled with LDCC grout.
    - 1) All surfaces of the exterior carrier pipe wall and casing/liner interior shall be in contact with the grout.
    - 2) Grout shall be pumped through a pipe or hose.
    - 3) Use grout pipes, or other appropriate materials, to avoid damage to carrier pipe during grouting.
4. Injection of LDCC Grout
  - a. Grout injection pressure shall not exceed the carrier pipe manufacturer's approved recommendations or 5 psi (whichever is lower).
  - b. Pumping equipment shall be of a size sufficient to inject grout at a volume, velocity and pressure compatible with the size/volume of the annular space.
  - c. Once grouting operations begin, grouting shall proceed uninterrupted, unless grouting procedures require multiple stages.
  - d. Grout placements shall not be terminated until the estimated annular volume of grout has been injected.
5. Block the carrier pipe during grouting to prevent flotation during grout installation.
6. Protect and preserve the interior surfaces of the casing from damage.

### **3.5 REPAIR / RESTORATION [NOT USED]**

### **3.6 RE-INSTALLATION [NOT USED]**

### **3.7 FIELD [OR] SITE QUALITY CONTROL**

- A. Reports and Records required for pipe installations greater than 48-inches and longer than 350 feet
  1. Maintain and submit daily logs of grouting operations.
    - a. Include:
      - 1) Grouting locations
      - 2) Pressures
      - 3) Volumes
      - 4) Grout mix pumped
      - 5) Time of pumping
  2. Note any problems or unusual observations on logs.
- B. Grout Strength Tests
  1. City will perform testing for 24-hour and 28-day compressive strength tests for the cylinder molds or grout cubes obtained during grouting operations.
  2. City will perform field sampling during annular space grouting.
    - a. City will collect at least 1 set of 4 cylinder molds or grout cubes for each 100 cubic yards of grout injected but not less than 1 set for each grouting shift.
    - b. City will perform 24-hour and 28-day compressive strength tests per ASTM C39 (cylindrical specimens) or ASTM C109 (cube specimens).

- c. Remaining samples shall be tested as directed by City.

C. Safety

1. The Contractor is responsible for safety on the job site.
  - a. Perform all Work in accordance with the current applicable regulations of the Federal, State and local agencies.
  - b. In the event of conflict, comply with the more restrictive applicable requirement.
2. No gasoline powered equipment shall be permitted in jacking shafts and receiving shafts/pits.
  - a. Diesel, electrical, hydraulic and air powered equipment is acceptable, subject to applicable local, State and Federal regulations.
3. Methods of construction shall be such as to ensure the safety of the Work, Contractor's and other employees on site and the public.
4. Furnish and operate a temporary ventilation system in accordance with applicable safety requirements when personnel are underground.
  - a. Perform all required air and gas monitoring.
  - b. Ventilation system shall provide a sufficient supply of fresh air and maintain an atmosphere free of toxic or flammable gasses in all underground work areas.
5. Perform all Work in accordance with all current applicable regulations and safety requirements of the federal, state and local agencies.
  - a. Comply with all applicable provisions of OSHA 29 CFR Part 1926, Subpart S, Underground Construction and Subpart P, Excavations.
  - b. In the event of conflict, comply with the more stringent requirements.
6. If personnel will enter the pipe during construction, the Contractor shall develop an emergency response plan for rescuing personnel trapped underground in a shaft excavation or pipe.
  - a. Keep on-site all equipment required for emergency response in accordance with the agency having jurisdiction

**3.8 SYSTEM STARTUP [NOT USED]**

**3.9 ADJUSTING [NOT USED]**

**3.10 CLEANING [NOT USED]**

**3.11 CLOSEOUT ACTIVITIES [NOT USED]**

**3.12 PROTECTION [NOT USED]**

**3.13 MAINTENANCE [NOT USED]**

**3.14 ATTACHMENTS [NOT USED]**

**END OF SECTION**



**PART 1 - GENERAL**

**1.1 SUMMARY**

- A. Section Includes:
  - 1. Buried and surface utility markers for utility construction
- B. Deviations from this Standard Specification
  - 1. None.
- C. Related Specification Sections include, but are not necessarily limited to:
  - 1. Division 0 – Bidding Requirements, Contract Forms, and Conditions of the Contract
  - 2. Division 1 – General Requirements

**1.2 PRICE AND PAYMENT PROCEDURES**

- A. Measurement and Payment
  - 1. Measurement
    - a. Measurement for this Item will be by lump sum.
  - 2. Payment
    - a. The work performed and materials furnished in accordance with this Item will be paid for at the lump sum price bid for “Utility Markers”.
  - 3. The price bid shall include:
    - a. Furnishing and installing Utility Markers as specified by the Drawings
    - b. Mobilization
    - c. Pavement removal
    - d. Excavation
    - e. Hauling
    - f. Disposal of excess material
    - g. Furnishing, placement and compaction of backfill
    - h. Clean-up

**1.3 REFERENCES**

- A. Reference Standards
  - 1. Reference standards cited in this Specification refer to the current reference standard published at the time of the latest revision date logged at the end of this Specification unless a date is specifically cited.
  - 2. American Public Works Association (AWPA):
    - a. Uniform Color Code.

**1.4 ADMINISTRATIVE REQUIREMENTS [NOT USED]**

**1.5 SUBMITTALS**

- A. Submittals shall be in accordance with Section 01 33 00.
- B. All submittals shall be approved by the City prior to delivery.

## **1.6 ACTION SUBMITTALS/INFORMATIONAL SUBMITTALS**

- A. Product Data
  - 1. Buried Marker
  - 2. Surface Marker

## **1.7 CLOSEOUT SUBMITTALS [NOT USED]**

## **1.8 MAINTENANCE MATERIAL SUBMITTALS [NOT USED]**

## **1.9 QUALITY ASSURANCE [NOT USED]**

## **1.10 DELIVERY, STORAGE, AND HANDLING [NOT USED]**

## **1.11 FIELD [SITE] CONDITIONS [NOT USED]**

## **1.12 WARRANTY [NOT USED]**

## **PART 2 - PRODUCTS**

### **2.1 OWNER-FURNISHED [OR] OWNER-SUPPLIED PRODUCTS [NOT USED]**

### **2.2 MATERIALS**

- A. Manufacturers
  - 1. Only the manufacturers as listed on the City's Standard Products List will be considered as shown in Section 01 60 00.
    - a. The manufacturer must comply with this Specification and related Sections.
  - 2. Any product that is not listed on the Standard Products List is considered a substitution and shall be submitted in accordance with Section 01 25 00.
  - 3. Provide new Utility Markers/Locators from a manufacturer regularly engaged in the manufacturing of Utility Markers/Locators.
- B. Materials
  - 1. Buried Markers (Detectable Warning Tape)
    - a. Provide detectable warning tape as follows:
      - 1) 5.0 mil overall thickness
      - 2) Width – 3 inch minimum
      - 3) Weight – 27.5 pounds per inch per 1,000 square feet
      - 4) Triple Layer with:
        - a) Minimum thickness 0.35 mils solid aluminum foil encased in a protective inert plastic jacket
          - (1) 100 percent virgin low density polyethylene
          - (2) Impervious to all known alkalis, acids, chemical reagents and solvents within soil
          - (3) Aluminum foil visible to both sides
      - 5) Locatable by conductive and inductive methods
      - 6) Printing encased to avoid ink rub-off
      - 7) Color and Legends
        - a) Potable water lines
          - (1) Color – Blue (in accordance with APWA Uniform Color Code)
          - (2) Legend – Caution Potable Water Line Below (repeated every 24 inches)
        - b) Reclaimed water lines
          - (1) Color – Purple (in accordance with APWA Uniform Color Code)

- (2) Legend – Caution Reclaimed Water Line Below (repeated every 24 inches)
  - c) Sewer Line
    - (1) Color – Green (in accordance with APWA Uniform ColorCode)
    - (2) Legend – Caution Sewer Line Below (repeated every 24 inches)
- 2. Surface Markers
  - a. Provide as follows:
    - 1) 4-inch diameter, 6-feet minimum length, polyethylene posts, or equal
    - 2) White posts with colored, ultraviolet resistant domes as follows:
      - a) Water Lines
        - (1) Color – Blue (in accordance with APWA Uniform ColorCode)
        - (2) Legend – Caution Potable Water Line Below
      - b) Reclaimed water lines
        - (1) Color – Purple (in accordance with APWA Uniform Color Code)
        - (2) Legend – Caution Reclaimed Water Line Below
      - c) Sewer lines
        - (1) Color – Green (in accordance with APWA Uniform ColorCode)
        - (2) Legend – Caution Sewer Line Below

**2.3 ACCESSORIES [NOT USED]**

**2.4 SOURCE QUALITY CONTROL [NOT USED]**

**PART 3 - EXECUTION**

**3.1 INSTALLERS [NOT USED]**

**3.2 EXAMINATION [NOT USED]**

**3.3 PREPARATION [NOT USED]**

**3.4 INSTALLATION**

- A. Buried Markers (Detectable Warning Tape)
  - 1. Install in accordance with manufacturer's recommendations below natural ground surface and directly above the utility for which it is marking.
    - a. Allow 18 inches minimum between utility and marker.
    - b. Bury to a depth of 3 feet or as close to the grade as is practical for optimum protection and detectability.
- B. Surface Markers
  - 1. Bury a minimum of 2 feet deep, with a minimum of 4 feet above ground
  - 2. The warning sign for all surface markers shall be 21 inches (not including post cap).
  - 3. Where possible, place surface markers near fixed objects.
  - 4. Place Surface Markers at the following locations:
    - a. Buried Features
      - 1) Place directly above a buried feature.
    - b. Above-Ground Features
      - 1) Place a maximum of 2 feet away from an above-ground feature.
    - c. Water lines 16-inches and larger
      - 1) Each right-of-way line (or end of casing pipe) for:
        - a) Highway crossings
        - b) Railroad crossings

- 2) Utility crossings such as:
  - a) High pressure or large diameter gas lines
  - b) Fiber optic lines
  - c) Underground electric transmission lines
  - d) Or other locations shown on the Drawings, or directed by the City
- d. Surface markers not required for 12-inch and smaller water lines
- e. For sanitary sewer lines:
  - 1) In undeveloped areas, place marker maximum of 2 feet away from an above-ground feature such as a manhole or combination air valve vault.
  - 2) Place at 500-foot intervals along the pipeline.

**3.5 REPAIR / RESTORATION [NOT USED]**

**3.6 RE-INSTALLATION [NOT USED]**

**3.7 FIELD [OR] SITE QUALITY CONTROL [NOT USED]**

**3.8 SYSTEM STARTUP [NOT USED]**

**3.9 ADJUSTING [NOT USED]**

**3.10 CLEANING [NOT USED]**

**3.11 CLOSEOUT ACTIVITIES [NOT USED]**

**3.12 PROTECTION [NOT USED]**

**3.13 MAINTENANCE [NOT USED]**

**3.14 ATTACHMENTS [NOT USED]**

**END OF SECTION**

**33 05 30 LOCATION OF EXISTING UTILITIES**

**PART 1 - GENERAL**

**1.1 SUMMARY**

- A. Section Includes:
  - 1. Locating and verifying the location and elevation of the existing underground utilities that may conflict with a facility proposed for construction by use of:
    - a. Exploratory Excavation
    - b. Vacuum Excavation
- B. Deviations from this Standard Specification
  - 1. None.
- C. Related Specification Sections include, but are not necessarily limited to:
  - 1. Division 0 – Bidding Requirements, Contract Forms, and Conditions of the Contract
  - 2. Division 1 – General Requirements
  - 3. Section 33 05 10 – Utility Trench Excavation, Embedment and Backfill

**1.2 PRICE AND PAYMENT PROCEDURES**

- A. Measurement and Payment
  - 1. Exploratory Excavation of Existing Utilities
    - a. Measurement
      - 1) Measurement for this Item shall be per each excavation performed as identified in the Drawings, or as directed.
    - b. Payment
      - 1) The work performed and materials furnished in accordance with this Item and measured as provided under “Measurement” will be paid for at the unit price bid per each “Exploratory Excavation for Existing Utilities” specified.
    - c. The price bid shall include:
      - 1) Grade survey
      - 2) Pavement removal
      - 3) Excavation
      - 4) Utility Location
      - 5) Hauling
      - 6) Disposal of excess material
      - 7) Furnishing, placing and compaction of embedment
      - 8) Furnishing, placing and compaction of backfill
      - 9) Clean-up
      - 10) Surface restoration
  - 2. Vacuum Excavation of Existing Utilities
    - a. Measurement
      - 1) Measurement for this Item shall be per each excavation performed as identified in the Drawings, or as directed.
    - b. Payment
      - 1) The work performed and materials furnished in accordance with this Item and measured as provided under “Measurement” will be paid for at the unit price bid per each “Vacuum Excavation” specified.

- c. The price bid shall include:
  - 1) Grade survey
  - 2) Pavement removal
  - 3) Vacuum Excavation
  - 4) Utility Location
  - 5) Hauling
  - 6) Disposal of excess material
  - 7) Furnishing, placing and compaction of embedment
  - 8) Furnishing, placing and compaction of backfill
  - 9) Clean-up
  - 10) Surface restoration

### **1.3 REFERENCES**

#### **A. Definitions**

- 1. Exploratory Excavation: Previously called “D-Hole” within the City, a method used to locate existing underground utility as shown on the plans through the use of standard excavation equipment.
- 2. Vacuum Excavation: Method used to locate existing underground utility as shown on the plans through the use of geophysical prospecting equipment such as vacuum excavation.

#### **B. Reference Standards**

- 1. Reference standards cited in this Specification refer to the current reference standard published at the time of the latest revision date logged at the end of this Specification unless a date is specifically cited.
- 2. American Society of Civil Engineers (ASCE)
  - a. ASCE Publication CI/ASCE 38 (Standard Guideline for the Collection and Depiction of Existing Subsurface Utility Data)

### **1.4 ADMINISTRATIVE REQUIREMENTS**

#### **A. Coordination**

- 1. Coordinate with City Inspector at least 48 hours prior to commencing on site for Exploratory Excavation of Existing Utilities.
- 2. Coordinate location of all other existing utilities within vicinity of excavation prior to commencing Exploratory Excavation.
- 3. Coordinate staking of Exploratory Excavations with City at least 1 week prior to commencement.

#### **B. Sequencing**

- 1. Exploratory Excavations shall be conducted prior to the construction of the entire project.

#### **C. Scheduling**

- 1. For critical utility locations, the City may choose to be present during excavation.
- 2. Alter schedule for Exploratory Excavation of Existing Utilities to accommodate City personnel.

**1.5 SUBMITTALS [NOT USED]**

**1.6 ACTION SUBMITTALS/INFORMATIONAL SUBMITTALS [NOT USED]**

**1.7 CLOSEOUT SUBMITTALS**

A. Report of Utility Location

1. Horizontal location of utility as surveyed
2. Vertical elevation of utility as surveyed
  - a. Top of utility
  - b. Spring line of utility
  - c. Existing ground
3. Material type, diameter and description of the condition of existing utility

**1.8 MAINTENANCE MATERIAL SUBMITTALS [NOT USED]**

**1.9 QUALITY ASSURANCE [NOT USED]**

**1.10 DELIVERY, STORAGE, AND HANDLING [NOT USED]**

**1.11 FIELD [SITE] CONDITIONS [NOT USED]**

**1.12 WARRANTY [NOT USED] PART**

**PART 2 - PRODUCTS [NOT USED]**

**PART 3 - EXECUTION**

**3.1 INSTALLERS [NOT USED]**

**3.2 EXAMINATION**

A. Verification of Conditions

1. Verify location of existing utilities in accordance with the General Requirements, the General Notes and the Drawings.

**3.3 PREPARATION**

A. Coordinate with City Survey, if applicable.

**3.4 INSTALLATION**

A. Exploratory Excavation

1. Verify location of existing utility at location denoted on the Drawings, or as directed by the City.
  - a. Expose utility to spring line, as necessary.
  - b. Excavate and Backfill Trench for the Exploratory Excavation in accordance with Section 33 05 10.

B. Vacuum Excavation

1. Verify location of existing utility at location denoted on the Drawings, or as directed by the City.

2. Designate the horizontal position of the existing underground utilities that are to be located using geophysical prospecting equipment.
    - a. Acquire record documentation from and coordinate with utility companies, as necessary to locate utility.
  3. Perform excavation in general accordance with the recommended practices and procedures described in ASCE Publication CI/ASCE 38.
- C. Upon completion of the utility locating, submit a report of the findings.
- D. If location of utility is in conflict with the Drawings, notify the City Project Manager for appropriate design modifications.
- E. Place embedment and backfill in accordance with Section 33 05 10.
- F. Once necessary data is obtained, immediately restore surface to existing conditions to:
1. Obtain a safe and proper driving surface, if applicable
  2. Ensure the safety of the general public
  3. The satisfaction of the City

**3.5 REPAIR / RESTORATION [NOT USED]**

**3.6 RE-INSTALLATION [NOT USED]**

**3.7 FIELD [OR] SITE QUALITY CONTROL [NOT USED]**

**3.8 SYSTEM STARTUP [NOT USED]**

**3.9 ADJUSTING [NOT USED]**

**3.10 CLEANING [NOT USED]**

**3.11 CLOSEOUT ACTIVITIES [NOT USED]**

**3.12 PROTECTION [NOT USED]**

**3.13 MAINTENANCE [NOT USED]**

**3.14 ATTACHMENTS [NOT USED]**

**END OF SECTION**



**33 11 05      BOLTS, NUTS, AND GASKETS**

**PART 1 - GENERAL**

**1.1 SUMMARY**

- A. Section Includes:
  - 1. All nuts, bolts and gaskets associated with pressurized water utility lines including:
    - a. T-Bolts and Nuts
    - b. Flange Bolts and Nuts
    - c. Threaded Rods
    - d. Push-on Gaskets
    - e. Mechanical Joint Gaskets
    - f. Flange Gaskets
    - g. Flange Isolation Kits
    - h. Petrolatum Tape Systems
- B. Deviations from this Standard Specification
  - 1. None.
- C. Related Specification Sections include, but are not necessarily limited to:
  - 1. Division 0 – Bidding Requirements, Contract Forms, and Conditions of the Contract
  - 2. Division 1 – General Requirements
  - 3. Section 33 04 10 – Joint Bonding and Electrical Isolation
  - 4. Section 33 11 10 – Ductile Iron Pipe

**1.2 PRICE AND PAYMENT PROCEDURES**

- A. Measurement and Payment
  - 1. Hydrocarbon Resistant Gaskets
    - a. Measurement
      - 1) Measurement for this Item shall be by lump sum.
    - b. Payment
      - 1) The work performed and the materials furnished in accordance with this Item shall be paid for at the lump sum price bid for all “Hydrocarbon Resistant Gaskets”.
  - 2. All Other Items
    - a. Measurement
      - 1) The Items in this Section are considered subsidiary to the Item being installed.
    - b. Payment
      - 1) The work performed and materials furnished in accordance with this Item are subsidiary to the unit price bid for the Item being installed and no other compensation will be allowed.

### 1.3 REFERENCES

#### A. Reference Standards

1. Reference standards cited in this specification refer to the current reference standard published at the time of the latest revision date logged at the end of this specification unless a date is specifically cited.
2. American Iron and Steel Institute (AISI).
3. American Society of Mechanical Engineers (ASME):
  - a. PCC-1-2012 Guidelines for Pressure Boundary Bolted Flange Joint Assembly.
4. American Society of Testing and Materials (ASTM):
  - a. A193, Standard Specification for Alloy-Steel and Stainless-Steel Bolting for High Temperature or High Pressure Service and Other Special Purpose Applications.
  - b. A194, Standard Specification for Carbon and Alloy Steel Nuts for Bolts for High Pressure or High Temperature Service, or Both.
  - c. A242, Standard Specification for High-Strength Low-Alloy Carbon Structural Steel
  - d. B117, Salt Spray Testing
  - e. F436, Standard Specification for Hardened Steel Washers
5. American Water Works Association (AWWA):
  - a. C111/A21.11, Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.
  - b. C207, Steel Pipe Flanges for Waterworks Service – Sizes 4 In. Through 144 In. (100 mm Through 3,600 mm).
  - c. C600, Installation of Ductile-Iron Mains and Their Appurtenances.
  - d. M11, Steel Pipe.
  - e. M41, Ductile-Iron Pipe and Fittings.
6. Fastener Quality Act (FQA)
  - a. Public Law 106-34 (P.L. 106-34)
7. NSF International (NSF):
  - a. 61, Drinking Water System Components - Health Effects.
8. Society for Protective Coating (SSPC) Surface Preparation Standards (SP):
  - a. SP2, Hand Tool Cleaning
  - b. SP3, Power Tool Cleaning

### 1.4 ADMINISTRATIVE REQUIREMENTS [NOT USED]

### 1.5 SUBMITTALS

- A. Submittals shall be in accordance with Section 01 33 00.
- B. All submittals shall be approved by the City prior to delivery and/or fabrication for specials.

### 1.6 ACTION SUBMITTALS / INFORMATIONAL SUBMITTALS

- A. Product Data
  1. Bolts and nuts for mechanical and or flange joints
  2. Gaskets
- B. Certificates

1. Furnish an affidavit certifying that all fasteners, excluding T-Bolts, shall conform to the Fastener Quality Act (FQA) (P.L. 106-34).
2. Furnish an affidavit certifying that the Xylan Coating is manufactured by Whitford Corporation, or a Whitford Corporation certified Applicator.

**1.7 CLOSEOUT SUBMITTALS [NOT USED]**

**1.8 MAINTENANCE MATERIAL SUBMITTALS [NOT USED]**

**1.9 QUALITY ASSURANCE**

A. Qualifications

1. Manufacturers
  - a. Fastener manufacturing operations (bolts, nuts, gaskets and coatings) shall be performed under the control of the manufacturer.
  - b. All gaskets shall meet or exceed the latest revisions NSF 61 and shall meet or exceed the requirements of this Specification.

B. Preconstruction Testing

1. The City may, at its own cost, subject random fittings for destructive testing by an independent laboratory for compliance with this Specification.
  - a. The compliance test shall be performed in the United States.
  - b. Any visible defects or failure to meet the quality standards herein will be grounds for rejecting the entire order.

**1.10 DELIVERY, STORAGE, AND HANDLING**

A. Storage and Handling Requirements

1. Secure and maintain a location to store the material in accordance with Section 01 66 00.

**1.11 FIELD [SITE] CONDITIONS [NOT USED]**

**1.12 WARRANTY [NOT USED]**

**PART 2 - PRODUCTS**

**2.1 OWNER-FURNISHED [OR] OWNER-SUPPLIED PRODUCTS [NOT USED]**

**2.2 EQUIPMENT, PRODUCT TYPES AND MATERIALS**

A. Manufacturers

1. Only the manufacturers as listed on the City's Standard Products List will be considered as shown in Section 01 60 00.
  - a. The manufacturer must comply with this Specification and related Sections.
2. Any product that is not listed on the Standard Products List is considered a substitution and shall be submitted in accordance with Section 01 25 00.

B. Regulatory Requirements

1. All fasteners, excluding T-Bolts, shall conform to the Fastener Quality Act (FQA) (P.L. 106-34). All fasteners shall meet the marking requirements set forth by this Act.

C. T-Bolts and Nuts

1. Standard Xylan Coated T-bolt and Nut
  - a. High strength, corrosion-resistant, low-carbon weathering steel in accordance with AWWA/ANSI C111/A21.11 and ASTM A242
  - b. Xylan Coating in accordance with this Section
2. Stainless Steel T-bolt with Xylan Coated Stainless Steel Nut
  - a. Stainless Steel T-bolt and Nut in accordance with AISI 304.
  - b. Coat nut with Xylan in accordance with this Section.

D. Flange Bolts and Nuts

1. Stainless Steel Bolt and Xylan Coated Nut
  - a. Meet requirements of AWWA C207
  - b. Bolts: ASTM A193, Grade B8, Class 1(AISI 304 Stainless Steel, carbide solution treated)
  - c. Nuts and Washers: ASTM A194, Grade 8 Nuts with AISI 304 Stainless Steel Washers
    - 1) Coat nut with Xylan in accordance with this Section.

E. Threaded Rods

1. Meet requirements of AWWA C207
2. Rods: ASTM A193, Grade B8, Class 1(AISI 304 Stainless Steel, carbide solution treated)
3. Nuts and Washers: ASTM A194, Grade 8 Nuts with AISI 304 Stainless Steel Washers
  - a. Coat nut with Xylan in accordance with this Section.

F. Push-on Gaskets

1. Conforming to the physical and marking requirements specified in ANSI/AWWA C111/A21.11.
2. All gaskets shall meet or exceed the latest revisions NSF 61.
3. Rubber gaskets shall be made of vulcanized styrene butadiene rubber SBR, unless otherwise specified in Drawings.
4. Gaskets shall be free from porous areas, foreign material and other defects that make them unfit for intended use.
5. Gaskets shall be the size and shape required to provide an adequate compressive force against the plain end and socket after assembly to affect a positive seal under all combinations of joint and gasket tolerances.

G. Mechanical Joint Gaskets

1. Conforming to the physical and marking requirements specified in ANSI/AWWA C111/A21.11.
2. All gaskets shall meet or exceed the latest revisions NSF 61.
3. Rubber gaskets shall be made of vulcanized styrene butadiene rubber SBR, unless otherwise specified in Drawings.
4. Gaskets shall be free from porous areas, foreign material and other defects that make them unfit for intended use.

H. Flange Gaskets

1. Class E Flanges

- a. Full face
  - b. Manufactured true to shape from minimum 80 durometer SBR rubber stock of a thickness not less than 1/8 inch
  - c. Virgin stock
  - d. Conforming to the physical and test requirements specified in AWWA/ANSI C111/A21.11
  - e. All gaskets shall meet or exceed the latest revisions NSF 61.
  - f. Finished gaskets shall have holes punched by the manufacturer and shall match the flange pattern in every respect.
  - g. Frayed cut edges are not acceptable.
  - h. Field cut sheet gaskets are not acceptable.
- I. Hydrocarbon Resistant Gaskets
    - 1. Furnish Viton® (Fluorocarbon) Rubber, hydrocarbon resistant gaskets, when required.
  - J. Flange Isolation Kits
    - 1. Flanges which are required by the Drawings to be Isolation Flanges shall conform to Section 33 04 10.
    - 2. For bolts used with isolation sleeves per Section 33 04 10, threading must extend to bolt head with no grip to ensure sleeves fit properly.
  - K. Petrolatum Tape System
    - 1. Petrolatum Tape Primer: Denso Paste, or approved equal
    - 2. Molding and Filler mastic: Densyl Mastic, or approved equal
    - 3. All Purpose Petrolatum Tape: Densyl Tape, or approved equal
  - L. Xylan Coating
    - a. Coat nuts and bolts with a ceramic-filled, baked on fluorocarbon resin, when required.
    - b. Coated nuts and bolts shall be prepared "near white" or "white" when coated to the coating manufacturer's recommended thickness by a certified applicator.
    - c. Coating shall be of Xylan as manufactured by Whitford Corporation and applied by Whitford Corporation or Whitford Corporation Recommended Coater.
    - d. Coating shall be free from holidays and defects.
    - e. Coating thickness shall between 0.0007-inches and 0.0012-inches and shall be such that the nut turns freely on the bolt.
    - f. Coating shall conform to the performance requirements of ASTM B117, "Salt Spray Test" and shall include, if required, a certificate of conformance.

### **2.3 ACCESSORIES [NOT USED]**

### **2.4 SOURCE QUALITY CONTROL [NOT USED]**

## **PART 3 - EXECUTION**

### **3.1 INSTALLERS [NOT USED]**

### **3.2 EXAMINATION [NOT USED]**

### 3.3 PREPARATION [NOT USED]

### 3.4 INSTALLATION

#### A. Mechanical Joints

1. Assemble mechanical joints in accordance with ANSI/AWWA C111/A21.11 Appendix A, AWWA C600 and AWWA Manual M41.
2. Use Standard Xylan Coated T-bolts and Nuts.
  - a. Stainless Steel T-bolts with Xylan Coated Stainless Steel Nuts shall only be used when specifically required in the Drawings.

#### B. Flanged Joints

1. Install in accordance with ASME PCC-1-2012.
2. Use Stainless Steel Bolts and Xylan Coated Nuts.
3. Wrap all buried steel flanges for AWWA C200, C301 or C303 pipe with Petrolatum Tape System.
  - a. If only 1 flange in a joint is steel (AWWA C200, C301, or C303), petrolatum tape wrapping will be required.
  - b. If a joint is made between two ductile iron flanges, the joint should be polyethylene encased in accordance with Section 33 11 10.
4. Flange bolts are normally spaced evenly around the flange.
5. During assembly, tighten nuts gradually and equally using a three-pass method in accordance with ASME PCC-1-2012.
  - a. For the first pass, tighten the nuts to 50 percent at diametrically opposite sides to prevent misalignment and to ensure that all bolts carry equal loads.
  - b. For the second pass, tighten the nuts to 100 percent again in a diametrically opposite pattern.
  - c. Allow a minimum of 1 hour to pass to provide time for settlement between bolts and nuts and gasket relaxation.
  - d. Complete the third pass by checking each bolt in a clockwise pattern. Each nut should be tightened until it will no longer turn. This step compensates for elastic interaction and brings all bolts into parity.
6. The threads of the bolts should protrude a minimum of ½-inch from the nuts.

#### C. Flanged Joints with Isolation Kit

1. Flange Isolation Kits shall be installed in accordance with Section 33 04 10.
2. City will verify Isolation in accordance with Section 33 04 10.

#### D. Threaded Rod

1. Install as part of joint harness assembly in accordance with AWWA Manual M11.
2. Space rods evenly around the pipe.
3. During assembly, tighten nuts gradually and equally using a three-pass method in accordance with ASME PCC-1-2012.
  - a. For the first pass, tighten the nuts to 50 percent at diametrically opposite sides to prevent misalignment and to ensure that all bolts carry equal loads.
  - b. For the second pass, tighten the nuts to 100 percent again in a diametrically opposite pattern.
4. The threads of the bolts should protrude a minimum of ½-inch from the nuts.

5. Wrap joint harness assembly with Petrolatum Tape System.
- E. Petrolatum Tape System
1. Surfaces should be free from dirt, loose rust, scale or flaking coatings.
    - a. Clean surfaces in accordance with SSPC SP2 or SSPC SP3.
      - 1) High pressure wash of 3,000 to 7,000 psi is also suitable.
    - b. Surfaces may be damp but shall not have droplets or continuous film of water.
  2. Apply a uniform, thin coat of Petrolatum Tape Primer to the entire surface by stiff brush, gloved hand or rag at normal ambient temperatures.
  3. By hand application, apply Molding and Filler Mastic to a rounded configuration to fill irregular shapes and reduce sharp-edged surfaces.
  4. Spirally wrap All Purpose Petrolatum Tape with a minimum overlap of 1 inch.
    - a. For severely corrosive environments, an overlap of 55 percent is recommended.
    - b. Press air pockets out and smooth all lap seams.
  5. For additional mechanical protection, overwrap may be applied to increase impact strength and electrical resistance.

**3.5 REPAIR / RESTORATION [NOT USED]**

**3.6 RE-INSTALLATION [NOT USED]**

**3.7 FIELD [OR] SITE QUALITY CONTROL [NOT USED]**

**3.8 SYSTEM STARTUP [NOT USED]**

**3.9 ADJUSTING [NOT USED]**

**3.10 CLEANING [NOT USED]**

**3.11 CLOSEOUT ACTIVITIES [NOT USED]**

**3.12 PROTECTION [NOT USED]**

**3.13 MAINTENANCE [NOT USED]**

**3.14 ATTACHMENTS [NOT USED]**

**END OF SECTION**

**33 11 10      DUCTILE IRON PIPE**

**PART 1 - GENERAL**

**1.1 SUMMARY**

A. Section Includes:

1. Ductile Iron Pipe 3-inch through 64-inch for potable water, wastewater and reuse applications

B. Deviations from this Standard Specification

1. None.

C. Related Specification Sections include, but are not necessarily limited to:

1. Division 0 – Bidding Requirements, Contract Forms, and Conditions of the Contract
2. Division 1 – General Requirements
3. Section 33 01 31 – Closed Circuit Television (CCTV) Inspection
4. Section 33 04 10 – Joint Bonding and Electrical Isolation
5. Section 33 04 40 – Cleaning and Acceptance Testing of Water Mains
6. Section 33 05 10 – Utility Trench Excavation, Embedment and Backfill
7. Section 33 05 24 – Installation of Carrier Pipe in Casing or Tunnel Liner Plate
8. Section 33 11 05 – Bolts, Nuts, and Gaskets
9. Section 33 11 11 – Ductile Iron Fittings

**1.2 PRICE AND PAYMENT PROCEDURES**

A. Measurement and Payment

1. Ductile Iron Pipe

a. Measurement

- 1) Measured horizontally along the surface from center line to center line of the fitting, manhole, or appurtenance

b. Payment



- 1) The work performed and materials furnished in accordance with this Item and measured as provided under "Measurement" will be paid for at the unit price bid per linear foot for "DIP" installed for:
  - a) Various sizes
  - b) Various types of backfill
  - c) Various linings
  - d) Various Depths, for miscellaneous sewer projects only
  - e) Various restraints
  - f) Various uses
- c. The price bid shall include:
  - 1) Furnishing and installing Ductile Iron Pipe with joints as specified by the Drawings
  - 2) Mobilization
  - 3) Polyethylene encasement
  - 4) Lining
  - 5) Pavement removal
  - 6) Excavation
  - 7) Hauling
  - 8) Disposal of excess material
  - 9) Furnishing, placement and compaction of embedment
  - 10) Furnishing, placement and compaction of backfill
  - 11) Trench water stops
  - 12) Thrust restraint, if required in Contract Documents
  - 13) Bolts and nuts
  - 14) Gaskets
  - 15) Clean-up
  - 16) Cleaning
  - 17) Disinfection
  - 18) Testing

### 1.3 REFERENCES

#### A. Definitions

1. Gland or Follower Gland
  - a. Non-restrained, mechanical joint fitting
2. Retainer Gland
  - a. Mechanically restrained mechanical joint fitting

#### B. Reference Standards

1. Reference standards cited in this Specification refer to the current reference standard published at the time of the latest revision date logged at the end of this Specification, unless a date is specifically cited.
2. American Association of State Highway and Transportation Officials (AASHTO).
3. American Society of Mechanical Engineers (ASME):
  - a. B16.1, Gray Iron Pipe Flanges and Flanged Fittings (Classes 25, 125 and 250).
4. ASTM International (ASTM):
  - a. A193, Standard Specification for Alloy-Steel and Stainless Steel Bolting for High Temperature or High Pressure Service and Other Special Purpose Applications
  - b. A194, Specification for Carbon and Alloy Steel Nuts for Bolts for High Pressure or High Temperature Service, or Both
  - c. A242, Standard Specification for High-Strength Low-Alloy Structural Steel.
  - d. A307, Standard Specification for Carbon Steel Bolts and Studs, 60,000 psi Tensile Strength.
  - e. A674, Standard Practice for Polyethylene Encasement for Ductile Iron Pipe for Water or Other Liquids.
  - f. B117, Standard Practice for Operating Salt Spray (Fog) Apparatus.
  - g. B633, Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel.
5. American Water Works Association (AWWA):
  - a. C203, Coal-Tar Protective Coatings and Linings for Steel Water Pipelines- Enamel and Tape - Hot Applied.
  - b. C600, Installation of Ductile-Iron Water Mains and their Appurtenances.
  - c. M41, Ductile-Iron Pipe and Fittings.

6. American Water Works Association/American National Standards Institute (AWWA/ANSI):
  - a. C104/A21.4, Cement–Mortar Lining for Ductile-Iron Pipe and Fittings.
  - b. C105/A21.5, Polyethylene Encasement for Ductile-Iron Pipe Systems.
  - c. C111/A21.11, Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.
  - d. C115/A21.15, Flanged Ductile-Iron Pipe with Ductile-Iron or Gray-Iron Threaded Flanges.
  - e. C150/A21.50, Thickness Design of Ductile-Iron Pipe.
  - f. C151/A21.51, Ductile-Iron Pipe, Centrifugally Cast, for Water.
  - g. C600, Installation of Ductile-Iron Water Mains and their Appurtenances
7. NSF International (NSF):
  - a. 61, Drinking Water System Components - Health Effects.
8. Society for Protective Coatings (SSPC):
  - a. PA 2, Measurement of Dry Coating Thickness with Magnetic Gages.

**1.4 ADMINISTRATIVE REQUIREMENTS [NOT USED]**

**1.5 SUBMITTALS**

- A. Submittals shall be in accordance with Section 01 33 00.
- B. All submittals shall be approved by the City prior to delivery and/or fabrication for specials.

**1.6 ACTION SUBMITTALS / INFORMATIONAL SUBMITTALS**

- A. Product Data
  1. Interior lining
    - a. If it is other than cement mortar lining in accordance with AWWA/ANSI C104/A21.4, including:
      - 1) Material
      - 2) Application recommendations
      - 3) Field touch-up procedures
  2. Thrust Restraint
    - a. Retainer glands, thrust harnesses or any other means

3. Gaskets
    - a. If hydrocarbon or other special gaskets are required
- B. Shop Drawings – Furnish for Ductile Iron Pipe used in the water distribution system or for a wastewater force main for 24-inch and greater diameters, including:
1. Wall thickness design calculations sealed by a Licensed Professional Engineer in Texas including:
    - a. Working pressure
    - b. Surge pressure
    - c. Deflection
  2. Provide thrust restraint calculations for all fittings and valves, sealed by a Licensed Professional Engineer in Texas, to verify the restraint lengths shown in the Drawings.
  3. Lay schedule/drawing for 24-inch and greater diameters, sealed by a Licensed Professional Engineer in Texas including:
    - a. Pipe class
    - b. Joints type
    - c. Fittings
    - d. Stationing
    - e. Transitions
    - f. Joint deflection
- C. Certificates
1. Furnish an affidavit certifying that all Ductile Iron Pipe meets the provisions of this Section, each run of pipe furnished has met Specifications, all inspections have been made, and that all tests have been performed in accordance with AWWA/ANSI C151/A21.51.
  2. Furnish a certificate stating that buried bolts and nuts conform to ASTM B117.

**1.7 CLOSEOUT SUBMITTALS [NOT USED]**

**1.8 MAINTENANCE MATERIAL SUBMITTALS [NOT USED]**

**1.9 QUALITY ASSURANCE**

A. Qualifications

1. Manufacturers

- a. Finished pipe shall be the product of 1 manufacturer.
  - 1) Change orders, specials, and field changes may be provided by a different manufacturer upon City approval.
- b. Pipe manufacturing operations (pipe, lining, and coatings) shall be performed under the control of the manufacturer.
- c. Ductile Iron Pipe
  - 1) Manufactured in accordance with AWWA/ANSI C151/A21.51
    - a) Perform quality control tests and maintain results as outlined within standard to assure compliance.
  - 2) Subject each pipe to a hydrostatic test of not less than 500 psi for duration of at least 10 seconds.

B. Preconstruction Testing

- 1. The City may, at its own cost, subject random lengths of pipe for testing by an independent laboratory for compliance with this Specification.
  - a. The compliance test shall be performed in the United States.
  - b. Any visible defects or failure to meet the quality standards herein will be grounds for rejecting the entire order.

**1.10 DELIVERY, STORAGE, AND HANDLING**

A. Storage and Handling Requirements

- 1. Ductile Iron Pipe shall be stored and handled in accordance with the guidelines as stated in AWWA M41.
- 2. Secure and maintain a location to store the material in accordance with Section 01 66 00.

**1.11 FIELD [SITE] CONDITIONS [NOT USED]**

**1.12 WARRANTY [NOT USED]**

**PART 2 - PRODUCTS**

**2.1 OWNER-FURNISHED [OR] OWNER-SUPPLIED PRODUCTS [NOT USED]**

**2.2 EQUIPMENT, PRODUCT TYPES AND MATERIALS**

A. Manufacturers

1. Only the manufacturers as listed in the City's Standard Products List will be considered as shown in Section 01 60 00.
  - a. The manufacturer must comply with this Specification and related Sections.
2. Any product that is not listed on the Standard Products List is considered a substitution and shall be submitted in accordance with Section 01 25 00.

B. Pipe

1. Pipe shall be in accordance with AWWA/ANSI C111/A21.11, AWWA/ANSI C150/A21.15, and AWWA/ANSI C151/A21.51.
2. All pipe shall meet the requirements of NSF 61.
3. Pipe shall have a lay length of 18 feet or 20 feet except for special fittings or closure pieces and necessary to comply with the Drawings.
4. As a minimum the following pressures classes apply. The Drawings may specify a higher pressure class or the pressure and deflection design criteria may also require a higher pressure class, but in no case should they be less than the following:

<b>Diameter (inches)</b>	<b>Min Pressure Class (psi)</b>
3 through 12	350
14 through 20	250
24	200
30 through 64	150

5. Pipe markings shall meet the minimum requirements of AWWA/ANSI C151/A21.51. Minimum pipe markings shall be as follows:
  - a. "DI" or "Ductile" shall be clearly labeled on each pipe
  - b. Weight, pressure class and nominal thickness of each pipe
  - c. Year and country pipe was cast
  - d. Manufacturer's mark

6. Pressure and Deflection Design

- a. Pipe design shall be based on trench conditions and design pressure class specified in the Drawings.
  - b. Pipe shall be designed according to the methods indicated in AWWA/ANSI C150/A21.50, AWWA/ANSI C151/A21.51, and AWWA M41 for trench construction, using the following parameters:
    - 1) Unit Weight of Fill ( $w$ ) = 130 pcf
    - 2) Live Load = AASHTO HS 20
    - 3) Trench Depth = 12 feet minimum, or as indicated in Drawings
    - 4) Bedding Conditions = Type 4
    - 5) Working Pressure ( $P_w$ ) = 150 psi
    - 6) Surge Allowance ( $P_s$ ) = 100 psi
    - 7) Design Internal Pressure ( $P_i$ ) =  $P_w + P_s$  or 2:1 safety factor of the actual working pressure plus the actual surge pressure, whichever is greater.
      - a) Test Pressure =
        - (1) No less than 1.25 minimum times the stated working pressure (187 psi minimum) of the pipeline measured at the highest elevation along the test section.
        - (2) No less than 1.5 times the stated working pressure (225 psi minimum) at the lowest elevation of the test section.
      - 8) Maximum Calculated Deflection ( $D_x$ ) = 3 percent
      - 9) Restrained Joint Safety Factor ( $S_i$ ) = 15 percent
  - c. Trench depths shall be verified after existing utilities are located.
    - 1) Vertical alignment changes required because of existing utility or other conflicts shall be accommodated by an appropriate change in pipe design depth.
    - 2) In no case shall pipe be installed deeper than its design allows.
7. Provisions for Thrust
- a. Thrust at bends, tees, plugs or other fittings shall be mechanically restrained joints when required by the Drawings.
  - b. Thrust at bends adjacent to casing pipe shall be restrained by mechanical means through casing and for a sufficient distance each side of casing.
  - c. No thrust restraint contribution shall be allowed for the restrained length of pipe within the casing.

- d. Restrained joints, when required, shall be used for a sufficient distance from each side of the bend, tee, plug, valve or other fitting to resist thrust which will be developed at the design pressure of the pipe. For the purpose of thrust, the following shall apply:
  - 1) Valves shall be calculated as dead ends.
  - 2) Design pressure shall be greater than the working pressure of the pipe or the internal pressure ( $P_i$ ) whichever is greater.
  - 3) Restrained joints shall consist of approved mechanical restrained or push-on restrained joints as listed in the City's Standard Products List as shown in Section 01 60 00.
- e. The Pipe Manufacturer shall verify the length of pipe with restrained joints to resist thrust in accordance with the Drawings, AWWA M41, and the following:
  - 1) The weight of earth ( $W_e$ ) shall be calculated as the weight of the projected soil prism above the pipe, for unsaturated soil conditions.
  - 2) Soil density = 130 pcf (maximum value to be used), for unsaturated soil conditions
  - 3) If indicated on the Drawings and the Geotechnical Borings that ground water is expected, account for reduced soil density.

8. Joints

- a. General – Comply with AWWA/ANSI C111/A21.11.
- b. Push-On Joints
- c. Mechanical Joints
- d. Push-On Restrained Joints
  - 1) Restraining Push-on joints by means of a special gasket
    - a) Only those products that are listed in Section 01 60 00
    - b) The working pressure rating of the restrained gasket must exceed the test pressure of the pipe line to be installed.
    - c) Approved for use of restraining Ductile Iron Pipe in casing with a carrier pipe of 4-inches to 12-inches
    - d) Otherwise only approved if specially listed on the Drawings
  - 2) Push-on Restrained Joint bell and spigot
    - a) Only those products list in the standard products list will be allowed for the size listed in the standard products list per Section 01 60 00.
    - b) Pressure rating shall exceed the working and test pressure of the pipe line.



- e. Flanged Joints – AWWA/ANSI C115/A21.15, ASME B16.1, Class 125
  - f. Flange bolt circles and bolt holes shall match those of ASME B16.1, Class 125.
  - g. Field fabricated flanges are prohibited.
9. Gaskets
- a. Provide Gaskets in accordance with Section 33 11 05.
10. Isolation Flanges
- a. Flanges required by the drawings to be Isolation Flanges shall conform to Section 33 04 10.
11. Bolts and Nuts
- a. Mechanical Joints
    - 1) Provide bolts and nuts in accordance with Section 33 11 05.
  - b. Flanged Ends
    - 1) Meet requirements of AWWA C115.
      - a) Provide bolts and nuts in accordance with Section 33 11 05.
12. Flange Coatings
- a. Connections to Steel Flanges
    - 1) Buried connections with Steel Flanges shall be coated with a Petrolatum Tape System in accordance with Section 33 11 05.
13. Ductile Iron Pipe Exterior Coatings
- a. All ductile iron shall have an asphaltic coating, minimum of 1 mil thick, on the pipe exterior, unless otherwise specified in the Contract Documents.
14. Polyethylene Encasement
- a. All buried Ductile Iron Pipe shall be polyethylene encased.
  - b. Only manufacturers listed in the City's Standard Products List as shown in Section 01 60 00 will be considered acceptable.
  - c. Use only virgin polyethylene material.
  - d. Encasement for buried pipe shall be 8 mil linear low density (LLD) polyethylene conforming to AWWA/ANSI C105/A21.5 or 4 mil high density cross-laminated (HDCL) polyethylene encasement conforming to AWWA/ANSI C105/A21.5 and ASTM A674.
  - e. Marking: At a minimum of every 2 feet along its length, the mark the polyethylene film with the following information:

- 1) Manufacturer's name or trademark
  - 2) Year of manufacturer
  - 3) AWWA/ANSI C105/A21.5
  - 4) Minimum film thickness and material type
  - 5) Applicable range of nominal diameter sizes
  - 6) Warning – Corrosion Protection – Repair Any Damage
- f. Special Markings/Colors
- 1) Reclaimed Water, perform one of the following:
    - a) Label polyethylene encasement with “RECLAIMED WATER”,
    - b) Provide purple polyethylene in accordance with the American Public Works Association Uniform Color Code; or
    - c) Attach purple reclaimed water marker tape to the polyethylene wrap.
  - 2) Wastewater, perform one of the following:
    - a) Label polyethylene encasement with “WASTEWATER”;
    - b) Provide green polyethylene in accordance with the American Public Works Association Uniform Color Code; or
    - c) Attach green sanitary sewer marker tape to the polyethylene wrap.
- g. Minimum widths

**Polyethylene Tube and Sheet Sizes for Push-On Joint Pipe**

Nominal Pipe Diameter (inches)	Min. Width – Flat Tube (inches)	Min. Width – Sheet (inches)
3	14	28
4	14	28
6	16	32
8	20	40
10	24	48
12	27	54
14	30	60
16	34	68
18	37	74
20	41	82
24	54	108
30	67	134
36	81	162

42	81	162
48	95	190
54	108	216
60	108	216
64	121	242

15. Ductile Iron Pipe Interior Lining

a. Cement Mortar Lining

- 1) Ductile Iron Pipe for potable water shall have a cement mortar lining in accordance with AWWA/ANSI C104/A21.04 and be acceptable according to NSF 61.

b. Ceramic Epoxy or Epoxy Linings

- 1) Ductile Iron Pipe for use in wastewater applications shall be lined with a Ceramic Epoxy or Epoxy lining as designated in the City's Standard Products List as shown in Section 01 60 00.
- 2) Apply lining at a minimum of 40 mils DFT.
- 3) Due to the tolerances involved, the gasket area and spigot end up to 6 inches back from the end of the spigot end must be coated with 6 mils nominal, 10 mils maximum using a Joint Compound as supplied by the manufacturer.
  - a) Apply the joint compound by brush to ensure coverage.
  - b) Care should be taken that the joint compound is smooth without excess buildup in the gasket seat or on the spigot ends.
  - c) Coat the gasket seat and spigot ends after the application of the lining.
- 4) Surface preparation shall be in accordance with the manufacturer's recommendations.
- 5) Check thickness using a magnetic film thickness gauge in accordance with the method outlined in SSPC PA 2.
- 6) Test the interior lining of all pipe barrels for pinholes with a non-destructive 2,500 volt test.
  - a) Repair any defects prior to shipment.
- 7) Mark each fitting with the date of application of the lining system along with its numerical sequence of application on that date and records maintained by the applicator of his work.
- 8) For all Ductile Iron Pipe in wastewater service where the pipe has been cut, coat the exposed surface with the touch-up material as recommended by the manufacturer.

- a) The touch-up material and the lining shall be of the same manufacturer.

**2.3 ACCESSORIES [NOT USED]**

**2.4 SOURCE QUALITY CONTROL [NOT USED]**

**PART 3 - EXECUTION**

**3.1 INSTALLERS [NOT USED]**

**3.2 EXAMINATION [NOT USED]**

**3.3 PREPARATION [NOT USED]**

**3.4 INSTALLATION**

A. General

1. Install pipe, fittings, specials and appurtenances as specified herein, as specified in AWWA C600, AWWA M41 and in accordance with the pipe manufacturer's recommendations.
2. See Section 33 11 11 for installation requirements for Ductile Iron Fittings.
3. Lay pipe to the lines and grades as indicated in the Drawings.
4. Excavate and backfill trenches in accordance with Section 33 05 10.
5. Embed Ductile Iron Pipe in accordance with Section 33 05 10.
6. For installation of carrier pipe within casing, see Section 33 05 24.

B. Pipe Handling

1. Haul and distribute pipe and fittings at the project site.
2. Handle piping with care to avoid damage.
  - a. Inspect each joint of pipe and reject or repair any damaged pipe prior to lowering into the trench.
  - b. Do not handle the pipe in such a way that will damage the interior lining.
  - c. Use only nylon ropes, slings or other lifting devices that will not damage the surface of the pipe for handling the pipe.
3. At the close of each operating day:
  - a. Keep the pipe clean and free of debris, dirt, animals and trash – during and after the laying operation.

- b. Effectively seal the open end of the pipe using a gasketed night cap.

### C. Joint Making

#### 1. Mechanical Joints

- a. Bolt the follower ring into compression against the gasket with the bolts tightened down evenly then cross torqued in accordance with AWWA C600.
- b. Overstressing of bolts to compensate for poor installation practice will not be permitted.

#### 2. Push-on Joints

- a. Install Push-on joints as defined in AWWA/ANSI C111/A21.11.
- b. Wipe clean the gasket seat inside the bell of all extraneous matter.
- c. Place the gasket in the bell in the position prescribed by the manufacturer.
- d. Apply a thin film of non-toxic vegetable soap lubricant to the inside of the gasket and the outside of the spigot prior to entering the spigot into the bell.
- e. When using a field cut plain end piece of pipe, refinish the field cut and scarf to conform to AWWA C600.

#### 3. Flanged Joints

- a. Use erection bolts and drift pins to make flanged connections.
  - 1) Do not use undue force or restraint on the ends of the fittings.
  - 2) Apply even and uniform pressure to the gasket.
- b. The fitting must be free to move in any direction while bolting.
  - 1) Install flange bolts with all bolt heads faced in one direction.

#### 4. Joint Deflection

- a. Deflect the pipe only when necessary to avoid obstructions or to meet the lines and grades and shown in the Drawings.
- b. The deflection of each joint must be in accordance with AWWA C600 Table 3.
- c. The maximum deflection allowed is 50 percent of that indicated in AWWA C600.
- d. The manufacturer's recommendation may be used with the approval of the Engineer.

### D. Polyethylene Encasement Installation

#### 1. Preparation

- a. Remove all lumps of clay, mud, cinders, etc., on pipe surface prior to installation of polyethylene encasement.
    - 1) Prevent soil or embedment material from becoming trapped between pipe and polyethylene.
  - b. Fit polyethylene film to contour of pipe to affect a snug, but not tight encase with minimum space between polyethylene and pipe.
    - 1) Provide sufficient slack in contouring to prevent stretching polyethylene where it bridges irregular surfaces such as bell-spigot interfaces, bolted joints or fittings and to prevent damage to polyethylene due to backfilling operations.
    - 2) Secure overlaps and ends with adhesive tape and hold.
  - c. For installations below water table and/or in areas subject to tidal actions, seal both ends of polyethylene tube with adhesive tape at joint overlap.
2. Tubular Type (Method A)
- a. Cut polyethylene tube to length approximately 2 feet longer than pipe section.
  - b. Slip tube around pipe, centering it to provide 1-foot overlap on each adjacent pipe section and bunching it accordion-fashion lengthwise until it clears pipe ends.
  - c. Lower pipe into trench and make up pipe joint with preceding section of pipe.
  - d. Make shallow bell hole at joints to facilitate installation of polyethylene tube.
  - e. After assembling pipe joint, make overlap of polyethylene tube, pull bunched polyethylene from preceding length of pipe, slip it over end of the new length of pipe and wrap until it overlaps joint at end of preceding length of pipe.
  - f. Secure overlap in place.
  - g. Take up slack width at top of pipe to make a snug, but not tight, fit along barrel of pipe, securing fold at quarter points.
  - h. Repair cuts, tears, punctures or other damage to polyethylene.
  - i. Proceed with installation of next pipe in same manner.
3. Tubular Type (Method B)
- a. Cut polyethylene tube to length approximately 1 foot shorter than pipe section.
  - b. Slip tube around pipe, centering it to provide 6 inches of bare pipe at each end.
  - c. Take up slack width at top of pipe to make a snug, but not tight, fit along barrel of pipe, securing fold at quarter points; secure ends.
  - d. Before making up joint, slip 3-foot length of polyethylene tube over end of preceding pipe section, bunching it accordion-fashion lengthwise.

- e. After completing joint, pull 3-foot length of polyethylene over joint, overlapping polyethylene previously installed on each adjacent section of pipe by at least 1 foot; make each end snug and secure.
4. Sheet Type
- a. Cut polyethylene sheet to a length approximately 2 feet longer than piece section.
  - b. Center length to provide 1-foot overlap on each adjacent pipe section, bunching it until it clears the pipe ends.
  - c. Wrap polyethylene around pipe so that it circumferentially overlaps top quadrant of pipe.
  - d. Secure cut edge of polyethylene sheet at intervals of approximately 3 feet.
  - e. Lower wrapped pipe into trench and make up pipe joint with preceding section of pipe.
  - f. Make shallow bell hole at joints to facilitate installation of polyethylene.
  - g. After completing joint, make overlap and secure ends.
  - h. Repair cuts, tears, punctures or other damage to polyethylene.
  - i. Proceed with installation of next section of pipe in same manner.
5. Pipe-Shaped Appurtenances
- a. Cover bends, reducers, offsets and other pipe-shaped appurtenances with polyethylene in same manner as pipe and fittings.
6. Odd-Shaped Appurtenances
- a. When it is not practical to wrap valves, tees, crosses, and other odd-shaped pieces in tube, wrap with flat sheet or split length polyethylene tube by passing sheet under appurtenances and bringing it up around body.
  - b. Make seams by bringing edges together, folding over twice and taping down.
  - c. Tape polyethylene securely in place at the valve stem and at any other penetrations.
7. Repairs
- a. Repair any cuts, tears, punctures or damage to polyethylene with adhesive tape or with short length of polyethylene sheet or cut open tube, wrapped around fitting to cover damaged area and secured in place.
8. Openings in Encasement

- a. Provide openings for branches, service taps, blow-offs, air valves and similar appurtenances by making an X-shaped cut in polyethylene and temporarily folding back film.
  - b. After appurtenance is installed, tape slack securely to appurtenance and repair cut, as well as other damaged area in polyethylene with tape.
  - c. Service taps may also be made directly through polyethylene, with any resulting damaged areas being repaired as described above.
9. Junctions between Wrapped and Unwrapped Pipe:
- a. Where polyethylene-wrapped pipe joins an adjacent pipe that is not wrapped, extend polyethylene wrap to cover adjacent pipe for distance of at least 3 feet.
  - b. Secure end with circumferential turns of tape.
  - c. Wrap service lines of dissimilar metals with polyethylene or suitable dielectric tape for minimum clear distance of 3 feet away from Cast or Ductile Iron Pipe.

### **3.5 REPAIR/RESTORATION**

#### **A. Patching**

- 1. Excessive field-patching is not permitted of lining or coating.
- 2. Patching of lining or coating will be allowed where area to be repaired does not exceed 100 square inches and has no dimensions greater than 12 inches.
- 3. In general, there shall not be more than 1 patch on either the lining or the coating of any 1 joint of pipe.
- 4. Wherever necessary to patch the pipe:
  - a. Make patch with cement mortar as previously specified for interior joints.
  - b. Do not install patched pipe until the patch has been properly and adequately cured and approved for laying by the City.
- 5. Promptly remove rejected pipe from the site.

### **3.6 RE-INSTALLATION [NOT USED]**

### **3.7 FIELD [OR] SITE QUALITY CONTROL**

#### **A. Potable Water Mains**

- 1. Cleaning, disinfection, hydrostatic testing and bacteriological testing of water mains
  - a. Clean, flush, pig, disinfect, hydrostatic test and bacteriological test the water main as specified in Section 33 04 40.



B. Wastewater Lines

1. Closed Circuit Television (CCTV) Inspection

- a. Provide a Post-CCTV Inspection in accordance with Section 33 01 31.

**3.8 SYSTEM STARTUP [NOT USED]**

**3.9 ADJUSTING [NOT USED]**

**3.10 CLEANING [NOT USED]**

**3.11 CLOSEOUT ACTIVITIES [NOT USED]**

**3.12 PROTECTION [NOT USED]**

**3.13 MAINTENANCE [NOT USED]**

**3.14 ATTACHMENTS [NOT USED]**

**END OF SECTION**

**PART 1 - GENERAL****1.1 SUMMARY**

## A. Section Includes:

1. Ductile Iron Fittings 3-inch through 64-inch for potable water, wastewater, and other liquids for use with Ductile Iron Pipe and Polyvinyl Chloride (PVC) Pipe
2. All mechanical joint fittings shall be mechanically restrained using restrained wedge type retainer glands.

## B. Deviations from this Standard Specification

1. None.

## C. Related Specification Sections include, but are not necessarily limited to:

1. Division 0 – Bidding Requirements, Contract Forms, and Conditions of the Contract
2. Division 1 – General Requirements
3. Section 03 30 00 – Cast-in-Place Concrete
4. Section 33 04 10 – Joint Bonding and Electrical Isolation
5. Section 33 04 40 – Cleaning and Acceptance Testing of Water Mains
6. Section 33 05 10 – Utility Trench Excavation, Embedment and Backfill
7. Section 33 11 05 – Bolts, Nuts, and Gaskets

**1.2 PRICE AND PAYMENT PROCEDURES**

## A. Measurement and Payment

## 1. Ductile Iron Water Fittings with Restraint

## a. Measurement

- 1) Shall be per ton of fittings supplied
- 2) Fittings weights are the sum of the various types of fittings multiplied by the weight per fitting as listed in AWWA/ANSI C153/A21.53.
- 3) The fitting weights listed in AWWA/ANSI C110/A21.10 are only allowed for specials where an AWWA/ANSI C153/A21.53 is not available, or if the Drawings specifically call for an AWWA/ANSI C110/A21.10 fittings.
- 4) If the Contractor chooses to supply AWWA/ANSI C110/A21.10 (full body) Ductile Iron Fittings in lieu of AWWA/ANSI C153/A21.53 (compact) Ductile Iron Fittings at his convenience, then the weight shall be measured in accordance with AWWA/ANSI C153/A21.53.

b. Payment

- 1) The work performed and materials furnished in accordance with this Item and measured as provided under "Measurement" will be paid for at the unit price bid per ton of "Ductile Iron Water Fittings with Restraint".

c. The price bid shall include:

- 1) Furnishing and installing Ductile Iron Water Fittings as specified by the Drawings
- 2) Polyethylene encasement
- 3) Lining
- 4) Pavement removal
- 5) Excavation
- 6) Hauling
- 7) Disposal of excess material
- 8) Furnishing and installing bolts, nuts, and restraints
- 9) Furnishing, placement and compaction of embedment
- 10) Furnishing, placement and compaction of backfill
- 11) Trench water stops
- 12) Clean-up
- 13) Cleaning
- 14) Disinfection
- 15) Testing

2. Ductile Iron Sewer Fittings

a. Measurement

- 1) Shall be per ton of fittings supplied
- 2) Fittings weights are the sum of the various types of fittings multiplied by the weight per fitting as listed in AWWA/ANSI C153/A21.53.
- 3) The fitting weights listed in AWWA/ANSI C110/A21.10 are only allowed for specials where an AWWA/ANSI C153/A21.53 is not available, or if the Drawings specifically call for an AWWA/ANSI C110/A21.10 fittings.
- 4) If the Contractor chooses to supply AWWA/ANSI C110/A21.10 (full body) Ductile Iron Fittings in lieu of AWWA/ANSI C153/A21.53 (compact) Ductile Iron Fittings at his convenience, then the weight shall be measured in accordance with AWWA/ANSI C153/A21.53.

- b. Payment
  - 1) The work performed and materials furnished in accordance with this Item and measured as provided under "Measurement" will be paid for at the unit price bid per ton of "Ductile Iron Sewer Fittings".
- c. The price bid shall include:
  - 1) Furnishing and installing Ductile Iron Water Fittings as specified by the Drawings
  - 2) Epoxy Coating
  - 3) Polyethylene encasement
  - 4) Lining
  - 5) Pavement removal
  - 6) Excavation
  - 7) Hauling
  - 8) Disposal of excess material
  - 9) Furnishing and installing bolts, nuts, and restraints
  - 10) Furnishing, placement and compaction of embedment
  - 11) Furnishing, placement and compaction of backfill
  - 12) Clean-up
  - 13) Cleaning
  - 14) Disinfection
  - 15) Testing

### **1.3 REFERENCES**

#### **A. Definitions**

- 1. Gland or Follower Gland
  - a. Non-restrained, mechanical joint fitting
- 2. Retainer Gland
  - a. Mechanically restrained mechanical joint fitting, consisting of multiple gripping wedges incorporated into a follower gland meeting the applicable requirements of ANSI/AWWA C110/A21.10.

#### **B. Reference Standards**

1. Reference standards cited in this Specification refer to the current reference standard published at the time of the latest revision date logged at the end of this Specification, unless a date is specifically cited.
2. American Society of Mechanical Engineers (ASME):
  - a. B16.1, Gray Iron Pipe Flanges and Flanged Fittings (Classes 25, 125 and 250).
3. ASTM International (ASTM):
  - a. A193, Standard Specification for Alloy-Steel and Stainless Steel Bolting for High Temperature or High Pressure Service and Other Special Purpose Applications
  - b. A194, Specification for Carbon and Alloy Steel Nuts for Bolts for High Pressure or High Temperature Service, or Both
  - c. A242, Standard Specification for High-Strength Low-Alloy Structural Steel.
  - d. A674, Standard Practice for Polyethylene Encasement for Ductile Iron Pipe for Water or Other Liquids.
  - e. B117, Standard Practice for Operating Salt Spray (Fog) Apparatus.
4. American Water Works Association (AWWA):
  - a. C203, Coal-Tar Protective Coatings and Linings for Steel Water Pipelines - Enamel and Tape - Hot Applied.
  - b. C600, Installation of Ductile-Iron Water Mains and their Appurtenances.
  - c. M41, Ductile-Iron Pipe and Fittings.
5. American Water Works Association/American National Standards Institute (AWWA/ANSI):
  - a. C104/A21.4, Cement–Mortar Lining for Ductile-Iron Pipe and Fittings.
  - b. C105/A21.5, Polyethylene Encasement for Ductile-Iron Pipe Systems.
  - c. C110/A21.10, Ductile-Iron and Gray-Iron Fittings.
  - d. C111/A21.11, Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.
  - e. C115/A21.15, Flanged Ductile-Iron Pipe with Ductile-Iron or Gray-Iron Threaded Flanges.
  - f. C151/A21.51, Ductile-Iron Pipe, Centrifugally Cast, for Water.
  - g. C153/A21.53, Ductile-Iron Compact Fittings for Water Service.
6. NSF International (NSF):
  - a. 61, Drinking Water System Components - Health Effects.
7. Society for Protective Coatings (SSPC):

- a. PA 2, Measurement of Dry Coating Thickness with Magnetic Gages.

**1.4 ADMINISTRATIVE REQUIREMENTS [NOT USED]**

**1.5 SUBMITTALS**

- A. Submittals shall be in accordance with Section 01 33 00.
- B. All submittals shall be approved by the City prior to delivery and/or fabrication for specials.

**1.6 ACTION SUBMITTALS / INFORMATIONAL SUBMITTALS**

- A. Product Data
  - 1. Ductile Iron Fittings
    - a. Pressure class
    - b. Interior lining
    - c. Joint types
  - 2. Polyethylene encasement and tape
    - a. Planned method of installation
    - b. Whether the film is linear low density or high density cross linked polyethylene
    - c. The thickness of the film provided
  - 3. The interior lining, if it is other than cement mortar lining in accordance with AWWA/ANSI C104/A21.4
    - a. Material
    - b. Application recommendations
    - c. Field touch-up procedures
  - 4. Thrust Restraint
    - a. Retainer glands
    - b. Thrust harnesses
    - c. Any other means
  - 5. Gaskets
    - a. Provide Gaskets in accordance with Section 33 11 05.
  - 6. Isolation Flanges
    - a. Flanges required by the drawings to be Isolation Flanges shall conform to Section 33 04 10.
  - 7. Bolts and Nuts

- a. Mechanical Joints
  - 1) Provide bolts and nuts in accordance with Section 33 11 05.
- b. Flanged Ends
  - 1) Meet requirements of AWWA C115.
    - a) Provide bolts and nuts in accordance with Section 33 11 05.
- 8. Flange Coatings
  - a. Connections to Steel Flanges
    - 1) Buried connections with Steel Flanges shall be coated with a Petrolatum Tape System in accordance with Section 33 11 05.
- B. Certificates
  - 1. The manufacturer shall furnish an affidavit certifying that all Ductile Iron Fittings meet the provisions of this Section and meet the requirements of AWWA/ANSI C110/A21.10 or AWWA/ANSI C153/A21.53.
  - 2. Furnish a certificate stating that buried bolts and nuts conform to ASTM B117.

**1.7 CLOSEOUT SUBMITTALS [NOT USED]**

**1.8 MAINTENANCE MATERIAL SUBMITTALS [NOT USED]**

**1.9 QUALITY ASSURANCE**

A. Qualifications

- 1. Manufacturers
  - a. Fittings manufacturing operations (fittings, lining, and coatings) shall be performed under the control of the manufacturer.
  - b. Ductile Iron Fittings shall be manufactured in accordance with AWWA/ANSI C110/A21.10 or AWWA/ANSI C153/A21.53.
    - 1) Perform quality control tests and maintain the results as outlined in these standards to assure compliance.

B. Preconstruction Testing

- 1. The City may, at its own cost, subject random fittings for destructive testing by an independent laboratory for compliance with this Specification.
  - a. The compliance test shall be performed in the United States.
  - b. Any visible defects or failure to meet the quality standards herein will be grounds for rejecting the entire order.

**1.10 DELIVERY, STORAGE, AND HANDLING**

A. Storage and Handling Requirements

1. Store and handle in accordance with the guidelines as stated in AWWA M41.
2. Secure and maintain a location to store the material in accordance with Section 01 66 00.

**1.11 FIELD [SITE] CONDITIONS [NOT USED]**

**1.12 WARRANTY [NOT USED]**

**PART 2 - PRODUCTS**

**2.1 OWNER-FURNISHED [OR] OWNER-SUPPLIED PRODUCTS [NOT USED]**

**2.2 EQUIPMENT, PRODUCT TYPES AND MATERIALS**

A. Manufacturers

1. Only the manufacturers as listed on the City's Standard Products List will be considered as shown in Section 01 60 00.
  - a. The manufacturer must comply with this Specification and related Sections.
2. Any product that is not listed on the Standard Products List is considered a substitution and shall be submitted in accordance with Section 01 25 00.

B. Ductile Iron Fittings

1. Ductile Iron Fittings shall be in accordance with AWWA/ANSI C110/A21.10, AWWA/ANSI C153/A21.53.
2. All fittings for potable water service shall meet the requirements of NSF 61.
3. Ductile Iron Fittings, at a minimum, shall meet or exceed the pressures classes of the pipe which the fitting is connected, unless specifically indicated in the Drawings.
4. Fittings Markings
  - a. Meet the minimum requirements of AWWA/ANSI C151/A21.51.
  - b. Minimum markings shall include:
    - 1) "DI" or "Ductile" cast or metal stamped on each fitting
    - 2) Applicable AWWA/ANSI standard for that the fitting
    - 3) Pressure rating
    - 4) Number of degrees for all bends
    - 5) Nominal diameter of the openings
    - 6) Year and country fitting was cast
    - 7) Manufacturer's mark

5. Joints



- a. Mechanical Joints with mechanical restraint
  - 1) Comply with AWWA/ANSI C111/A21.11 and applicable parts of ANSI/AWWA C110/A21.10.
  - 2) The retainer gland shall have the following working pressure ratings based on size and type of pipe:
    - a) Ductile Iron Pipe
      - (1) 3-inch – 16-inch, 350 psi
      - (2) 18-inch – 48-inch, 250 psi
    - b) PVC C900 and C905
      - (1) 3-inch – 12-inch, 305psi
      - (2) 14-inch – 16-inch, 235psi
      - (3) 18-inch – 20-inch, 200psi
      - (4) 24-inch – 30 –inch 165psi
    - c) Ratings are for water pressure and must include a minimum safety factor of 2 to 1 in all sizes
  - 3) Retainer glands shall have specific designs for Ductile Iron and PVC and it should be easy to differentiate between the 2.
  - 4) Gland body, wedges and wedge actuating components shall be cast from grade 65-45-12 ductile iron material in accordance with ASTM A536.
  - 5) Mechanical joint restraint shall require conventional tools and installation procedures per AWWA C600, while retaining full mechanical joint deflection during assembly as well as allowing joint deflection after assembly.
  - 6) Proper actuation of the gripping wedges shall be ensured with torque limiting twist off nuts.
  - 7) A minimum of 6 wedges shall be required for 8 inch diameter PVC pipe.
- b. Push-On, Restrained Joints
  - 1) Restraining Push-on joints by means of a special gasket
    - a) Only those products that are listed in 01 60 00
    - b) The working pressure rating of the restrained gasket must exceed the test pressure of the pipe line to be installed.
    - c) Approved for use of restraining Ductile Iron Pipe in casing with a carrier pipe of 4-inches to 12-inches
    - d) Otherwise only approved if specially listed on the drawings

- 2) Push-on Restrained Joint bell and spigot
  - a) Only those products list in the standard products list will be allowed for the size listed in the standard products list per Section 01 60 00
  - b) Pressure rating shall exceed the working and test pressure of the pipe line
- c. Flanged Joints
  - 1) AWWA/ANSI C115/A21.15, ASME B16.1, Class 125
  - 2) Flange bolt circles and bolt holes shall match those of ASME B16.1, Class 125.
  - 3) Field fabricated flanges are prohibited.
- 6. Gaskets
  - a. Provide Gaskets in accordance with Section 33 11 05.
- 7. Isolation Flanges
  - a. Flanges required by the drawings to be Isolation Flanges shall conform to Section 33 04 10.
- 8. Bolts and Nuts
  - a. Mechanical Joints
    - 1) Provide bolts and nuts in accordance with Section 33 11 05.
  - b. Flanged Ends
    - 1) Meet requirements of AWWA C115.
      - a) Provide bolts and nuts in accordance with Section 33 11 05.
- 9. Flange Coatings
  - a. Connections to Steel Flanges
    - 1) Buried connections with Steel Flanges shall be coated with a Petrolatum Tape System in accordance with Section 33 11 05.
- 10. Ductile Iron Fitting Exterior Coatings
  - a. All Ductile Iron Fittings shall have an asphaltic coating, minimum of 1 mil thick, on the exterior, unless otherwise specified in the Contract Documents.
- 11. Polyethylene Encasement
  - a. All buried Ductile Iron Fittings shall be polyethylene encased.
  - b. Only manufacturers listed in the City's Standard Products List as shown in Section 01 60 00 will be considered acceptable.

- c. Use only virgin polyethylene material.
- d. Encasement for buried fittings shall be 8 mil linear low density (LLD) polyethylene conforming to AWWA/ANSI C105/A21.5 or 4 mil high density cross-laminated (HDCL) polyethylene encasement conforming to conforming to AWWA/ANSI C105/A21.5 and ASTM A674.
- e. Marking: At a minimum of every 2 feet along its length, the mark the polyethylene film with the following information:
  - 1) Manufacturer's name or trademark
  - 2) Year of manufacturer
  - 3) AWWA/ANSI C105/A21.5
  - 4) Minimum film thickness and material type
  - 5) Applicable range of nominal diameter sizes
  - 6) Warning – Corrosion Protection – Repair Any Damage
- f. Special Markings/Colors
  - 1) Reclaimed Water, perform one of the following:
    - a) Label polyethylene encasement with "RECLAIMED WATER",
    - b) Provide purple polyethylene in accordance with the American Public Works Association Uniform Color Code; or
    - c) Attach purple reclaimed water marker tape to the polyethylene wrap.
  - 2) Wastewater, perform one of the following:
    - a) Label polyethylene encasement with "WASTEWATER";
    - b) Provide green polyethylene in accordance with the American Public Works Association Uniform Color Code; or
    - c) Attach green sanitary sewer marker tape to the polyethylene wrap.
- g. Minimum widths

**Polyethylene Tube and Sheet Sizes for Push-On Joint Fittings**

<b>Nominal Fittings Diameter (inches)</b>	<b>Min. Width – Flat Tube (inches)</b>	<b>Min. Width – Sheet (inches)</b>
3	14	28
4	14	28
6	16	32
8	20	40
10	24	48
12	27	54

14	30	60
16	34	68
18	37	74
20	41	82
24	54	108
30	67	134
36	81	162
42	81	162
48	95	190
54	108	216
60	108	216
64	121	242

12. Ductile Iron Fittings Interior Lining

a. Cement Mortar Lining

- 1) Ductile Iron Fittings for potable water shall have a cement mortar lining in accordance with AWWA/ANSI C104/A21.4 and be acceptable according to NSF 61.

b. Ceramic Epoxy or Epoxy Linings

- 1) Ductile Iron Fittings for use in wastewater applications shall be lined with a Ceramic Epoxy or Epoxy lining as designated in the Standard Products List as shown in Section 01 60 00.
- 2) Apply lining at a minimum of 40 mils DFT
- 3) Due to the tolerances involved, the gasket area and spigot end up to 6 inches back from the end of the spigot end must be coated with 6 mils nominal, 10 mils maximum using a Joint Compound as supplied by the manufacturer.
  - a) Apply the joint compound by brush to ensure coverage.
  - b) Care should be taken that the joint compound is smooth without excess buildup in the gasket seat or on the spigot ends.
  - c) Coat the gasket seat and spigot ends after the application of the lining.
- 4) Surface preparation shall be in accordance with the manufacturer's recommendations.
- 5) Check thickness using a magnetic film thickness gauge in accordance with the method outlined in SSPC PA 2.
- 6) Test the interior lining of all fittings for pinholes with a non-destructive 2,500 volt test.
  - a) Repair any defects prior to shipment.

- 7) Mark each fitting with the date of application of the lining system along with its numerical sequence of application on that date and records maintained by the applicator of his work.
- 8) For all Ductile Iron Fittings in wastewater service where the fitting has been cut, coat the exposed surface with the touch-up material as recommended by the manufacturer.
  - a) The touch-up material and the lining shall be of the same manufacturer.

### **2.3 ACCESSORIES [NOT USED]**

### **2.4 SOURCE QUALITY CONTROL [NOT USED]**

## **PART 3 - EXECUTION**

### **3.1 INSTALLERS [NOT USED]**

### **3.2 EXAMINATION [NOT USED]**

### **3.3 PREPARATION [NOT USED]**

### **3.4 INSTALLATION**

#### **A. General**

1. Install fittings, specials and appurtenances as specified herein, as specified in AWWA C600, AWWA M41, and in accordance with the fittings manufacturer's recommendations.
2. Lay fittings to the lines and grades as indicated in the Drawings.
3. Excavate and backfill trenches in accordance with 33 05 10.
4. Embed Ductile Iron Fittings in accordance with 33 05 10.

#### **B. Joint Making**

1. Mechanical Joints with required mechanical restraint
  - a. All mechanical joints require mechanical restraint.
  - b. Bolt the retainer gland into compression against the gasket, with the bolts tightened down evenly then cross torqued in accordance with AWWA C600.
  - c. Overstressing of bolts to compensate for poor installation practice will not be permitted.
2. Push-on Joints (restrained)
  - a. All push-on joints shall be restrained push-on type.
  - b. Install Push-on joints as defined in AWWA/ANSI C111/A21.11.
  - c. Wipe clean the gasket seat inside the bell of all extraneous matter.
  - d. Place the gasket in the bell in the position prescribed by the manufacturer.

- e. Apply a thin film of non-toxic vegetable soap lubricant to the inside of the gasket and the outside of the spigot prior to entering the spigot into the bell.
- f. When using a field cut plain end piece of pipe, refinish the field cut and scarf to conform to AWWA M-41.

### 3. Flanged Joints

- a. Use erection bolts and drift pins to make flanged connections.
  - 1) Do not use undue force or restraint on the ends of the fittings.
  - 2) Apply even and uniform pressure to the gasket.
- b. The fitting must be free to move in any direction while bolting.
  - 1) Install flange bolts with all bolt heads faced in 1 direction.

### 4. Joint Deflection

- a. Deflect the pipe only when necessary to avoid obstructions or to meet the lines and grades and shown in the Drawings.
- b. The deflection of each joint must be in accordance with AWWA C600 Table 3.
- c. The maximum deflection allowed is 50 percent of that indicated in AWWA C600.
- d. The manufacturer's recommendation may be used with the approval of the Engineer.

## C. Polyethylene Encasement Installation

### 1. Preparation

- a. Remove all lumps of clay, mud, cinders, etc., on fittings surface prior to installation of polyethylene encasement.
  - 1) Prevent soil or embedment material from becoming trapped between fittings and polyethylene.
- b. Fit polyethylene film to contour of fittings to affect a snug, but not tight encase with minimum space between polyethylene and fittings.
  - 1) Provide sufficient slack in contouring to prevent stretching polyethylene where it bridges irregular surfaces such as bell-spigot interfaces, bolted joints or fittings, and to prevent damage to polyethylene due to backfilling operations.
  - 2) Secure overlaps and ends with adhesive tape and hold.
- c. For installations below water table and/or in areas subject to tidal actions, seal both ends of polyethylene tube with adhesive tape at joint overlap.

### 2. Tubular Type (Method A)

- a. Cut polyethylene tube to length approximately 2 feet longer than fittings section.
  - b. Slip tube around fittings, centering it to provide 1 foot overlap on each adjacent pipe section and bunching it accordion-fashion lengthwise until it clears fittings ends.
  - c. Lower fittings into trench with preceding section of pipe.
  - d. Make shallow bell hole at joints to facilitate installation of polyethylene tube.
  - e. After assembling fittings make overlap of polyethylene tube, pull bunched polyethylene from preceding length of pipe, slip it over end of the fitting and wrap until it overlaps joint at end of preceding length of pipe.
  - f. Secure overlap in place.
  - g. Take up slack width at top of fitting to make a snug, but not tight, fit along barrel of fitting, securing fold at quarter points.
  - h. Repair cuts, tears, punctures or other damage to polyethylene.
  - i. Proceed with installation of next fitting in same manner.
3. Tubular Type (Method B)
- a. Cut polyethylene tube to length approximately 1 foot shorter than fitting section.
  - b. Slip tube around fitting, centering it to provide 6 inches of bare fitting at each end.
  - c. Take up slack width at top of fitting to make a snug, but not tight, fit along barrel of fitting, securing fold at quarter points; secure ends.
  - d. Before making up joint, slip 3-foot length of polyethylene tube over end of preceding pipe section, bunching it accordion-fashion lengthwise.
  - e. After completing joint, pull 3-foot length of polyethylene over joint, overlapping polyethylene previously installed on each adjacent section of pipe by at least 1 foot; make each end snug and secure.
4. Sheet Type
- a. Cut polyethylene sheet to a length approximately 2 feet longer than piece section.
  - b. Center length to provide 1-foot overlap on each fitting, bunching it until it clears the fitting ends.
  - c. Wrap polyethylene around fitting so that it circumferentially overlaps top quadrant of fitting.
  - d. Secure cut edge of polyethylene sheet at intervals of approximately 3 feet.
  - e. Lower wrapped fitting into trench with preceding section of pipe.

- f. Make shallow bell hole at joints to facilitate installation of polyethylene.
  - g. After completing joint, make overlap and secure ends.
  - h. Repair cuts, tears, punctures or other damage to polyethylene.
  - i. Proceed with installation of fittings in same manner.
5. Pipe-Shaped Appurtenances
- a. Cover bends, reducers, offsets, and other pipe-shaped appurtenances with polyethylene in same manner as pipe and fittings.
6. Odd-Shaped Appurtenances
- a. When it is not practical to wrap valves, tees, crosses and other odd-shaped pieces in tube, wrap with flat sheet or split length polyethylene tube by passing sheet under appurtenances and bringing it up around body.
  - b. Make seams by bringing edges together, folding over twice and taping down.
  - c. Tape polyethylene securely in place at the valve stem and at any other penetrations.
7. Repairs
- a. Repair any cuts, tears, punctures or damage to polyethylene with adhesive tape or with short length of polyethylene sheet or cut open tube, wrapped around fitting to cover damaged area, and secure in place.
8. Openings in Encasement
- a. Provide openings for branches, service taps, blow-offs, air valves and similar appurtenances by making an X-shaped cut in polyethylene and temporarily folding back film.
  - b. After appurtenance is installed, tape slack securely to appurtenance and repair cut, as well as other damaged area in polyethylene with tape.
  - c. Service taps may also be made directly through polyethylene, with any resulting damaged areas being repaired as described above.
9. Junctions between Wrapped and Unwrapped Fittings
- a. Where polyethylene-wrapped fitting joins an adjacent pipe that is not wrapped, extend polyethylene wrap to cover adjacent pipe for distance of at least 3 feet.
  - b. Secure end with circumferential turns of tape.
  - c. Wrap service lines of dissimilar metals with polyethylene or suitable dielectric tape for minimum clear distance of 3 feet away from cast or Ductile Iron Fittings.

D. Blocking



1. Install concrete blocking in accordance with Section 03 30 00 for all bends, tees, crosses and plugs in the pipe lines as indicated in the Drawings.
2. Place the concrete blocking so as to rest against firm undisturbed trench walls, normal to the thrust.
3. The supporting area for each block shall be at least as great as that indicated on the Drawings and shall be sufficient to withstand the thrust, including water hammer, which may develop.
4. Each block shall rest on a firm, undisturbed foundation or trench bottom.
5. If the Contractor encounters soil that appears to be different than that which was used to calculate the blocking according to the Drawings, the Contractor shall notify the Engineer prior to the installation of the blocking.

### **3.5 REPAIR/RESTORATION**

#### **A. Patching**

1. Excessive field-patching is not permitted of lining or coating.
2. Patching of lining or coating will be allowed where area to be repaired does not exceed 100 square inches and has no dimensions greater than 12 inches.
3. In general, there shall not be more than 1 patch on either the lining or the coating of any fitting.
4. Wherever necessary to patch the fitting:
  - a. Make patch with cement mortar as previously specified for interior joints.
  - b. Do not install patched fitting until the patch has been properly and adequately cured and approved for laying by the City.
  - c. Promptly remove rejected fittings from the site.

### **3.6 RE-INSTALLATION [NOT USED]**

### **3.7 FIELD [OR] SITE QUALITY CONTROL**

#### **A. Potable Water Mains**

1. Cleaning, disinfection, hydrostatic testing and bacteriological testing of water mains
  - a. Clean, flush, pig, disinfect, hydrostatic test and bacteriological test the water main as specified in Section 33 04 40.

- 3.8 SYSTEM STARTUP [NOT USED]
- 3.9 ADJUSTING [NOT USED]
- 3.10 CLEANING [NOT USED]
- 3.11 CLOSEOUT ACTIVITIES [NOT USED]
- 3.12 PROTECTION [NOT USED]
- 3.13 MAINTENANCE [NOT USED]
- 3.14 ATTACHMENTS [NOT USED]

END OF SECTION

**33 11 12          POLYVINYL CHLORIDE (PVC) PRESSURE PIPE**

**PART 1 - GENERAL**

**1.1 SUMMARY**

A. Section Includes:

1. Polyvinyl Chloride (PVC) Pressure Pipe 4-inch through 36-inch for potable water, wastewater and reuse applications

B. Deviations from this Standard Specification

1. None.

C. Related Specification Sections include, but are not necessarily limited to:

1. Division 0 – Bidding Requirements, Contract Forms, and Conditions of the Contract
2. Division 1 – General Requirements
3. 33 01 31 – Closed Circuit Television (CCTV) Inspection
4. 33 04 40 – Cleaning and Acceptance Testing of Water Mains
5. 33 05 10 – Utility Trench Excavation, Embedment and Backfill
6. 33 05 24 – Installation of Carrier Pipe in Casing or Tunnel Liner Plate
7. 33 11 11 – Ductile Iron Fittings

**1.2 PRICE AND PAYMENT PROCEDURES**

A. Measurement and Payment

1. Measurement

- a. Measured horizontally along the surface from center line to center line of the fitting, manhole, or appurtenance

2. Payment

- a. The work performed and materials furnished in accordance with this Item and measured as provided under “Measurement” will be paid for at the unit price bid per linear foot of “PVC Water Pipe” installed for:

- 1) Various sizes

City of Lewisville

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POLYVINYL CHLORIDE (PVC)

IH-35E Utility Relocation Analysis

PRESSURE PIPE

Fox Ave. to W. College St.

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- 2) Various types of backfill
- b. The work performed and materials furnished in accordance with this Item and measured as provided under "Measurement" will be paid for at the unit price bid per linear foot of "Sewer Force Main" installed for:
  - 1) Various sizes
- 3. The price bid shall include:
  - a. Furnishing and installing PVC Pressure Pipe with joints as specified by the Drawings
  - b. Mobilization
  - c. Pavement removal
  - d. Excavation
  - e. Hauling
  - f. Disposal of excess material
  - g. Furnishing, placement and compaction of embedment
  - h. Furnishing, placement and compaction of backfill
  - i. Trench water stops
  - j. Thrust restraint, if required by Contract Documents
  - k. Gaskets
  - l. Clean-up
  - m. Cleaning
  - n. Disinfection
  - o. Testing

### 1.3 REFERENCES

#### A. Reference Standards

- 1. Reference standards cited in this Specification refer to the current reference standard published at the time of the latest revision date logged at the end of this Specification, unless a date is specifically cited.
- 2. American Association of State Highway and Transportation Officials (AASHTO).
- 3. ASTM International (ASTM):
  - a. D1784, Standard Specification for Rigid Poly(Vinyl-Chloride) (PVC) Compounds and Chlorinated Poly(Vinyl Chloride) (CPVC) Compounds.

- b. D3139, Standard Specification for Joints for Plastic Pressure Pipes Using Flexible Elastomeric Seals.
4. American Water Works Association (AWWA):
    - a. C600, Installation of Ductile-Iron Water Mains and their Appurtenances.
    - b. C605, Underground Installation of Polyvinyl Chloride (PVC) Pressure Pipes and Fittings for Water.
    - c. C900, Polyvinyl Chloride (PVC) Pressure Pipe, and Fabricated Fittings, 4 IN through 12 IN, for Water Transmission and Distribution.
    - d. C905, Polyvinyl Chloride (PVC) Pressure Pipe, and Fabricated Fittings, 14 IN through 48 IN, for Water Transmission and Distribution.
    - e. M23, PVC Pipe – Design and Installation.
    - f. M41, Ductile-Iron Pipe and Fittings.
  5. NSF International (NSF):
    - a. 61, Drinking Water System Components – Health Effects.
  6. Underwriters Laboratories, Inc. (UL).

**1.4 ADMINISTRATIVE REQUIREMENTS [NOT USED]**

**1.5 SUBMITTALS**

- A. Submittals shall be in accordance with Section 01 33 00.
- B. All submittals shall be approved by the City prior to delivery.

**1.6 ACTION SUBMITTALS / INFORMATIONAL SUBMITTALS**

- A. Product Data
  1. For PVC Pressure Pipe that is used for water distribution, wastewater force mains or wastewater gravity mains, including:
    - a. PVC Pressure Pipe
    - b. Manufacturer
    - c. Dimension Ratio
    - d. Joint Types
  2. Restraint, if required in Contract Documents
    - a. Retainer glands
    - b. Thrust harnesses

- c. Any other means of restraint
  - 3. Gaskets
- B. Shop Drawings: When restrained joints are required, furnish for PVC Pressure Pipe used in the water distribution system or for a wastewater force main for 24-inch and greater diameters, including:
  - 1. Wall thickness design calculations sealed by a Licensed Professional Engineer in Texas including:
    - a. Working pressure
    - b. Surge pressure
    - c. Deflection
  - 2. Provide thrust restraint calculations for all fittings and valves, sealed by a Licensed Professional Engineer in Texas, to verify the restraint lengths shown on the Drawings.
  - 3. Lay schedule / drawing for 24-inch and greater diameters sealed by a Licensed Professional Engineer in Texas including:
    - a. Pipe class
    - b. Joints type
    - c. Fittings
    - d. Stationing
    - e. Transitions
    - f. Joint deflection
- C. Certificates
  - 1. Furnish an affidavit certifying that all PVC Pressure Pipe meets the provisions of this Section, each run of pipe furnished has met Specifications, all inspections have been made and that all tests have been performed in accordance with AWWAC900 or AWWA C905.

**1.7 CLOSEOUT SUBMITTALS [NOT USED]**

**1.8 MAINTENANCE MATERIAL SUBMITTALS [NOT USED]**

**1.9 QUALITY ASSURANCE**

A. Qualifications

- 1. Manufacturers

- a. Finished pipe shall be the product of 1 manufacturer for each size, unless otherwise approved by the City.
  - 1) Change orders, specials, and field changes may be provided by a different manufacturer upon City approval.
- b. Pipe manufacturing operations shall be performed under the control of the manufacturer.
- c. All pipe furnished shall be in conformance with AWWA C900 and AWWA C905.

**1.10 DELIVERY, STORAGE, AND HANDLING**

A. Storage and Handling Requirements

- 1. Store and handle in accordance with the guidelines as stated in AWWA M23.
- 2. Secure and maintain a location to store the material in accordance with Section 01 66 00.

**1.11 FIELD [SITE] CONDITIONS [NOT USED]**

**1.12 WARRANTY [NOT USED]**

**PART 2 - PRODUCTS**

**2.1 OWNER-FURNISHED [OR] OWNER-SUPPLIED PRODUCTS [NOT USED]**

**2.2 EQUIPMENT, PRODUCT TYPES AND MATERIALS**

A. Manufacturers

- 1. Only the manufacturers as listed in the City's Standard Products List will be considered as shown in Section 01 60 00.
  - a. The manufacturer must comply with this Specification and related Sections.
- 2. Any product that is not listed on the Standard Products List is considered a substitution and shall be submitted in accordance with Section 01 25 00.

B. Pipe

- 1. Pipe shall be in accordance with AWWA C900 or AWWA C905.
- 2. PVC Pressure Pipe for potable water shall meet the requirements of NSF 61.
- 3. Pressure Pipe shall be approved by the UL.
- 4. Pipe shall have a lay length of 20 feet except for special fittings or closure pieces necessary to comply with the Drawings.

5. The pipe material shall be PVC, meeting the requirements of ASTM D1784, with a cell classification of 12454. Outside diameters must be equal to those of cast iron and ductile iron pipes.
6. As a minimum the following Dimension Ratio's apply:

<b>Diameter (inch)</b>	<b>Min Pressure Class (psi)</b>
4 through 12	DR 14
16 through 24	DR 18

7. Pipe Markings
  - a. Meet the minimum requirements of AWWA C900 or AWWA C905. Minimum pipe markings shall be as follows:
    - 1) Manufacturer's Name or Trademark and production record
    - 2) Nominal pipe size
    - 3) Dimension Ratio
    - 4) AWWA C900 or AWWA C905
    - 5) Seal of testing agency that verified the suitability of the pipe

C. Pressure and Deflection Design

1. Pipe design shall be based on trench conditions and design pressure class specified in the Drawings. Pipe shall be designed according to the methods indicated in AWWA M23 for trench construction, using the following parameters:
  - a. Unit Weight of Fill ( $w$ ) = 130 pcf
  - b. Live Load = AASHTO HS 20
  - c. Trench Depth = 12 feet minimum, or as indicated in Drawings
  - d. Maximum  $E'$  = 1,000 max
  - e. Deflection Lag Factor = 1.0
  - f. Working Pressure ( $P_w$ ) = 150 psi
  - g. Surge Allowance ( $P_s$ ) = 100 psi minimum
  - h. Test Pressure =



- 1) No less than 1.25 times the stated working pressure (187 psi minimum) of the pipeline measured at the highest elevation along the test section.
  - 2) No less than 1.5 times the stated working pressure (225 psi minimum) at the lowest elevation of the test section.
- i. Maximum Calculated Deflection = 3 percent
  - j. Restrained Joint Safety Factor (SF) = 1.5
  - k. Maximum Joint Deflection = 50 percent of the manufacturer's recommendations.
2. Verify trench depths after existing utilities are located.
    - a. Accommodate vertical alignment changes required because of existing utility or other conflicts by an appropriate change in pipe design depth.
    - b. In no case shall pipe be installed deeper than its design allows.
  3. Provisions for Thrust
    - a. Thrusts at bends, tees, plugs or other fittings shall be mechanically restrained joints when required by the Drawings.
    - b. No thrust restraint contribution shall be allowed for the restrained length of pipe within the casing.
    - c. Restrained joints, where required, shall be used for a sufficient distance from each side of the bend, tee, plug, valve, or other fitting to resist thrust which will be developed at the design pressure of the pipe. For the purpose of thrust the following shall apply:
      - 1) Calculate valves as dead ends.
      - 2) Design pressure shall be greater than the pressure class of the pipe or the internal pressure ( $P_i$ ), whichever is greater.
      - 3) Restrained joints shall consist of approved mechanical restrained or push-on restrained joints as listed in the City's Standard Products List as shown in Section 01 60 00.
      - 4) Restrained PVC pipe is not allowed for pipe greater than 12 inches.
    - d. The Pipe Manufacturer shall verify the length of pipe with restrained joints to resist thrust in accordance with the Drawings and the following:
      - 1) Calculate the weight of the earth ( $W_e$ ) as the weight of the projected soil prism above the pipe, for unsaturated soil conditions.
      - 2) Soil density = 115 pcf (maximum value to be used), for unsaturated soil conditions

3) In locations where ground water is encountered, reduce the soil density to its buoyant weight for the backfill below the water table.

a) Reduce the coefficient of friction to 0.25.

4. Joints

a. Joints shall be gasket, bell and spigot and push-on type conforming to ASTM D3139.

b. Since each pipe manufacturer has a different design for push-on joints, gaskets shall be part of a complete pipe section and purchased as such.

c. Lubricant must be non-toxic and NSF approved for potable water applications.

d. Push-On Restrained Joints shall only be as approved in the Standard Products List in Section 01 60 00.

5. Detectable Markers

a. Provide detectable markers in accordance with Section 33 05 26.

**2.3 ACCESSORIES [NOT USED]**

**2.4 SOURCE QUALITY CONTROL [NOT USED]**

**PART 3 - EXECUTION**

**3.1 INSTALLERS [NOT USED]**

**3.2 EXAMINATION [NOT USED]**

**3.3 PREPARATION [NOT USED]**

**3.4 INSTALLATION**

A. General

1. Install pipe, fittings, specials and appurtenances as specified herein, as specified in AWWA C600, AWWA C605, AWWA M23 and in accordance with the pipe manufacturer's recommendations.

2. Lay pipe to the lines and grades as indicated in the Drawings.

3. Excavate and backfill trenches in accordance with Section 33 05 10.

4. Embed PVC Pressure Pipe in accordance with Section 33 05 10.

5. For installation of carrier pipe within casing, see Section 33 05 24.

B. Pipe Handling

1. Haul and distribute pipe and fittings at the project site.
2. Handle piping with care to avoid damage.
  - a. Inspect each joint of pipe and reject or repair any damaged pipe prior to lowering into the trench.
  - b. Use only nylon ropes, slings or other lifting devices that will not damage the surface of the pipe for handling the pipe.
3. At the close of each operating day:
  - a. Keep the pipe clean and free of debris, dirt, animals and trash – during and after the laying operation.
  - b. Effectively seal the open end of the pipe using a gasketed night cap.

#### C. Joint Making

1. Mechanical Joints
  - a. In accordance with Section 33 11 11.
2. Push-on Joints
  - a. Install Push-On joints as defined in AWWA C900 and AWWA C905.
  - b. Wipe clean the gasket seat inside the bell of all extraneous matter.
  - c. Place the gasket in the bell in the position prescribed by the manufacturer.
  - d. Apply a thin film of non-toxic vegetable soap lubricant to the inside of the gasket and the outside of the spigot prior to entering the spigot into the bell.
  - e. When using a field cut plain end piece of pipe, refinish the field cut to conform to AWWA C605.
3. Joint Deflection
  - a. Deflect the pipe only when necessary to avoid obstructions, or to meet the lines and grades shown in the Drawings.
  - b. Joint deflection shall not exceed 50 percent of the manufacturer's recommendation.

#### D. Detectable Metallic Tape Installation

1. See Section 33 05 26.

**3.5 REPAIR/RESTORATION [NOT USED]**

**3.6 RE-INSTALLATION [NOT USED]**

**3.7 FIELD [OR] SITE QUALITY CONTROL**

A. Potable Water Mains

1. Cleaning, disinfection, hydrostatic testing, and bacteriological testing of water mains:
  - a. Clean, flush, pig, disinfect, hydrostatic test and bacteriological test the water main as specified in Section 33 04 40.

B. Wastewater Lines

1. Closed Circuit Television (CCTV) Inspection
  - a. Provide a Post-CCTV Inspection in accordance with Section 33 01 31.

**3.8 SYSTEM STARTUP [NOT USED]**

**3.9 ADJUSTING [NOT USED]**

**3.10 CLEANING [NOT USED]**

**3.11 CLOSEOUT ACTIVITIES [NOT USED]**

**3.12 PROTECTION [NOT USED]**

**3.13 MAINTENANCE [NOT USED]**

**3.14 ATTACHMENTS [NOT USED]**

**END OF SECTION**

**PART 1 - GENERAL**

**1.1 SUMMARY**

- A. Section Includes:
  - 1. Lead-free 1-inch to 2-inch water service lines from the water main to the right-of-way, fittings and water meter boxes complete in place, as shown on the Drawings, directed by the Engineer, and specified herein for:
    - a. New Water Service
    - b. New Water Service (Bored)
    - c. Water Meter Service Relocate
    - d. Private Water Service
- B. Deviations from this Standard Specification
  - 1. None.
- C. Products Installed but not Furnished Under this Section
  - 1. Water meters for various sizes
- D. Related Specification Sections include, but are not necessarily limited to:
  - 1. Division 0 – Bidding Requirements, Contract Forms and Conditions of the Contract
  - 2. Division 1 – General Requirements
  - 3. Section 33 04 40 – Cleaning and Acceptance Testing of Water Mains
  - 4. Section 33 05 10 – Utility Trench Excavation, Embedment and Backfill
  - 5. Section 33 12 25 – Connection to Existing Water Mains

**1.2 PRICE AND PAYMENT PROCEDURES**

- A. Measurement and Payment
  - 1. New Water Service
    - a. Measurement
      - 1) Measurement for this Item shall be per each new “Water Service” complete in place from the tap of the main to the installation of the meter box and

associated appurtenances where the service line is installed by open cut construction.

b. Payment

- 1) The work performed and materials furnished in accordance with this Item and measured as provided under "Measurement" will be paid for at the unit price bid per each "Water Service" installed for:

- a) Various sizes

c. The price bid shall include:

- 1) Furnishing and installing New Service Line as specified by the Drawings
- 2) Submitting product data
- 3) Tapping saddle
- 4) Corporation stop
- 5) Curb stop
- 6) Fittings
- 7) Service line installed by open cut
- 8) Connection to meter
- 9) Meter Box and Lid
- 10) Pavement removal
- 11) Excavation
- 12) Hauling
- 13) Disposal of excess material
- 14) Surface Restoration associated with Meter Box installation and connection, excluding grass (seeding, sodding or hydro-mulch paid separately)
- 15) Clean-up
- 16) Disinfection
- 17) Testing

2. New Bored Water Service

a. Measurement

- 1) Measurement for this Item shall be per each new Water Service complete in place from the tap of the main to the installation of the meter box and associated appurtenances where the service line is installed by trenchless method.

b. Payment

- 1) The work performed and materials furnished in accordance with this Item and measured as provided under "Measurement" will be paid for at the unit price bid per each "Bored Water Service" installed for:
  - a) Various sizes
- c. The price bid shall include:
  - 1) Submitting product data
  - 2) Tapping saddle
  - 3) Corporation stop
  - 4) Curb stop
  - 5) Fittings
  - 6) Service line installed by trenchless method
  - 7) Connection to meter
  - 8) Meter Box and Lid
  - 9) Pavement removal
  - 10) Excavation
  - 11) Hauling
  - 12) Disposal of excess material
  - 13) Surface restoration associated with Meter Box installation and connection, excluding grass (seeding, sodding or hydro-mulch paid separately)
  - 14) Clean-up
  - 15) Disinfection
  - 16) Testing
3. Water Meter Service Reconnect
  - a. Measurement
    - 1) Measurement for this Item shall be per each Water Meter Service Reconnect complete in place from public service line connection to private service line connection.
  - b. Payment
    - 1) The work performed in conjunction with relocation of the meter, associated private service line, fittings and meter box 5 feet or less in any direction from centerline of existing meter location and the materials furnished in accordance with this Item will be paid for at the unit price bid per each "Water Meter Service, Reconnection" installed for:
      - a) Various size of services

- c. The price bid shall include:
  - 1) Private service line
  - 2) Fittings
  - 3) Private connection to water meter
  - 4) Connection to existing private service line
  - 5) Cut and crimp of existing service
  - 6) Removal and Disposal or Salvage of existing 2-inch or smaller water meter, as directed by City
  - 7) Pavement removal
  - 8) Excavation
  - 9) Hauling
  - 10) Disposal of excess material
  - 11) Surface restoration for area disturbed for installation of meter box, excluding grass (seeding, sodding or hydro-mulch paid separately)
  - 12) Clean-up
  - 13) Cleaning
  - 14) Disinfection
  - 15) Testing

4. Private Water Service Relocation

a. Measurement

- 1) Measurement for this Item shall be per linear foot of Private Service relocation complete in place from the meter box to a connection to the existing service line on private property.

b. Payment

- 1) The work performed in conjunction with Private Service Line installation where the meter and meter boxes are moved more than 5 feet in any direction from centerline of existing meter location and materials furnished in accordance with the Item and measured as provided under "Measurement" will be paid for at the unit price bid per linear foot of "Private Water Service" performed for:

- a) Various service sizes

c. The price bid shall include:

- 1) Obtaining appropriate permit
- 2) Obtaining Right of Entry



- 3) Submitting product data
- 4) Private service line
- 5) Fittings
- 6) Backflow preventer, check valve, and isolation valve relocation, if applicable
- 7) Connection to existing private service line
- 8) Pavement removal and replacement
- 9) Excavation
- 10) Hauling
- 11) Disposal of excess material
- 12) Surface restoration, excluding grass (seeding, sodding or hydro-mulch paid separately)
- 13) Clean-up
- 14) Cleaning
- 15) Disinfection
- 16) Testing

### **1.3 REFERENCES**

#### **A. Definitions**

1. New Service
  - a. Installation of new 1-inch to 2-inch Water Service Line by open cut construction from the water main to the right-of-way, including corporation stop, curb stop, fittings and water meter boxes complete in place, as shown on the Drawings.
2. New Service (Bored)
  - a. Installation of new 1-inch to 2-inch Water Service Line by trenchless construction method from the water main to the right-of-way, including corporation stop, curb stop, fittings and water meter boxes complete in place, as shown on the Drawings.
3. Meter Service Reconnection
  - a. Relocation and reconnection of the private service line from an existing meter to be abandoned and a new meter installed that lies within 5 feet of the existing meter.
4. Private Service Relocation

- a. Relocation and reconnection of private service line behind the water meter where the existing meter to be abandoned and the new meter installed is greater than 5 feet of the existing meter. A licensed plumber is required to relocate the private service.

5. Lead-free

- a. Lead-free pipes and plumbing fittings and fixtures shall contain less than 0.25 percent lead in accordance with the reduction of Lead in Drinking Water Act (P.L. 111-380).

B. Reference Standards

1. Reference standards cited in this Specification refer to the current reference standard published at the time of the latest revision date logged at the end of this Specification, unless a date is specifically cited.
2. ASTM International (ASTM):
  - a. A48, Standard Specification for Gray Iron Castings.
  - b. A536, Standard Specification for Ductile Iron Castings.
  - c. B88, Standard Specification for Seamless Copper Water Tube.
  - d. B98, Standard Specification for Copper-Silicon Alloy Rod, Bar and Shapes.
  - e. C131, Standard Specification for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine.
  - f. C150, Standard Specification for Portland Cement.
  - g. C330, Standard Specification for Lightweight Aggregates for Structural Concrete.
  - h. C857 (RL), Standard Practice for Minimum Structural Design Loading for Underground Precast Concrete Utility Structures
  - i. D883, Standard Terminology Relating to Plastics.
  - j. D1693, Standard Test Method for Environmental Stress-Cracking of Ethylene Plastics
3. American Water Works Association (AWWA):
  - a. C700, Cold-Water Meters - Displacement Type, Bronze Main Case.
  - b. C800, Underground Service Line Valves and Fittings.
4. NSF International (NSF):
  - a. 61, Drinking Water System Components - Health Effects.
5. Reduction of Lead in Drinking Water Act

- a. Public Law 111-380 (P.L. 111-380)
- 6. General Services Administration (GSA):
  - a. RR-F-621E, Frames, Covers, Gratings, Steps, Sump and Catch Basin, Manhole

#### **1.4 ADMINISTRATIVE REQUIREMENTS**

- A. Scheduling
  - 1. Provide advance notice for service interruptions and meet requirements of Division 0 and Division 1.

#### **1.5 SUBMITTALS**

- A. Submittals shall be in accordance with Section 01 33 00.
- B. All submittals shall be approved by the City prior to delivery.

#### **1.6 ACTION SUBMITTALS/INFORMATIONAL SUBMITTALS**

- A. Product Data, if applicable:
  - 1. Tapping Saddle
  - 2. Corporation stop
  - 3. Curb Stop
  - 4. Service Line
  - 5. Meter Box
  - 6. Meter Box Lid
- B. Certificates and Test Reports
  - 1. Prior to shipment of any Water Service components, the manufacturer shall submit the following:
    - a. A Certificate of Adequacy of Design stating that the components to be furnished comply with all regulatory requirements identified in this Section including:
      - 1) The Reduction of Lead in Drinking Water Act (P.L. 111-380)
      - 2) AWWA C800
      - 3) NSF 61

**1.7 CLOSEOUT SUBMITTALS [NOT USED]**

**1.8 MAINTENANCE MATERIAL SUBMITTALS [NOT USED]**

**1.9 QUALITY ASSURANCE**

A. Qualifications

1. Manufacturers

- a. Water Services shall meet or exceed the latest revisions of AWWA C800, NSF 61, the Reduction of Lead in Drinking Water Act and shall meet or exceed the requirements of this Specification.

**1.10 DELIVERY, STORAGE, AND HANDLING**

A. Storage and Handling Requirements

- 1. Protect all parts such that no damage or deterioration will occur during a prolonged delay from the time of shipment until installation is completed and the units and equipment are ready for operation.
- 2. Protect all equipment and parts against any damage during a prolonged period at the site.
- 3. Prevent plastic and similar brittle items from being directly exposed to sunlight or extremes in temperature.
- 4. Secure and maintain a location to store the material in accordance with Section 01 66 00.

**1.11 FIELD [SITE] CONDITIONS [NOT USED]**

**1.12 WARRANTY [NOT USED]**

**PART 2 - PRODUCTS**

**2.1 OWNER-FURNISHED PRODUCTS**

- A. Water meters for various sizes

**2.2 EQUIPMENT, PRODUCT TYPES, AND MATERIALS**

A. Manufacturers

- 1. Only the manufacturers as listed on the City's Standard Products List will be considered as shown in Section 01 60 00.
  - a. The manufacturer must comply with this Specification and related Sections.
- 2. Any product that is not listed on the Standard Products List is considered a substitution and shall be submitted in accordance with Section 01 25 00.

3. The Water Services and appurtenances shall be new and the product of a manufacturer regularly engaged in the manufacturing of Water Services and appurtenances having similar service and size.

B. Description

1. Regulatory Requirements

- a. **All materials shall conform to the Reduction of Lead in Drinking Water Act (P.L. 111-380). This Act defines “Lead-free” for pipes and other appurtenances to be less than 0.25 percent lead.**
- b. Water Services shall meet or exceed the latest revisions of AWWA C800 and shall meet or exceed the requirements of this Specification.
- c. All Water Services components in contact with potable water shall conform to the requirements of NSF 61.

C. Materials/Design Criteria

1. Service Lines

- a. Provide Type K Copper Tubing per ASTM B88.
- b. Furnish in the annealed conditions, unless otherwise specified in the Contract Documents.

2. Service Couplings

- a. Fitting Ends
  - 1) Flared Copper Tubing with thread dimensions per AWWA C800
  - 2) Provide coupling nuts with a machined bearing skirt of a length equal to the tubing outer diameter (O.D.).
- b. Provide with hexagonal wrench grip compatible with the coupling size.
- c. Provide lead-free service couplings in accordance with the Reduction of Lead in Drinking Water Act.

3. Corporation stops

- a. Provide brass castings per AWWA C800 for:
  - 1) Bodies
  - 2) Plugs
  - 3) D washers
  - 4) Bottom nuts
- b. Machining and Finishing of Surfaces

- 1) Provide 1  $\frac{3}{4}$  inch per foot or 0.1458 inch per inch  $\pm$  0.007 inch per inch taper of the seating surfaces for the key and body.
  - 2) Reduce large end of the tapered surface of the key in diameter by chamfer or turning for a distance that will bring the largest end of the seating surface of the key into the largest diameter of the seating surface of the body.
  - 3) Relieve taper seat in the body on the small end.
  - 4) Extend small end of the key there-through to prevent the wearing of a shoulder and facilitate proper seating of key.
  - 5) Design key, key nut and washer such that if the key nut is tightened to failure point, the stem end of the key shall not fracture.
  - 6) Design nut and stem to withstand a turning force on the nut of at least 3 times the necessary effort to properly seat the key without failure in any manner.
  - 7) Port through corporation stop shall be full size to eliminate turbulence in the flow way.
  - 8) Design stop for rotation about the axis of the flow passageway inside the following minimum circles in order to properly clear the tapping machine:
    - a) Two  $\frac{7}{8}$ -inch for 1-inch corporation stops
    - b) Four  $\frac{15}{16}$ -inch for 1  $\frac{1}{2}$  -inch and 2-inch corporation stops
  - c. Provide lead-free corporation stops in accordance with the Reduction of Lead in Drinking Water Act.
4. Curb Stops
- a. Provide brass castings per AWWA C800.
  - b. Valve plugs shall be:
    - 1) Cylinder type
    - 2) Plug type, or
    - 3) Ball type
  - c. Incorporate full flow porting.
  - d. Provide for full 360 degree plug rotation clockwise or counter-clockwise.
  - e. Overall Length
    - 1) 3-5/16 inch  $\pm$  1/8 inch for 1-inch diameter
    - 2) 4-1/32 inch  $\pm$  9.32 for 1-inch diameter
  - f. Cylindrical Plug Type
    - 1) Provide O-ring seal at top and bottom.

- a) O-ring at top only is acceptable if bottom of curb stop body is closed.
  - 2) Seals shall be Buna N.
  - 3) 1 O-ring seal shall surround the outlet port of the curb stop and act to effectively seal in the closed position.
  - 4) The port in the plug shall provide a straight through, full size flow way, so shaped as to eliminate turbulence.
  - 5) All waterways shall be smooth and free of burrs or rough areas.
  - 6) Design the curb stop to provide ease and accuracy of operation and positive shut-off of water.
- g. Tapered Plug Type
- 1) Provide O-ring seal at top and bottom.
  - 2) The tapered plug and cylindrical recess in the valve body shall be machined to match within approved manufacturing tolerances.
  - 3) Inlet and outlet ports shall be sealed by O-rings or combination Teflon U-shaped seal rings backed with O-rings.
  - 4) The port in the plug shall provide a straight through, full size flow way, so shaped as to eliminate turbulence.
  - 5) All waterways shall be smooth and free of burrs or rough areas.
  - 6) Design the curb stop to provide ease and accuracy of operation and positive shut-off of water.
- h. Ball Plug Type
- 1) Provide double O-ring seals on the stem.
  - 2) The ball shall seal against rubber rings mounted in the valve body at the inlet and outlet ports.
  - 3) The ball shall be bronze with a smooth Teflon coating.
  - 4) The port in the plug shall provide a straight through, full size flow way, so shaped as to eliminate turbulence.
  - 5) All waterways shall be smooth and free of burrs or rough areas.
- i. Provide lead-free curb stops in accordance with the Reduction of Lead in Drinking Water Act.
5. Straight Adapters
- a. Brass castings and threads per AWWA C800
  - b. Provide lead-free straight adapters in accordance with the Reduction of Lead in Drinking Water Act.

6. Three Part Copper Unions
  - a. Brass castings and threads per AWWA C800
  - b. Provide lead-free Three Part Copper Unions in accordance with the Reduction of Lead in Drinking Water Act.
  
7. Straight Meter Couplings
  - a. Brass castings per AWWA C800
  - b. Threads per AWWA C700
  - c. Tailpiece with outside iron pipe thread
  - d. Chamfer corners on threaded end of meter nut.
  - e. Machine inside and outside of tailpiece.
  - f. Provide lead-free Straight Meter Couplings in accordance with the Reduction of Lead in Drinking Water Act.
  
8. Branch Connections
  - a. Brass castings per AWWA C800
  - b. Inlet and outlet connections per AWWA C800
  - c. Provide lead-free branch connections in accordance with the Reduction of Lead in Drinking Water Act.
  
9. Service Saddles
  - a. Castings
    - 1) Brass or Nylon coated ductile iron castings per AWWA C800
    - 2) Free of porosity with sharp edges removed
    - 3) Saddle
      - a) Form to fit firmly against side of maximum diameter of water main with approximately 180 degrees wrap around.
    - 4) Outlet
      - a) Design outlet boss for no thread distortion by bending moments.
      - b) Tapped for taper threaded corporation stop conforming to AWWA C800.
  - b. Straps
    - 1) Conform to ASTM B98.
    - 2) Form flat to fit uniformly against the wall of the water main.
    - 3) Shall be double straps



- 4) Rod diameter not less than 5/8 inch flattened to 1 inch on one side.
- 5) Straps shall be threaded 5/8 inch (11-NC-2A) for a distance such that ½ inch remains after clamp is fully tightened on the pipe.
- 6) Chamfer strap ends to protect the starting threads.
- 7) The threads shall be full and free from shear.
- 8) 4-inch and larger pipe shall be in accordance with Section 33 1225.

c. Nuts

- 1) Bronze material
  - a) Same material as straps
- 2) Dimensions equal to or larger than heavy hexagon nuts
- 3) Tapped 5/8 inch (11-NC-2B)

d. Gaskets

- 1) Neoprene rubber material
- 2) Cemented to saddle and positioned to facilitate installation

10. Brass Flanged Angle Valve

- a. For 1 ½-inch and 2-inch services
- b. Brass castings per AWWA C800
- c. Valve Body with integral outlet flange and inlet wrenching flat
- d. Fit together key and body by turning key and reaming body
  - 1) Key with O-ring seal seat at the upper end
  - 2) Lap key and body seat are to conform to corporation stop requirements of this Specification.
  - 3) The outlet flange shall contain an O-ring seat or a uniform flat drop-in flange gasket surface.
  - 4) Drop-in flange gasket surface shall contain gasket retaining grooves milled circular about the axis of the flange.
  - 5) The size of the outlet flange and the diameter and spacing of the bolt holes shall conform to AWWA C700.
  - 6) The flange on 2-inch angle valves shall be double drilled to permit connection to 1 ½ -inch meters.
  - 7) The inlet port of the valve shall be tapered to conform to AWWA C800 taper pipe thread.

- 8) The key cap shall include a wrenching tee marked with a raised or recessed arrow to show whether the valve is open or closed.
- 9) Valve Assembly (main body, key, key cap)
  - a) Brass material per AWWA C800
  - b) O-ring seal on the top of the key between the key and body seat
  - c) Key cap shall complete the assembly by attaching to the key by means of a strong bronze pin with phosphor bronze spring washer(s) depressed between the key cap and the top of the valve main body.
  - d) Provide with padlock wings for locking the valve in the closed position.
  - e) There shall be a uniform application of cold water valve grease between the body and the key.
  - f) The valve shall be capable of being easily opened and stopping lugs.
  - g) The waterway through the valve shall be smooth and rounded for minimum pressure loss, and shall be free of burrs or fins.
  - h) The valve shall be strong, well designed, neat in appearance, water-tight and entirely adequate for the intended purpose.
  - i) Provide with either a high quality rubber drop-in gasket or an O-ring seal depending on the manufacturer's flange seal surface design choice.
- e. Provide lead-free brass flanged angle valves in accordance with the Reduction of Lead in Drinking Water Act.

11. Meter Boxes shall:

- a. Be constructed of:
  - 1) Polymer, black polyethylene material as defined in ASTM D883.
    - a) Minimum wall thickness of 3/8-inch throughout with no blowing agents or foaming plastics
    - b) Body shall be black throughout, blended at the time of manufacture, and shall have a molded recycled emblem with a minimum of 35 percent Post Industrial/ Pre Consumer Recycled Content- verified with a Leed Product Documentation.
    - c) Have a tensile strength greater than 1700 pounds per square inch (psi).
    - d) Smooth edges and corners and be free from sharp edges so the unit can be handled safely without gloves.
    - e) Exterior free from seams or parting lines.
    - f) Have crush resistant ribbing along the outside of the box.

- g) Have a flange around the lid opening to help prevent settling and aid in adjustment to grade.
  - h) Not to be installed in roadway – designed to withstand loading in non-deliberate and incidental traffic only.
- 2) Concrete
- a) Frame of No. 6 gauge wire welded closed
  - b) Type I or Type II Portland cement, in accordance with ASTM C150, portioned with lightweight aggregate, in accordance with ASTM C330
    - (1) Percentage of wear not to exceed 40 per ASTM C131
    - (2) Minimum 28 day compressive strength of 3,000 psi
- b. Be able to withstand a minimum 15,000 pounds vertical load
- c. Withstand a minimum 400 pounds sidewall load.
- d. Have pipe holes measuring a minimum of 2-1/2" x 3-1/4".
- e. 1-inch Standard Meter Box (Class A)
- 1) For use with services utilizing 5/8-inch x 3/4-inch, 3/4-inch or 1-inch meter Single or Dual service meter.
  - 2) Polymer
    - a) Size: working area of not less than 10 inches x 16 inches, 12 inches high
  - 3) Concrete
    - a) Size: working area not less than 10-inches x 16-inches, 12 inches high
- f. 2-inch Standard Meter Box (Class C)
- 1) For use with services utilizing 1-1/2-inch or 2-inch Single service meter.
  - 2) Polymer
    - a) Size: working area not less than 14-inches x 28-inches, 12 inches high
  - 3) Concrete
    - a) Size: working area not less than 15-inches x 26-1/2-inches, 12 inches high
- g. Bullhead Standard Meter Box (Class B)
- 1) For use with services utilizing two 5/8-inch x 3/4-inch or 3/4-inch or 1-inch Single service meter.
  - 2) Polymer
    - a) Size: working area not less than 15-inches x 18-inches, 12 inches high
  - 3) Concrete

- a) Size: working area not less than 15-inches x 18-inches, 12 inches high

## 12. Meter Box Lid

### a. Meter Box Lids Shall:

- 1) Be solid throughout with reinforcing ribs.
- 2) Have City of Lewisville logo molded into the lid.
- 3) Bear the Manufacturer's IS (name or logo) and Country of Origin.
- 4) Be designed both with and without AMI receptacles
- 5) Have a molded tread-plate
- 6) Seat securely and evenly inside the meter box and shall not overlap the top edge of the meter box.
- 7) Have a molded pick bar for use by meter reading tool.
- 8) Have Automated Meter Infrastructure (AMI) snap locking slide mounts for number of meters/endpoints associated with meter box
- 9) Have an opening to accept the AMI end-point. Opening shall accommodate an endpoint with a 1-7/8 inches diameter.
- 10) Have recessed AMI end point area, to alleviate a trip hazard, centered over AMI slide mount. Recess area should be 4-1/2 inches in diameter and 3/8" deep.
- 11) Have built-in anti-flotation devices.

### b. Cast Iron or Ductile Iron

- 1) Lids for Concrete Meter Boxes shall be constructed out of a cast iron and meet RRF-621 specification.
- 2) Shall withstand a minimum vertical load of 15,000 pounds
- 3) Coat castings with a bituminous emulsified asphalt unless otherwise specified in the Contract Documents, ground smooth, and cleaned with shot blasting, to get a uniform quality free from strength defects and distortions.
- 4) Dimensions shall be within industry standards of  $\pm 1/16$  inch per foot.
- 5) Shall have a plug inserted in to the AMI receptacle to avoid water entering through opening until the AMI receptacle is used
- 6) Be a minimum of 1-3/4 inches thick at reinforcing ribs.
- 7) Casting weights may vary  $\pm 5$  percent from drawing weight per industry standards.

c. Plastic(Composite)

1) The lid shall :

a) Constructed of Engineered Plastic as defined in ASTM D883

- (1) Have a molded recycled emblem with a minimum of 50 percent Post Consumer Recycled and 50 percent Post Industrial/ Pre Consumer Recycled Content- verified with a Leed Product Documentation.
- (2) Be designed to fit a concrete box/cast iron box in retrofit installations.
- (3) Have a tensile strength greater than 1700 psi.
- (4) Have a "knock-out" plug to accept the AMI end- point. Knock-out diameter shall be 1-7/8 inch diameter. A removable plug may be substituted for the knock-out plug.
- (5) Be constructed out of a composite material blend for maximum durability and corrosion resistance.
- (6) Be black throughout with no blowing agents or foaming plastics
- (7) Smooth edges and corners and be free from sharp edges so the unit can be handled safely without gloves.
- (8) Exterior free from seams or parting lines.
- (9) Have a molded tread-pattern- tread dimensions shall be .188-inch x .938-inch x .150-inch deep.
- (10) Have "City of Lewisville" molded into the lid.
- (11) Have "Water Meter" molded into the lid- Font shall be standard Fadal CNC font with 1-inch characters x .150-inch deep.
- (12) Have a molded pick hole pocket- dimensions shall be 3-inch x 9/16-inch x Thru Hole with 3/16-inch 304 stainless steel rod.
- (13) Have 2 pieces of ½-inch rebar located in lid pockets for locatability as shown in Drawings.
- (14) Have location capability using metal detector.

b) Domestic Manufacture Only-Made in USA molded on Lid.

c) Not to be installed in roadway or parking area

d) Be designed to withstand H-10 loading for non-deliberate and incidental traffic only as .

e) Have ultraviolet protection.

2) 1-inch Standard Plastic Meter Box Lid (Class A)

- a) For use with services utilizing 5/8-inch x 3/4-inch, 3/4-inch or 1-inch meter Single or Dual service meter.
  - b) Size: 11-7/8-inch x 17-7/8-inch, 1-1/2 inches high
  - c) For use with Class A Standard Meter Box.
  - d) Polymer lid shall seat evenly inside meter box and shall not overlap the top edge of the meter box.
- 3) 2-inch Standard Plastic Meter Box Lid (Class C)
- a) For use with services utilizing 1-1/2-inch or 2-inch Single service meter.
  - b) Size 27-inches x 15-1/4-inches, 1-7/8 inches high
  - c) For use with Class C Standard Meter Box.
  - d) Polymer lid shall seat evenly inside meter box and shall not overlap the top edge of the meter box.
- 4) Bullhead Standard Plastic Meter Box Lid (Class B)
- a) For use with services utilizing two 5/8-inch x 3/4-inch or 3/4-inch or 1-inch Single service meter:
  - b) Size: 16-5/8-inch x 14—5/8-inch, 1-3/4 inches high
  - c) For use with Class B Standard Meter Box.
  - d) Polymer lid shall seat evenly inside meter box and shall not overlap the top edge of the meter box.

13. Horizontal Check Valve

- a. Equip 1 1/2-inch and 2-inch Water Services with a horizontal check valve, with pipe plug, only if specified in the Drawings.
- b. If an existing backflow preventer is present, the Contractor is to leave it, and is not required to provide an additional horizontal check valve.
- c. Provide lead-free horizontal check valves in accordance with the Reduction of Lead in Drinking Water Act.

14. Service Marker

- a. 3 inch wide, 5 mil blue vinyl tape

**2.3 ACCESSORIES [NOT USED]**

**2.4 SOURCE QUALITY CONTROL**

A. Tests and Inspections

1. At the City's option, the manufacturer shall be required to provide certification records showing conformance of materials, design and testing to these Specifications.
2. The test procedures shall conform to AWWA C800.
  - a. In the event that a chosen valve fails the City's hydrostatic test, the cost of the test shall be at the expense of the supplier.
  - b. Proof testing of the remainder of the valves shall be at the cost and responsibility of the supplier.
  - c. These tests will be the basis of acceptance or rejection of the remainder of the shipment by the City.
3. The City reserves the right to select products at random for testing. The failure of materials to conform to the applicable Specification may result in the rejection of the entire shipment.

B. Marking

1. Service saddle castings shall be clearly marked by letters and numerals cast thereon showing:
  - a. Manufacturer's name
  - b. Type
  - c. Size of Pipe

**PART 3 - EXECUTION**

**3.1 INSTALLERS**

- A. A licensed plumber is required for installations on the outlet side of the service meter.

**3.2 EXAMINATION [NOT USED]**

**3.3 PREPARATION [NOT USED]**

**3.4 INSTALLATION**

A. General

1. Install Water Services and appurtenances in accordance with AWWA C800.
2. Install Water Service Lines 5 feet north or east of center of lot frontage on lots 75 feet or wider, or where shown on Drawings.
3. Install Water Service Lines on lot center line on lots less than 75 feet wide, unless otherwise shown on the Drawings.

4. Install services at a minimum depth of 36 inches below final grade/proposed top of curb, unless otherwise specified in the Contract Documents.
5. Perform leak tests in accordance with Section 33 04 40.
6. Replace existing ¾-inch Service Lines with 1-inch new Service Line, tap, and corporation.
7. Install replaced or relocated services with the service main tap and service line being in line with the service meter, unless otherwise directed by the City.
8. Excavate, embed and backfill trenches in accordance with Section 33 05 10.

B. Handling

1. Haul and distribute Service Lines fittings at the project site and handle with care to avoid damage.
  - a. Inspect each segment of Service Line and reject or repair any damaged pipe prior to lowering into the trench.
  - b. Do not handle the pipe in such a way that will damage the pipe.
2. At the close of each operating day:
  - a. Keep the pipe clean and free of debris, dirt, animals and trash – during and after the laying operation.
  - b. Effectively seal the open end of the pipe using a gasketed night cap.

C. Service Line Installation

1. Service Taps
  - a. Only ductile iron pipe may be directly tapped.
  - b. Install service taps and/or tap assemblies of the specified size as indicated on the Drawings, or as specified by the Engineer.
  - c. Perform taps on a water system that is either uncharged or under pressure.
  - d. Taps consist of:
    - 1) For Concrete Pressure Pipe or Steel Pipe
      - a) Standard internal pipe threaded holes in the pipe walls
        - (1) Made during pipe fabrication
        - (2) Provide tapered threaded outlet with cc threads for up to 2-inch.
        - (3) Provide flange outlet with flange to thread insulator adaptor kits for 4-inch and larger taps.
    - 2) Other pipe materials



- a) Bronze service clamp with a sealed, threaded port through which the pipe wall is drilled to complete a service port
  - e. Tap Assemblies
    - 1) Consist of corporation stop with iron to copper connection attached to:
      - a) Copper tubing terminating as shown on the City's Standard Detail
      - b) May be required adjacent to gate valves
      - c) Install as shown on the Drawings, or as directed by the Engineer.
      - d) When required, shall be included in the unit price bid for installing gate valve.
    - 2) Chlorination and testing purposes
      - a) No separate payment will be made for taps required for testing and chlorination.
- 2. Installation of Water Services
  - a. Install tap and Service Line in accordance with City Details.
  - b. Install meter box in accordance with City Details.
    - 1) Adjustment of the Service Line to proper meter placement height shall be considered as part of the Meter Box installation.
- 3. Trenching
  - a. Provide a trench width sufficiently wide to allow for 2 inches of granular embedment on either side of the Service Line.
- 4. Bored Services
  - a. Services shall be bored utilizing a pilot hole having a diameter  $\frac{1}{2}$  inch to  $\frac{3}{4}$  inches larger than the Service Line.
- 5. Arrangement
  - a. Arrange corporation stops, branches, curb stops, meter spuds, meter boxes and other associate appurtenances as shown in the City Detail, and to the approval of the Engineer.
- 6. Service Marker
  - a. When Meter Box is not installed immediately subsequent to service installation:
    - 1) Mark Curb Stop with a strip of blue vinyl tape fastened to the end of the service and extending through the backfill approximately 6 inches above ground at the Meter Box location.
  - b. Installation of service taps only:

- 1) Attach service marker tape to the corporation stop or plug and extend upward and normal to the main through the backfill at the adjacent trench edge to at least 6 inches above ground to flag the tap location.

7. Corporation stops

- a. Fully open corporation stop prior to backfill.

D. Removal of Existing Water Meters

1. Remove, tag and collect existing Water Service meter for pickup by the City for reconditioning or replacement.
2. After installation of the Water Service in the proposed location and receipt of a meter from the City inspector, install the meter.
3. Reset the meter box as necessary to be flush with existing ground or as otherwise directed by the City.
4. All such work on the outlet side of the service meter shall be performed by a licensed plumber.

**3.5 REPAIR / RESTORATION [NOT USED]**

**3.6 RE-INSTALLATION [NOT USED]**

**3.7 FIELD [OR] SITE QUALITY CONTROL**

A. Field Tests and Inspections

1. Check each Water Service installation for leaks and full flow through the curb stop at the time the main is tested in accordance with Section 33 04 40.

**3.8 SYSTEM STARTUP [NOT USED]**

**3.9 ADJUSTING [NOT USED]**

**3.10 CLEANING [NOT USED]**

**3.11 CLOSEOUT ACTIVITIES [NOT USED]**

**3.12 PROTECTION [NOT USED]**

**3.13 MAINTENANCE [NOT USED]**

**3.14 ATTACHMENTS [NOT USED]**

**END OF SECTION**

**33 12 20 RESILIENT SEATED (WEDGE) GATE VALVE**

**PART 1 - GENERAL**

**1.1 SUMMARY**

- A. Section Includes:
  - 1. Resilient Seated (Wedge) Gate Valves 4-inch through 48-inch for use with potable water mains
    - a. 24-inch and larger valves may require an integral bypass
  - 2. Gate valves larger than 24-inches may be approved by the City on a case-by-case basis.
- B. Deviations from this Standard Specification
  - 1. None.
- C. Related Specification Sections include, but are not necessarily limited to:
  - 1. Division 0 – Bidding Requirements, Contract Forms, and Conditions of the Contract
  - 2. Division 1 – General Requirements
  - 3. Section 33 11 05 – Bolts, Nuts, and Gaskets
  - 4. Section 33 11 10 – Ductile Iron Pipe

**1.2 PRICE AND PAYMENT PROCEDURES**

- A. Measurement and Payment
  - 1. Gate Valve
    - a. Measurement
      - 1) Measurement for this Item shall be per each.
    - b. Payment
      - 1) The work performed and the materials furnished in accordance with this Item shall be paid for at the unit price bid per each “Gate Valve” installed for:
        - a) Various sizes
    - c. The price bid shall include:

- 1) Furnishing and installing Gate Valves with connections as specified in the Drawings
  - 2) Valve box
  - 3) Extension
  - 4) Extensions for valves in vaults
  - 5) Valve vault and appurtenances (for 16-inch and larger gate valves)
  - 6) Petrolatum tape for connections to steel flanges
  - 7) 2-inch risers (for 16-inch and larger gate valves)
  - 8) Isolation kits when installed with flanged connections
  - 9) Polyethylene encasement
  - 10) Pavement removal
  - 11) Excavation
  - 12) Hauling
  - 13) Disposal of excess material
  - 14) Furnishing, placement and compaction of embedment
  - 15) Furnishing, placement and compaction of backfill
  - 16) Clean-up
  - 17) Cleaning
  - 18) Disinfection
  - 19) Testing
2. Cut-in Gate Valve
- a. Measurement
    - 1) Measurement for this Item shall be per each.
  - b. Payment
    - 1) The work performed and the materials furnished in accordance with this Item shall be paid for at the unit price bid per each "Cut-in Gate Valve" installed for:
      - a) Various sizes
  - c. The price bid shall include:
    - 1) Furnishing and installing Gate Valves with connections as specified in the Drawings

- 2) System dewatering
- 3) Connections to existing pipe materials
- 4) Valve box
- 5) Extension
- 6) Extensions for valves in vaults
- 7) Valve vault and appurtenances (for 16-inch and larger gate valves)
- 8) Petrolatum tape for connections to steel flanges
- 9) 2-inch risers (for 16-inch and larger gate valves)
- 10) Isolation kits when installed with flanged connections
- 11) Valve vault and appurtenances (for 16-inch and larger gate valves)
- 12) Polyethylene encasement
- 13) Pavement removal
- 14) Excavation
- 15) Hauling
- 16) Disposal of excess material
- 17) Furnishing, placement and compaction of embedment
- 18) Furnishing, placement and compaction of backfill
- 19) Clean-up
- 20) Cleaning
- 21) Disinfection
- 22) Testing

### **1.3 REFERENCES**

#### A. Abbreviations and Acronyms

1. NRS – Non Rising Stem
2. OS&Y – Outside Screw and Yoke

#### B. Reference Standards

1. Reference standards cited in this Specification refer to the current reference standard published at the time of the latest revision date logged at the end of this Specification, unless a date is specifically cited.

2. American Association of State Highway and Transportation Officials (AASHTO).
3. American Society of Mechanical Engineers (ASME):
  - a. B16.1, Gray Iron Pipe Flanges and Flanged Fittings (Classes 25, 125, and 250).
4. American Iron and Steel Institute (AISI).
5. ASTM International (ASTM):
  - a. A48, Standard Specification for Gray Iron Castings.
  - b. A242, Standard Specification for High-Strength Low-Alloy Structural Steel.
  - c. A307, Standard Specification for Carbon Steel Bolts and Studs, 60,000 psi Tensile Strength.
  - d. A536, Standard Specification for Ductile Iron Castings.
  - e. B117, Standard Practice for Operating Salt Spray (Fog) Apparatus.
  - f. B633, Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel.
6. American Water Works Association (AWWA):
  - a. C509, Resilient-Seated Gate Valves for Water Supply Service.
  - b. C515, Reduced-Wall, Resilient-Seated Gate Valves for Water Supply Service.
  - c. C550, Protective Interior Coatings for Valves and Hydrants.
  - d. C900, Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 4 IN through 12 IN, for Water Transmission and Distribution.
7. American Water Works Association/American National Standards Institute (AWWA/ANSI):
  - a. C105/A21.5, Polyethylene Encasement for Ductile-Iron Pipe Systems.
  - b. C111/A21.11, Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.
  - c. C115/A21.15, Flanged Ductile-Iron Pipe with Ductile-Iron or Gray-Iron Threaded Flanges.
8. NSF International (NSF):
  - a. 61, Drinking Water System Components - Health Effects.

**1.4 ADMINISTRATIVE REQUIREMENTS [NOT USED]**

**1.5 SUBMITTALS**

- A. Submittals shall be in accordance with Section 01 33 00.
- B. All submittals shall be approved by the City prior to delivery.

**1.6 ACTION SUBMITTALS/INFORMATIONAL SUBMITTALS**

A. Product Data

- 1. Resilient Seated (Wedge) Gate Valve noting the pressure rating and coating system supplied, including:
  - a. Dimensions, weights, material list, and detailed drawings
  - b. Joint type
  - c. Maximum torque recommended by the manufacturer for the valve size
- 2. Polyethylene encasement and tape
  - a. Whether the film is linear low density or high density cross linked polyethylene
  - b. The thickness of the film provided
- 3. Thrust Restraint, if required by contract Documents
  - a. Retainer glands
  - b. Thrust harnesses
  - c. Any other means
- 4. Instructions for field repair of fusion bonded epoxy coating
- 5. Gaskets

B. Certificates

- 1. Furnish an affidavit certifying that all Resilient Seated (Wedge) Gate Valves meet the provisions of this Section, each valve meets Specifications, all inspections have been made and that all tests have been performed in accordance with AWWA C509 or AWWA C515.
- 2. Furnish a certificate stating that buried bolts and nuts conform to ASTM B117.
- 3. Furnish affidavit that Resilient Seated (Wedge) Gate Valve manufacturer has five years experience manufacturing Resilient Seated Gate Valves of similar service and size with experience record.

4. Furnish affidavit that Resilient Seated (Wedge) Gate Valve manufacturer owns or controls any foreign factory/foundry that supplies valve casings and can certify that the Resilient Seated (Wedge) Gate Valve manufacturer is in control of quality control at the foreign factory/foundry.

**1.7 CLOSEOUT SUBMITTALS [NOT USED]**

**1.8 MAINTENANCE MATERIAL SUBMITTALS [NOT USED]**

**1.9 QUALITY ASSURANCE**

A. Qualifications

1. Manufacturers

- a. Valves 16-inch and larger shall be the product of 1 manufacturer for each project.
  - 1) Change orders, specials and field changes may be provided by a different manufacturer upon City approval.
- b. For valves less than 16-inch, valves of each size shall be the product of 1 manufacturer, unless approved by the City.
  - 1) Change orders, specials and field changes may be provided by a different manufacturer upon City approval.
- c. Valves shall meet or exceed AWWA C509 or AWWA C515.
- d. For valves equipped with a bypass, the bypass valve must be of the same manufacturer as the main valve.
- e. Resilient Seated Gate Valves shall be new.
- f. Resilient Seated Gate Valve Manufacturer shall not have less than 5 years of successful experience manufacturing of Resilient Seated Gate Valves of similar service and size, and indicated or demonstrate an experience record that is satisfactory to the Engineer and City. This experience record will be thoroughly investigated by the Engineer, and acceptance will be at the sole discretion of the Engineer and City.
- g. Casings for Resilient Seated Gate Valve, such as valve body, wedge, and bypass; that are not manufactured within the United States of America, shall be manufactured by factories/foundries that are owned or controlled (partial ownership) such that the Resilient Seated Gate Valve Manufacturer can control and guarantee quality at the foreign factory/foundry.

**1.10 DELIVERY, STORAGE, AND HANDLING**

A. Storage and Handling Requirements



1. Protect all parts so that no damage or deterioration will occur during a prolonged delay from the time of shipment until installation is completed and the units and equipment are ready for operation.
2. Protect all equipment and parts against any damage during a prolonged period at the site.
3. Protect the finished surfaces of all exposed flanges by wooden blank flanges, strongly built and securely bolted thereto.
4. Protect finished iron or steel surfaces not painted to prevent rust and corrosion.
5. Prevent plastic and similar brittle items from being directly exposed to sunlight or extremes in temperature.
6. Secure and maintain a location to store the material in accordance with Section 01 66 00.

**1.11 FIELD [SITE] CONDITIONS [NOT USED]**

**1.12 WARRANTY**

A. Manufacturer Warranty

1. Manufacturer's Warranty shall be in accordance with Division 1.

**PART 2 - PRODUCTS**

**2.1 OWNER-FURNISHED [OR] OWNER-SUPPLIED PRODUCTS [NOT USED]**

**2.2 EQUIPMENT, PRODUCT TYPES AND MATERIALS**

A. Manufacturers

1. Only the manufacturers as listed on the City's Standard Products List will be considered as shown in Section 01 60 00.
  - a. The manufacturer must comply with this Specification and related Sections.
2. Any product that is not listed on the Standard Products List is considered a substitution and shall be submitted in accordance with Section 01 25 00.

B. Description

1. Regulatory Requirements
  - a. Valves shall be new and meet or exceed AWWA C509 or AWWA C515 and shall meet or exceed the requirements of this Specification.

- b. All valve components in contact with potable water shall conform to the requirements of NSF 61.

### C. Materials

#### 1. Valve Body

- a. Valve body: ductile iron per ASTM A536
- b. Flanged ends: Furnish in accordance with AWWA/ANSI C115/A21.15.
- c. Mechanical Joints: Furnish with outlets which conform to AWWA/ANSI C111/A21.11.
- d. Valve interior and exterior surfaces: fusion bonded epoxy coated, minimum 5 mils, meeting AWWA C550 requirements
- e. Buried valves: Provide with polyethylene encasement in accordance with AWWA/ANSI C105/A21.5.
  - 1) Polyethylene encasement: Furnish in accordance with Section 33 11 10.

#### 2. Wedge (Gate)

- a. Resilient wedge: rated at 250 psig cold water working pressure
- b. The wedge (gate) for all valve sizes shall be 1 piece, fully encapsulated with a permanently bonded EPDM rubber.

#### 3. Bypass

- a. For gate valves using a double roller, track and scrapper system, an integrally cast bypass on the body of the valve is required.
  - 1) Orient the bypass on the same side of the gate valve as the spur gear to allow operation of both valves from the manhole opening.
  - 2) The bypass shall be a minimum 4-inch in size.

#### 4. Gate Valve Bolts and Nuts

- a. Bonnet, Stuffing Box and Gear Box - Hex head bolt, and hex nut: Steel ASTM A307 Gr. B, Zinc Plate per ASTM B633, SC3 for non-buried service (4-inch through 12-inch valves) or as specified in 2.2.C.4.b.
- b. Hex head bolt and hex nut: AISI 304 stainless steel for buried service (all sizes) and for valves 16-inch through 36-inch (non-buried service)

#### 5. Bolts and Nuts

- a. Mechanical Joints
  - a) Provide bolts and nuts in accordance with Section 33 11 05.

- b. Flanged Ends
    - 1) Meet requirements of AWWA C115 or AWWA C207 depending on pipe material.
    - 2) Provide bolts and nuts in accordance with Section 33 11 05.
    - 3) Flanged isolation kits shall be provided when connecting to buried steel or concrete pressure pipe. Kits shall conform to Section 33 04 10.
6. Joints
- a. Valves: flanged, or mechanical-joint or any combination of these as specified on the Drawings or in the project Specifications
    - 1) Flanged-joints: AWWA/ANSI C115/A21.15, ASME B16.1, Class 125
      - a) Flange bolt circles and bolt holes shall match those of ASME B16.1, Class 125.
      - b) Field fabricated flanges are prohibited.
    - 2) Steel or concrete pressure pipe
      - a) Use flange-joints unless otherwise specified in the Contract Documents.
    - 3) Ductile Iron or PVC pressure pipe
      - a) Use mechanical joints with mechanically restrained retainer glands unless otherwise specified in the Contract Documents.
7. Operating Nuts
- a. Supply for buried service valves
  - b. 1-15/16-inch square at the top, 2-inch at the base, and 1-3/4-inch high
  - c. Cast an arrow showing the direction of opening with the word "OPEN" on the operating nut base.
  - d. To open, the operating nut shall be turned to the **RIGHT (CLOCKWISE)** direction. Nut shall be painted red per AWWA specifications
  - e. Connect the operating nut to the shaft with a shear pin that prevents the nut from transferring torque to that shaft or the gear box that exceeds the manufacturer's recommended torque.
  - f. Furnish handwheel operators for non-buried service, or when shown in the Drawings.
8. Gearing
- a. Gate valves that are 24 inch and larger: Equip with a spur gear.

- b. Bevel gears for horizontally mounted valves are not allowed.
  - c. The spur gear shall be designed and supplied by the manufacturer of the valve as an integral part of the gate valve.
9. Gaskets
- a. Provide gaskets in accordance with Section 33 11 05.

### 2.3 ACCESSORIES

- A. All gate valves shall have the following accessories provided as part of the gate valve installation:
1. A keyed solid extension stem of sufficient length to bring the operating nut up to within 1 foot of the surface of the ground, when the operating nut on the gate valve is 3 feet or more beneath the surface of the ground. Extension Stems are:
    - a. Not required on City stock orders
    - b. Not to be bolted or attached to the valve-operating nut
    - c. To be of cold rolled steel with a cross-sectional area of 1 square inch, fitting loosely enough to allow deflection
  2. Furnish joint components such as gaskets, glands, lubricant, bolts, and nuts in sufficient quantity for assembly of each joint.
  3. Cast Iron Valve Boxes: provide for buried service gate valves, cast iron valve boxes and covers
    - a. Each valve box for 4-inch through 12-inch valves shall be 2-piece, 5 ¼-inch shafts, screw type, consisting of a top section and a bottom section.
    - b. Valve boxes shall be as listed in the City Standard Products List in attached in Section 01 60 00.
    - c. Valve box covers shall be so designed that they can be easily removed to provide access to valve operating nut.
    - d. Valve box covers must be designed to stay in position and resist damage under AASHTO HS 20 traffic loads.
    - e. Each cover shall be casted with the word "WATER" or "RECLAIMED" in raised letters on the upper surface.
    - f. Cast iron valve boxes and covers shall conform to ASTM A48, Class 35B.
      - 1) Valve box covers shall be round for potable water applications and square for reclaimed water applications.
    - g. Box extension material shall be AWWA C900 PVC or ductile iron.

**2.4 SOURCE QUALITY CONTROL [NOT USED]**

**PART 3 - EXECUTION**

**3.1 INSTALLERS [NOT USED]**

**3.2 EXAMINATION [NOT USED]**

**3.3 PREPARATION [NOT USED]**

**3.4 INSTALLATION**

A. General

1. All valves shall be installed in vertical position when utilized in normal pipeline installation.
2. Valves shall be placed at line and grade as indicated on the Drawings.
3. Polyethylene encasement installation shall be in accordance with Section 33 11 10.

**3.5 REPAIR/RESTORATION [NOT USED]**

**3.6 RE-INSTALLATION [NOT USED]**

**3.7 FIELD [OR] SITE QUALITY CONTROL**

A. Field Inspections

1. Before acceptance of the installed valve, the City Field Operations Staff shall have the opportunity to operate the valve.
2. The City shall be given the opportunity to inspect all buried flanges before they are covered.
3. The Operator will be assessing the ease of access to the operating nut within the valve box and ease of operating the valve from a fully closed to fully opened position.
4. If access and operation of the valve meet the City's criteria, then the valve will be accepted as installed.

B. Non-Conforming Work

1. If access and operation of the valve or its appurtenances does not meet the City's criteria, the Contractor will remedy the situation until it meets the City's criteria, at the Contractor's expense.

- 3.8 SYSTEM STARTUP [NOT USED]
- 3.9 ADJUSTING [NOT USED]
- 3.10 CLEANING [NOT USED]
- 3.11 CLOSEOUT ACTIVITIES [NOT USED]
- 3.12 PROTECTION [NOT USED]
- 3.13 MAINTENANCE [NOT USED]
- 3.14 ATTACHMENTS [NOT USED]

END OF SECTION

**PART 1 - GENERAL****1.1 SUMMARY**

## A. Section Includes:

1. AWWA Rubber-Seated Butterfly Valves 30-inch through 72-inch for transmission, distribution system and plant applications (buried or above ground installation) as specified herein and shown on the Drawings
2. Butterfly valves smaller than 30-inches may be approved by the City on a case-by-case basis.

## B. Deviations from this Standard Specification

1. None.

## C. Related Specification Sections include, but are not necessarily limited to:

1. Division 0 – Bidding Requirements, Contract Forms and Conditions of the Contract
2. Division 1 – General Requirements
3. Section 03 30 00 – Cast-In-Place Concrete
4. Section 33 04 10 – Joint Bonding and Electrical Isolation
5. Section 33 05 16 – Concrete Water Vaults
6. Section 33 11 05 – Bolts, Nuts, and Gaskets

**1.2 PRICE AND PAYMENT PROCEDURES**

## A. Measurement and Payment

## 1. Measurement

- a. Measurement for this Item shall be per each.

## 2. Payment

- a. The work performed and materials furnished in accordance with this Item and measured as provided under "Measurement" will be paid for at the unit price bid per each "AWWA Butterfly Valve" installed for:

- 1) Various sizes

## 3. The price bid shall include:

- a. Furnishing and installing AWWA Butterfly Valves as specified in the Drawings
- b. AWWA Butterfly Valve vault and appurtenances

- c. Pavement removal
- d. Excavation
- e. Hauling
- f. Disposal of excess material
- g. Furnishing, placing and compaction of embedment
- h. Furnishing, placing and compaction of backfill
- i. Clean-up
- j. Cleaning
- k. Disinfection
- l. Testing

### 1.3 REFERENCES

#### A. Reference Standards

1. Reference standards cited in this Specification refer to the current reference standard published at the time of the latest revision date logged at the end of this Specification, unless a date is specifically cited.
2. American National Standards Institute (ANSI):
  - a. B1.1, Unified Inch Screw Thread Series
3. American Society of Mechanical Engineers (ASME):
  - a. B16.1, Gray Iron Pipe Flanges and Flanged Fittings (Classes 25, 125 and 250).
4. ASTM International (ASTM):
  - a. A36, Standard Specification for Carbon Structural Steel.
  - b. A242, Standard Specification for High-Strength Low-Alloy Structural Steel.
  - c. A536, Standard Specification for Ductile Iron Castings.
  - d. B117, Standard Practice for Operating Salt Spray (Fog) Apparatus.
5. American Water Works Association/American National Standards Institute (AWWA/ANSI):
  - a. C111/A21.11, Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.
6. American Water Works Association (AWWA):
  - a. C504, Rubber-Seated Butterfly Valves.
  - b. C550, Protective Interior Coatings for Valves and Hydrants.
7. NSF International (NSF):



- a. 61, Drinking Water System Components - Health Effects.
- 8. Society for Protective Coatings/NACE International (SSPC/NACE):
  - a. SP 10/NACE No. 2, Near-White Blast Cleaning.

**1.4 ADMINISTRATIVE REQUIREMENTS [NOT USED]**

**1.5 SUBMITTALS**

- A. Submittals shall be in accordance with Section 01 33 00.
- B. All submittals shall be approved by the City prior to delivery.

**1.6 ACTION SUBMITTALS/INFORMATIONAL SUBMITTALS**

A. Product Data

- 1. Rubber-Seated Butterfly Valves stating:
  - a. Material
  - b. Valve and Actuator Coating System
  - c. Working pressure rating
  - d. Test pressure rating
  - e. Valve classification
  - f. Valve Seat Type and bonding method to disc or body
  - g. Valve-port diameter
  - h. Valve Torque required
  - i. Actuator Type and maximum torque
  - j. Total net assembled weight
  - k. Valve operator and extension stems
  - l. Opening direction
- 2. Confirm valve seat type for specific project application with the City prior to ordering Rubber-Seated Butterfly Valve.

B. Shop Drawings

- 1. For below grade applications:
  - a. Cast-in-place concrete vault in accordance with shop drawing requirements set forth in Section 03 30 00.
  - b. Vault appurtenances in accordance with shop drawing requirements set forth in Section 33 05 16.

C. Certifications

1. Furnish an affidavit certifying that all AWWA Rubber-Seated Butterfly Valves meet the provisions of this Specification and have been hydrostatically tested at the factory and meet the requirements of AWWA C504.
2. Furnish an affidavit certifying that the coating for all AWWA Rubber-Seated Butterfly Valves meets the provisions of this Specification and meets the requirements of AWWA C504.
3. Furnish affidavit that AWWA Rubber-Seated Butterfly Valve manufacturer owns or controls any foreign factory/foundry that supplies valve casings and can certify that the Resilient Seated (Wedge) Gate Valve manufacturer is in control of quality control at the foreign factory/foundry.

### **1.7 CLOSEOUT SUBMITTALS [NOT USED]**

### **1.8 MAINTENANCE MATERIAL SUBMITTALS**

#### **A. Operation and Maintenance Manual**

1. Furnish Operation and Maintenance Manual in accordance with Division 1.

### **1.9 QUALITY ASSURANCE**

#### **A. Qualifications**

##### **1. Manufacturers**

- a. Rubber-Seated Butterfly Valves and manual actuators of the same size shall be the product of 1 manufacturer for each project.
  - 1) Change orders, specials and field changes may be provided by a different manufacturer upon City approval.
- b. Rubber-Seated Butterfly Valves shall be in conformance with AWWA C504.
- c. Casings for Rubber-Seated Butterfly Valves; that are not manufactured within the United States of America, shall be manufactured by factories/foundries that are owned or controlled (partial ownership) such that the Rubber-Seated Butterfly Valve Manufacturer can control and guarantee quality at the foreign factory/foundry.
- d. Worm-gear type actuator meeting the requirements of this specification shall be :
  - 1) Rotork Gears IW Series AWWA C504 & C5PV-3 Quarter-turn Worm Gear Operator,
  - 2) AUWA GS Part-Turn Gearbox,
  - 3) Limitorque HBC Worm Gearbox series
  - 4) EIM WO series for non-burier applications or WB series for direct-buried applications
  - 5) Or Engineer approved equal

2. The AWWA Rubber-Seated Butterfly Valve shall be the product of a manufacturer regularly engaged in the manufacturing of AWWA Rubber-Seated Butterfly Valves having similar service and size.
3. Unit Responsibility
  - a. All equipment specified under this Section is to be furnished by the valve manufacturer who shall be responsible for the adequacy and compatibility of all unit components including, but not limited to, the valve, actuator and extension stems.
  - b. Any component of each complete unit not provided by the valve manufacturer shall be designed, fabricated, tested and installed by factory-authorized representatives experienced in the design and manufacture of the equipment.
    - 1) This includes, but is not limited to, coordination of the torque required to properly operate the valve.
    - 2) This does not relieve the Contractor of the overall responsibility for this portion of the work.

#### **1.10 DELIVERY, STORAGE, AND HANDLING**

##### **A. Storage and Handling Requirements**

1. Protect all parts such that no damage or deterioration will occur during a prolonged delay from the time of shipment until installation is completed and the units and equipment are ready for operation.
2. Protect all equipment and parts against any damage during a prolonged period at the site.
3. Protect the finished surfaces of all exposed flanges by wooden blank flanges, strongly built and securely bolted thereto.
4. Protect finished iron or steel surfaces not painted to prevent rust and corrosion.
5. Prevent plastic and similar brittle items from being directly exposed to sunlight or extremes in temperature.
6. Secure and maintain a location to store the material in accordance with Section 01 66 00.

#### **1.11 FIELD [SITE] CONDITIONS [NOT USED]**

#### **1.12 WARRANTY**

##### **A. Manufacturer Warranty**

1. Manufacturer's Warranty shall be in accordance with Division 1.

## **PART 2 - PRODUCTS**

### **2.1 OWNER-FURNISHED [OR] OWNER-SUPPLIED PRODUCTS [NOT USED]**

### **2.2 EQUIPMENT, PRODUCT TYPES, AND MATERIALS**

#### **A. Manufacturers**

1. Only the manufacturers as listed on the City's Standard Products List will be considered as shown in Section 01 60 00.
  - a. The manufacturer must comply with this Specification and related sections.
2. Any product that is not listed on the Standard Product List or listed in this specification is considered a substitution and shall be submitted in accordance with Section 01 25 00.

#### **B. Description**

1. Regulatory Requirements
  - a. AWWA Rubber-Seated Butterfly Valves shall be new and meet or exceed the latest revisions of AWWA C504 and shall meet or exceed the requirements of this Specification.
  - b. All AWWA Rubber-Seated Butterfly Valve components in contact with potable water shall conform to the requirements of NSF 61.

#### **C. Materials**

1. Valve Body
  - a. Valve bodies shall be of ductile iron per ASTM A536 Grade 65-45-12 or fabricated steel ASTM A36.
  - b. Valve bodies shall be short body type.
2. Joints
  - a. Flange end valves shall be:
    - 1) Class 125 Standard flanged ends faced
    - 2) Drilled per ASME B16.1 standard for cast iron flanges
    - 3) Flanges shall be designed for the test pressure of the valve.
  - b. Mechanical joint end valves shall meet the requirements of AWWA/ANSI C111/A21.11.
  - c. Flanged ends shall be used with Steel or Concrete Cylinder pipe unless otherwise noted in the Contract Documents.
    - 1) Flange isolation kits shall be provided in accordance with Section 33 04 10.
  - d. Flanged ends shall be provided unless otherwise noted in the Contract Documents.

3. Bolts and Nuts
  - a. Flanged Ends
    - 1) Meet requirements of AWWA C115 or AWWA C207 depending on pipe material
    - 2) Provide bolts and nuts in accordance with Section 33 11 05.
  - b. Tapped Bolts
    - 1) Butterfly Valve manufacturer to provide tapped bolts with ANSI B1.1 UNC thread.
4. Gaskets
  - 1) Provide gaskets in accordance with Section 33 11 05.
5. Discs
  - a. Discs shall be ductile iron ASTM A536 Grade or fabricated steel ASTMA36.
    - 1) Disc and shaft connection shall be made with tapered pins of either monel or stainless steel
6. Valve Shaft
  - a. Valve shaft shall be:
    - 1) Type 304 stainless steel or equal
    - 2) 1-piece unit or stub-shaft type
      - a) Stub shaft shall be inserted into the valve disc hubs for distance of 1 ½ times shaft diameter
    - 3) Minimum diameter per AWWA C504
    - 4) Horizontal orientation
7. Shaft Seals
  - a. Valve shaft seals shall be self-compensating V-type packing with a minimum of 4 sealing rings.
  - b. Design shall allow adjustment or replacement without removing the valve shaft.
8. Valve Bearings
  - a. Valve shaft bearings shall be non-metallic and permanently lubricated.
9. Valve Seat
  - a. Seats on Body (for transmission projects only)
    - 1) The seat shall be a Buna-N or EPDM for water and shall be molded in and bonded to the valve body.
    - 2) Provide a 360 degree continuous, uninterrupted seating surface.

- 3) Field adjustable around the full 360 degrees circumference and replaceable without dismantling the actuator, disc or shaft and without removing the valve from the line.
  - 4) The seat shall be retained in the valve body by mechanical means without retaining rings, segments, screws or hardware of any kind in the flow stream.
  - 5) The seat shall contain an integral shaft seal protecting the valve bearings and packing from any line debris.
  - 6) Rubber seats shall be field adjustable and replaceable.
- b. Seats on Disc (for transmission or water facility)
- 1) The seat shall be a Buna-N or EPDM for water and shall be molded in and bonded to the disc.
  - 2) Resilient seats shall be located on the valve disc and shall provide a 360 degree continuous, uninterrupted seating surface.
  - 3) Seats shall be mechanically retained with a stainless steel retaining ring and stainless steel cap screws which shall pass through both the resilient seat and the retaining ring.
  - 4) The resilient seat's mating surface shall be to a 360 degree continuous uninterrupted stainless steel body seat ring.
  - 5) Rubber seats shall be field adjustable and replaceable.

10. Performance / Design Criteria

- a. Valve Classification shall be Class 250B

D. Finishes

1. Unless otherwise specified in the Contract Documents, exterior and interior metallic surfaces of each valve shall be shop fusion bonded epoxy coated meeting per the latest revision of AWWAC550.
2. Painting and Coatings
  - a. All surfaces of the valve shall be clean, dry and free from grease before applying paint or coating.
  - b. The valve interior and exterior surfaces, except for the seating surfaces, shall be provided with the manufacturer's standard coating or as specified in the Contract Documents.
  - c. All internal exposed surfaces that are susceptible to corrosion shall be coated with a Polyimide cured, rust inhibiting epoxy.
  - d. Surfaces to be coated shall be prepared and sand-blasted per SSPC SP 10/NACE No. 2.
  - e. Final coating thickness shall be 16 mils minimum.

- f. All surfaces shall be inspected for proper dry film thickness using a magnetic dry film thickness gauge.
- g. Tests for invisible holidays shall be conducted using a low voltage, wet sponge holiday or leak detector.

E. Marking for Identification

- 1. For each Rubber-Seated Butterfly Valve, clearly mark with the following information:
  - a. Valve size
  - b. Class for which it is designated
  - c. Name of manufacturer
  - d. Date of manufacturer

**2.3 ACCESSORIES**

A. Rubber-Seated Butterfly Valves shall have the following accessories provided as part of the valve installation:

- 1. Below grade Rubber-Seated Butterfly Valves shall be placed within a concrete vault in accordance with Section 03 30 00, or as shown on the Drawings. All vault appurtenances shall be in accordance with Section 33 05 16.
- 2. Manual Actuators
  - a. Valves shall be provided with manual actuators, unless otherwise specified in the Drawings.
  - b. Valves shall be opened by turning the actuator clockwise and close counter clockwise.
  - c. Manual actuators shall be fully greased, packed and have adjustable stops in the open and closed position.
    - 1) The actuator shall have a adjustable mechanical stop which will withstand an input torque of 450 foot-pounds against the stop.
    - 2) The actuator shall have a built in packing leak bypass to eliminate possible packing leakage into the actuator housing.
  - d. Butterfly valves in a vault shall be furnished with a 2-inch operating nut.
    - 1) The actuator shall be placed in a vault as indicated on the Drawings and have extension to the top of the vault.
  - e. Butterfly valves in plant, pump station or tank service applications located above ground shall be provided with a 16 inch minimum diameter handwheel operator.
    - 1) Handwheels shall be painted red.
  - f. Valve Position Indicator
    - 1) Provide position indicator with mechanical dial indicator as follows:

- a) Highly visible
  - b) Containing “Open” and “Closed” legend at the end of a 90 degree arc
  - c) Pointer to show the disc position (Closed-0 degree and Open-90 degree)
  - d) Arc graduated in degrees
- g. Actuator shall be worm-gear type, as follows:
- 1) Worm gear manual operator shall comply fully with AWWA C504, latest edition.
  - 2) Worm gear drive sleeve and worm shaft shall be of solid, 1-piece design; bolted segments or pinned worms will not be acceptable. Drive sleeve shall include an integral spline to accept a removable bottom-entry spline bushing for valve shaft connection.
  - 3) If required for torque purposes, spur gear reducers may be provided for increased torque outputs and to reduce handwheel diameter. Worm gear operator shall include handwheel with maximum 80 pound rim pull or a 2-inch AWWA Nut with a maximum 150 ft. lbs required input torque
  - 4) Materials of Construction
    - a) Housing: Ductile Iron
    - b) Drive sleeve: Bronze
    - c) Worm: Alloy steel with splined input drive connection
    - d) Bearings: Heavy duty tapered roller bearings
    - e) Finish: Thermostatically Applied Polyester Powdercoat
    - f) Fasteners: Stainless steel
  - 5) Manual gears shall be capable of being field retrofit with an electric motor operator in the future without major modifications.
    - a) With spur gear removed, splined worm gear input shaft and motor adapter flange shall be easily added to accept a multi-turn “torque-only” electric valve actuator.
      - (1) Supplier shall include the Number of Turns required to complete on Open-to-Close stroke in the Equipment Submittal.

3. Extension Stem

- a. Keyed solid extension stem of sufficient length to bring the operating nut up to within 1 foot of the surface of the ground, when the operating nut on the valve is 3 feet or more beneath the surface of the ground
  - 1) Not required for City stock orders.
  - 2) Extension stems shall not be bolted or attached to the valve-operating nut.



- 3) Extension stems shall be of cold rolled steel with a cross-sectional area of 1 square inch, fitting loosely enough to allow deflection.
- 4. 2-inch Taps
  - a. Provide two 2-inch taps on each side of the valve, 12 inches from the valve body.
    - 1) Taps shall be C.C. thread with flare, with insulated adaptor kit.
    - 2) Provide copper riser between corporation stop and curb stop.
    - 3) Install curb stop 12 inches from the vault top
      - a) Reachable by hand from the vault lid
- 5. Joint components such as gaskets, glands, lubricant, bolts and nuts, shall be furnished in sufficient quantity for assembly of each joint.

## **2.4 SOURCE QUALITY CONTROL**

### **A. Tests and Inspections**

- 1. Each valve shall be shop tested for leaks in the closed position with the valve horizontal.
  - a. The upper surface of the valve disc shall be visible and covered with a pool of water at 0 psi pressure.
  - b. Air pressure equivalent to the design rating of the valve shall be applied to the lower face of the disc for at least 5 minutes with no indication of leakage (i.e. bubbles in the water pool) during the test period.
- 2. The valve body shall be hydrostatically tested at twice the rated pressure for 10 minutes with the valve in the slightly open position.
  - a. During this test, there shall be no leakage or seeping through the valve body, weld or valve trunnions.

## **PART 3 - EXECUTION**

### **3.1 INSTALLERS [NOT USED]**

### **3.2 EXAMINATION [NOT USED]**

### **3.3 PREPARATION [NOT USED]**

### **3.4 INSTALLATION**

#### **A. General**

- 1. All Rubber-Seated Butterfly Valves shall be installed in accordance with the instructions of the manufacturer and as shown on the Drawings.

2. For buried applications, Rubber-Seated Butterfly Valves shall be placed in a concrete vault and installed in accordance with Section 03 30 00. All vault appurtenances shall be installed in accordance with Section 33 05 16.
3. All excavations shall be backfilled in accordance with Section 33 05 10.

**3.5 REPAIR / RESTORATION [NOT USED]**

**3.6 RE-INSTALLATION [NOT USED]**

**3.7 FIELD [OR] SITE QUALITY CONTROL**

A. Field Inspections

1. Before acceptance of the installed Rubber-Seated Butterfly Valve, the City Field Operations and/or Production Staff shall have the opportunity to operate the valve.
  - a. The operator will be assessing the ease of access to the operating nut within the valve box and ease of operating the valve from a fully closed to fully opened position.
  - b. If access and operation of the Rubber-Seated Butterfly Valve meet the City's criteria, then the valve will be accepted as installed.

B. Non-Conforming Work

1. If access and operation of the valve or its appurtenances does not meet the City's criteria, the Contractor will remedy the situation until it meets the City's criteria, at the Contractor's expense.

**3.8 SYSTEM STARTUP [NOT USED]**

**3.9 ADJUSTING [NOT USED]**

**3.10 CLEANING [NOT USED]**

**3.11 CLOSEOUT ACTIVITIES [NOT USED]**

**3.12 PROTECTION [NOT USED]**

**3.13 MAINTENANCE [NOT USED]**

**3.14 ATTACHMENTS [NOT USED]**

**END OF SECTION**

**PART 1 - GENERAL**

**1.1 SUMMARY**

A. Section Includes:

1. Connection to existing water mains to include, but not limited to:
  - a. Cutting in a tee for a branch connection
  - b. Extending from an existing water main
  - c. Installing a tapping sleeve and valve

B. Deviations from this Standard Specification

1. None.

C. Related Specification Sections include, but are not necessarily limited to:

1. Division 0 – Bidding Requirements, Contract Forms, and Conditions of the Contract
2. Division 1 – General Requirements
3. Section 33 04 40 – Cleaning and Acceptance Testing of Water Mains
4. Section 33 05 10 – Utility Trench Excavation, Embedment and Backfill
5. Section 33 05 30 – Location of Existing Utilities
6. Section 33 11 05 – Bolts, Nuts, and Gaskets
7. Section 33 11 10 – Ductile Iron Pipe

**1.2 PRICE AND PAYMENT PROCEDURES**

A. Measurement and Payment

1. Connection to an existing unpressurized Lewisville Water Distribution System Main that does not require the City to take part of the water system out of service
  - a. Measurement
    - 1) This Item is considered subsidiary to the water pipe being installed.
  - b. Payment

- 1) The work performed and the materials furnished in accordance with this Item are subsidiary to the unit price bid per linear foot of water pipe complete in place, and no other compensation will be allowed.
2. Connection to an existing pressurized Lewisville Water Distribution System Main that requires a shutdown of some part of the water system
    - a. Measurement
      - 1) Measurement for this Item shall be per each connection completed.
    - b. Payment
      - 1) The work performed and the materials furnished in accordance with this Item shall be paid for at the unit price bid per each "Connection to Existing Water Main" installed for:
        - a) Various sizes of existing water distribution main
    - c. The price bid shall include all aspects of making the connection including, but not limited to:
      - 1) Preparing submittals
      - 2) Dewatering
      - 3) Exploratory excavation (as needed)
      - 4) Coordination and notification
      - 5) Remobilization
      - 6) Temporary lighting
      - 7) Polyethylene encasement
      - 8) Make-up pieces
      - 9) Linings
      - 10) Pavement removal
      - 11) Excavation
      - 12) Hauling
      - 13) Disposal of excess material
      - 14) Clean-up
      - 15) Cleaning
      - 16) Disinfection
      - 17) Testing

3. Connection to an existing pressurized Lewisville Water Distribution System Main by Tapping Sleeve and Valve:
  - a. Measurement
    - 1) Measurement for this Item shall be per each connection completed.
  - b. Payment
    - 1) The work performed and the materials furnished in accordance with this Item shall be paid for at the unit price bid per each "Tapping Sleeve and Valve" installed for:
      - a) Various sizes of connecting main
      - b) Various sizes of existing water distribution main
  - c. The price bid shall include all aspects of making the connection including, but not limited to:
    - 1) Preparing submittals
    - 2) Dewatering
    - 3) Exploratory excavation (as needed)
    - 4) Coordination and notification
    - 5) Tapping Sleeve and Tapping Valve
    - 6) Remobilization
    - 7) Temporary lighting
    - 8) Polyethylene encasement
    - 9) Make-up pieces
    - 10) Linings
    - 11) Pavement removal
    - 12) Excavation
    - 13) Hauling
    - 14) Disposal of excess material
    - 15) Clean-up
    - 16) Cleaning
    - 17) Disinfection
    - 18) Testing

### 1.3 REFERENCES

#### A. Reference Standards

1. Reference standards cited in this Specification refer to the current reference standard published at the time of the latest revision date logged at the end of this Specification, unless a date is specifically cited.
2. American Society of Mechanical Engineers (ASME):
  - a. B16.1, Gray Iron Pipe Flanges and Flanged Fittings Classes 25, 125 and 250)
3. ASTM International (ASTM):
  - a. A36, Standard Specification for Carbon Structural Steel.
  - b. A193, Standard Specification for Alloy-Steel and Stainless Steel Bolting for High Temperature or High Pressure Service and Other Special Purpose Applications
  - c. A194, Specification for Carbon and Alloy Steel Nuts for Bolts for High Pressure or High Temperature Service, or Both
  - d. A242, Standard Specification for High-Strength Low-Alloy Structural Steel.
  - e. A283, Standard Specification for Low and Intermediate Tensile Strength Carbon Steel Plates.
  - f. A285, Standard Specification for Pressure Vessel Plates, Carbon Steel, Low- and Intermediate-Tensile Strength.
  - g. B117, Standard Practice for Operating Salt Spray (Fog) Apparatus.
  - h. D2000, Standard Classification System for Rubber Products in Automotive Applications.
4. American Water Works Association (AWWA):
  - a. C200, Steel Water Pipe - 6 IN and Larger.
  - b. C207, Steel Pipe Flanges for Waterworks Service – Sizes 4 IN through 144 IN.
  - c. C213, Fusion-Bonded Epoxy Coating for the Interior and Exterior of Steel Water Pipelines.
  - d. C223, Fabricated Steel and Stainless Steel Tapping Sleeves.
5. American Water Works Association/American National Standards Institute (AWWA/ANSI):
  - a. C105/A21.5, Polyethylene Encasement for Ductile-Iron Pipe Systems.
  - b. C111/A21.11, Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.

- c. C115A21/15, Flanged Ductile-Iron Pipe with Ductile Iron or Gray-Iron Threaded Flanges.
- 6. NSF International (NSF):
  - a. 61, Drinking Water System Components – Health Effects.
- 7. Manufacturers Standardization Society of the Valve and Fitting Industry Inc. (MSS):
  - a. SP-60, Connecting flange Joint Between Tapping Sleeves and Tapping Valves.

#### **1.4 ADMINISTRATIVE REQUIREMENTS**

##### **A. Pre-installation Meetings**

- 1. Required for any connections to an existing, pressurized 16-inch or larger City water distribution system main that requires a shutdown of some part of the water system
- 2. May also be required for connections that involve shutting water service off to certain critical businesses
- 3. Schedule a pre-installation meeting a minimum of 3 weeks prior to proposed time for the work to occur.
- 4. The meeting shall include the Contractor, City Inspector and City Valve Crew.
- 5. Review work procedures as submitted and any adjustments made for current field conditions.
- 6. Verify that all valves and plugs to be used have adequate thrust restraint or blocking.
- 7. Schedule a test shutdown with the City.
- 8. Schedule the date for the connection to the existing system.

##### **B. Scheduling**

- 1. Schedule work to make all connections to existing 16-inch and larger mains:
  - a. During the period from November through April, unless otherwise approved by the City
  - b. During normal business hours from Monday through Friday, unless otherwise approved by the City
- 2. Schedule City Valve Crew by 1:00 P.M. a minimum of 1 business day prior to planned disruption to the existing water system.

- a. In the event that other water system activities do not allow the existing main to be dewatered at the requested time, schedule work to allow the connection at an alternate time acceptable to the City.
  - 1) If water main cannot be taken out of service at the originally requested time, coordination will be required with the City to discuss rescheduling and compensation for mobilization.
  - 2) No additional payment will be provided if the schedule was altered at the Contractor's request.

## 1.5 SUBMITTALS

- A. Submittals shall be in accordance with Section 01 33 00.
- B. All submittals shall be approved by the City prior to delivery and/or fabrication for specials.

## 1.6 ACTION SUBMITTALS/INFORMATIONAL SUBMITTALS

- A. Product Data, if applicable
  - 1. Tapping Sleeve noting the pressure rating and coating system supplied including:
    - a. Dimensions, weights, material list, and detailed drawings
    - b. Maximum torque recommended by the manufacturer for the valve by size
- B. Submittals
  - 1. Provide a detailed sequence of work for 16-inch, or larger, connections if required by City that includes:
    - a. Results of exploratory excavation
    - b. Dewatering
    - c. Procedure for connecting to the existing water main
    - d. Time period for completing work from when the water is shut down to when the main is back in service
    - e. Testing and repressurization procedures
  - 2. Welders that are assigned to work on connection to concrete cylinder or steel pipe must be certified and provide Welding Certificates, upon request, in accordance with AWWA C200.



**1.7 CLOSEOUT SUBMITTALS [NOT USED]**

**1.8 MAINTENANCE MATERIAL SUBMITTALS [NOT USED]**

**1.9 QUALITY ASSURANCE [NOT USED]**

**1.10 DELIVERY, STORAGE, AND HANDLING**

A. Storage and Handling Requirements

1. Protect parts so that no damage or deterioration occurs during a prolonged delay from the time of shipment until installation is completed.
2. Protect all equipment and parts against any damage during a prolonged period at the site.
3. Protect the finished surfaces of all exposed flanges using wooden flanges, strongly built and securely bolted thereto.
4. Protect finished iron or steel surfaces not painted to prevent rust and corrosion.
5. Prevent plastic and similar brittle items from being exposed to direct sunlight and extremes in temperature.
6. Secure and maintain a location to store the material in accordance with Section 01 66 00.

**1.11 FIELD [SITE] CONDITIONS [NOT USED]**

**1.12 WARRANTY**

A. Manufacturer Warranty

1. Manufacturer's warranty shall be in accordance with Division 1.

**PART 2 - PRODUCTS**

**2.1 OWNER-FURNISHED [OR] OWNER-SUPPLIED PRODUCTS [NOT USED]**

**2.2 EQUIPMENT, PRODUCT TYPES AND MATERIALS**

A. Manufacturers

1. Only the manufacturers as listed by the City's Standard Products List will be considered as shown in Section 01 60 00.
  - a. The manufacturer must comply with this Specification and related Sections.
2. Any product that is not listed on the Standard Products List is considered a substitution and shall be submitted in accordance with Section 01 25 00.

B. Description

1. Regulatory Requirements

- a. Tapping Sleeves shall meet or exceed AWWA C223 and the requirements of this Specification.
- b. All valve components in contact with potable water shall conform to the requirements of NSF 61.

C. Tapping Sleeve Materials

1. Body

- a. Body: Carbon Steel per ASTM A283 Grade C, ASTM A285 Grade C, ASTM A36 Steel or equal
- b. Finish: fusion bonded epoxy coating to an average 12 mil thickness. Fusion applied per AWWA C213.
- c. All buried tapping sleeves shall be provided with polyethylene encasement in accordance with AWWA/ANSI C105/A21.5.
  - 1) Polyethylene encasement shall be in accordance with Section 33 11 10.

2. Flange

- a. Carbon Steel per ASTM A36 in accordance with AWWA C207 and ASME B16.1 Class 125.
- b. Recessed for tapping valve per MSS SP-60

3. Bolts and Nuts

- a. Flanged Ends
  - 1) Meet requirements of AWWA C115 or AWWA C207 depending on pipe material.
  - 2) Provide bolts and nuts in accordance with Section 33 11 05.

4. Gaskets

- a. Provide gaskets in accordance with Section 33 11 05.

5. Test Plug

- a. ¾-inch NPT carbon steel with square head and fusion bonded epoxy coating

**2.3 ACCESSORIES [NOT USED]**

**2.4 SOURCE QUALITY CONTROL [NOT USED]**

**PART 3 - EXECUTION**

**3.1 INSTALLERS [NOT USED]**

**3.2 EXAMINATION**

A. Verification of Conditions

1. Verify by exploratory excavation, if needed, that existing water main is as depicted in the Drawings and that the location is suitable for a connection to the existing water main.
  - a. Excavate and backfill trench for the exploratory excavation in accordance with 33 05 10.
2. Verify that all equipment and materials are available on-site prior to the shutdown of the existing main.
3. Pipe lines shall be completed, tested and authorized for connection to the existing system in accordance with Section 33 04 40.

**3.3 PREPARATION [NOT USED]**

**3.4 INSTALLATION**

A. General

1. Upon disruption of the existing water main, continue work until the connection is complete and the existing water main is back in service.

B. Procedure

1. Expose the proposed connection point in accordance with Section 33 05 10.
2. Dewater the existing water line so the chlorinated water is not unlawfully discharged.
3. Maintain the water that may bleed by existing valves or plugs during installation within the work area to a reasonable level.
  - a. Control the water in such a way that it does not interfere with the proper installation of the connection or create a discharge of chlorinated water.
4. If any discharge of chlorinated water occurs, discharged water shall be de-chlorinated in accordance with Section 33 04 40

5. Cut and remove existing water main in order to make the connection.
6. Verify that the existing pipe line is suitable for the proposed connection.
7. Place trench foundation and bedding in accordance with 33 05 10.
8. In the event that a tapping sleeve and valve is used, the coupon from the existing water main shall be submitted to the City.
9. Prevent embedment, backfill, soil, water or other debris from entering the pipeline.
10. Establish thrust restraint as provided for in the Drawings.
11. Clean and disinfect the pipeline associated with the connection in accordance with Section 33 04 40.
12. Place embedment to the top of the pipe zone.
13. Request that the City Valve Crew re-pressurize the pipeline.
14. Directionally flush the connection in accordance with Section 33 04 40.
15. Request that City Valve Crew open all remaining valves.

**3.5 REPAIR/RESTORATION [NOT USED]**

**3.6 RE-INSTALLATION [NOT USED]**

**3.7 FIELD [OR] SITE QUALITY CONTROL [NOT USED]**

**3.8 SYSTEM STARTUP [NOT USED]**

**3.9 ADJUSTING [NOT USED]**

**3.10 CLEANING [NOT USED]**

**3.11 CLOSEOUT ACTIVITIES [NOT USED]**

**3.12 PROTECTION [NOT USED]**

**3.13 MAINTENANCE [NOT USED]**

**3.14 ATTACHMENTS [NOT USED]**

**END OF SECTION**

**PART 1 - GENERAL****1.1 SUMMARY**

- A. Section Includes:
  - 1. Dry-barrel fire hydrants with 5<sup>1</sup>/<sub>4</sub>-inch main valve for use with potable water mains
- B. Deviations from this Standard Specification
  - 1. None.
- C. Related Specification Sections include, but are not necessarily limited to:
  - 1. Division 0 – Bidding Requirements, Contract Forms and Conditions of the Contract
  - 2. Division 1 – General Requirements
  - 3. Section 33 05 10 – Utility Trench Excavation, Embedment and Backfill
  - 4. Section 33 04 40 – Cleaning and Acceptance Testing of Water Mains
  - 5. Section 33 11 10 – Ductile Iron Pipe
  - 6. Section 33 11 11 – Ductile Iron Fittings
  - 7. Section 33 11 14 – Buried Steel Pipe and Fittings
  - 8. Section 33 12 20 – Resilient Seated (Wedge) Gate Valve

**1.2 PRICE AND PAYMENT PROCEDURES**

- A. Measurement and Payment
  - 1. Measurement
    - a. Fire Hydrant and Extension
      - 1) Measurement for this item shall be by the each hydrant, complete in place.
  - 2. Payment
    - a. The work performed and materials furnished in accordance with this Item and measured under “Measurement” will be paid for at the unit prices bid per each “Fire Hydrant” installed.
  - 3. The price bid shall include:
    - a. Furnishing and installing Fire Hydrants with appurtenances as specified in the Drawings
    - b. Dry-Barrel Fire Hydrant assembly from base to operating nut
    - c. Extension barrel and stem
    - d. Adjusting hydrant to the appropriate height
    - e. Painting
    - f. Pavement Removal
    - g. Excavation
    - h. Freight, loading, unloading and handling
    - i. Disposal of excess material
    - j. Furnish, placement and compaction of embedment
    - k. Furnish, placement and compaction of backfill
    - l. Blocking, Braces and Rest
    - m. Clean up
    - n. Disinfection
    - o. Testing

### **1.3 REFERENCES**

#### **A. Definitions**

1. Base: The lateral connection to the fire hydrant lead; also called a shoe

#### **B. Reference Standards**

1. Reference standards cited in this Specification refer to the current reference standard published at the time of the latest revision date logged at the end of this Specification, unless a date is specifically cited.
2. American Water Works Association (AWWA):
  - a. C502, Dry-Barrel Fire Hydrants
  - b. Manual of Water Supply Practices M17 (AWWA Manual M17) – Installation, Field Testing, and Maintenance of Fire Hydrants
3. NSF International
  - a. 61, Drinking Water System Components – Health Effects
4. National Fire Protection Association (NFPA)
  - a. 1963, Standard for Fire Hose Connections
5. Underwriters Laboratories, Inc. (UL)
  - a. 246, Hydrants for Fire-Protection Service
6. Factory Mutual (FM)
  - a. Class Number 1510, Approval Standard for Fire Hydrant (Dry Barrel Type) for Private Fire Service

### **1.4 ADMINISTRATIVE REQUIREMENTS [NOT USED]**

### **1.5 SUBMITTALS**

- A. Submittals shall be in accordance with Section 01 33 00.
- B. All submittals shall be approved by the City prior to construction.

### **1.6 ACTION SUBMITTALS/INFORMATIONAL SUBMITTALS**

#### **A. Product Data**

1. Dry-Barrel Fire Hydrant stating:
  - a. Main valve opening size
  - b. Nozzle arrangement and sizes
  - c. Operating nut size
  - d. Operating nut operating direction
  - e. Working pressure rating
  - f. Component assembly and materials
  - g. Coatings and Finishes

### **1.7 CLOSEOUT SUBMITTALS [NOT USED]**

### **1.8 MAINTENANCE MATERIAL SUBMITTALS [NOT USED]**

### **1.9 QUALITY ASSURANCE**

#### **A. Qualifications**

1. Manufacturers
  - a. Dry-Barrel Fire Hydrants shall be the product of 1 manufacturer.
    - 1) Change orders, specials and field changes may be provided by a different manufacturer upon City approval.
2. Dry-Barrel Fire Hydrants shall be in conformance with AWWA C502, UL 246 and FM 1510.

### **1.10 DELIVERY, STORAGE, AND HANDLING**

#### **A. Storage and Handling Requirements**

1. Store and handle in accordance with the guidelines as stated in AWWA C502 and AWWA Manual M17.
2. Protect all parts so that no damage or deterioration will occur during a prolonged delay from the time of shipment until installation is completed and the units and equipment are ready for operation.
3. Protect all equipment and parts against any damage during a prolonged period at the site.
4. Protect the finished surfaces of all exposed flanges by wooden blank flanges, strongly built and securely bolted thereto.
5. Protect finished iron or steel surfaces not painted to prevent rust and corrosion.
6. Prevent plastic and similar brittle items from being directly exposed to sunlight or extremes in temperature.
7. Secure and maintain a location to store the material in accordance with **Section 01 66 00**.

### 1.11 FIELD CONDITIONS [NOT USED]

### 1.12 WARRANTY

#### A. Manufacturer Warranty

1. Manufacturer's Warranty shall be in accordance with Division 1.

## PART 2 - PRODUCTS

### 2.1 OWNER-FURNISHED [OR] OWNER-SUPPLIED PRODUCTS [NOT USED]

### 2.2 EQUIPMENT, PRODUCT TYPES, AND MATERIALS

#### A. Manufacturers

1. Only the manufacturers as listed on the City's Standard Products List will be considered as shown in **Section 01 60 00**.
  - a. The manufacturer must comply with this Specification and related Sections.
2. Any product that is not listed on the Standard Products List is considered a substitution and shall be submitted in accordance with **Section 01 25 00**.
3. The Dry-Barrel Fire Hydrant shall be new and the product of a manufacturer regularly engaged in the manufacturing of Dry-Barrel Fire Hydrants having similar service and size.

#### B. Description

1. Regulatory Requirements
  - a. Dry-Barrel Fire Hydrant shall meet or exceed the latest revisions of AWWA C502 and shall meet or exceed the requirements of this Specification.
  - b. All Dry-Barrel Fire Hydrant components in contact with potable water shall conform to the requirements of NSF 61.

#### C. Performance / Design Criteria

1. Capacities
  - a. Rated working pressure of 250 psi or greater
2. Design Criteria
  - a. Operating nut
    - 1) Uniformly tapered square nut measuring:
      - a) 1 inch at the base
      - b)  $\frac{7}{8}$  inch at the top
    - 2) Open by turning the operating nut to the right (**clockwise**)
      - a) Provide operating direction clearly marked with an arrow and the word "OPEN".

- 3) Provide weather shield with operating nut.
  - b. Main Valve
    - 1) Minimum 5<sup>1</sup>/<sub>4</sub>-inch opening
    - 2) Compression type
      - a) Opening against pressure
      - b) Closing with pressure
  - c. Nozzles
    - 1) 'T' shape, 3 nozzle arrangement
    - 2) Nozzle sizes, threads and configuration in accordance with NFPA 1963
      - a) Hose nozzles
        - (1) 2 x 2<sup>1</sup>/<sub>2</sub>-inch (nominal size of connection)
          - (a) 180 degrees apart
          - (b) Thread Designation 2.5-7.5 NH (NFPA 1963)
      - b) Pump nozzle
        - (1) 4-inch (nominal size of connection)
          - (a) Thread Designation 4-4 NH (NFPA 1963)
  - d. Hydrant Barrel Configuration
    - 1) Upper barrel
    - 2) Breakable flange and stem
      - a) To be installed above ground at the connection to the upper barrel
    - 3) Extension barrel (if needed) and lower barrel
      - a) Extension barrel and stem
        - (1) Lengthen in 6-inch increments
  - e. Drain Valve
    - 1) Non-corrodible material
    - 2) Spring operated drain valves are not allowed.
- D. Function
- 1. Drain Valve
    - a. Drain fire hydrant barrels when main valve is closed.
- E. Materials
- 1. Furnish materials in accordance with AWWA C502.
  - 2. Dry-Barrel Fire Hydrant Assembly
    - a. Internal parts
      - 1) Threads
        - a) Provide operating thread designed to avoid metal such as iron or steel threads against iron or steel parts.
      - 2) Stem
        - a) Stem Nuts
          - (1) Provide bronze stem nuts.
            - (a) Grades per AWWA C502
          - b) Where needed, stem shall be grooved and sealed with O-rings.
  - 3. Provide crushed rock for placement around base conforming to **Section 33 05 10**.
- F. Finishes
- 1. Primer Materials
    - a. Furnish primer for Dry-Barrel Fire Hydrants in accordance with AWWA C502.
  - 2. Finish Materials
    - a. Dry-Barrel Fire Hydrant
      - 1) Exterior
        - a) Above grade
          - (1) Furnish exterior coating for above grade Dry-Barrel Fire Hydrant assembly components in accordance with AWWA C502.
          - (2) Coating shall be Flynt Aluminum Paint in Silver.
        - b) Below grade



- (1) Furnish exterior coating for below grade Dry-Barrel Fire Hydrant assembly components in accordance with AWWA C502.
- 2) Interior
  - a) Interior coating for Dry-Barrel Fire Hydrants assemblies in accordance with AWWA C502

## **2.3 ACCESSORIES**

- A. Polyethylene Encasement
  1. Provide polyethylene encasement in accordance with Section 33 11 10.
- B. Embedment
  1. Provide crushed rock and filter fabric in accordance with Section 33 05 10.

## **2.4 SOURCE QUALITY CONTROL**

- A. Tests and Inspections
  1. Testing and inspection of Dry-Barrel Fire Hydrants in accordance with AWWA C502.
- B. Markings
  1. Provide each Dry-Barrel Fire Hydrant marked in accordance with AWWA C502.

## **PART 3 - EXECUTION [NOT USED]**

### **3.1 INSTALLERS [NOT USED]**

### **3.2 EXAMINATION [NOT USED]**

### **3.3 PREPARATION [NOT USED]**

### **3.4 INSTALLATION**

- A. General
  1. Install in accordance with AWWA Manual of Water Supply Practice M17, manufacturer's recommendations and as shown on the Drawings.
  2. Provide vertical installation with braces, rest and blocking in accordance with City Standard Details.
  3. Excavate and backfill trenches in accordance with 33 05 10.
  4. Embed Dry-Barrel Fire Hydrant assemblies in accordance with 33 05 10.
    - a. At the location of the weep holes, wrap barrel with polyethylene encasement and crushed rock with filter fabric to prevent dirt and debris from entering the fire hydrant.
  5. Polyethylene encasement installation shall be in accordance with the applicable portion of Section 33 11 10.
  6. Install concrete blocking and rest in accordance with Section 03 30 00 as indicated in the Drawings.
  7. A minimum 1/3 cubic yard of crushed rock shall be placed around the base, in accordance with AWWA Manual of Water Supply Practice M17, to allow drain outlets to operate.
    - a. The crushed rock should extend 6 inches above the drain outlets and a minimum of 1 foot on all sides of the fire hydrant base.
  8. Fire hydrant lead line shall be installed with a maximum cover of 7 feet.
    - a. Cover is measured from the invert at the fire hydrant base, vertical to ground elevation.
    - b. Fittings may be used along fire lead line to ensure minimum and maximum cover requirements are met.

**3.5 REPAIR / RESTORATION [NOT USED]**

**3.6 RE-INSTALLATION [NOT USED]**

**3.7 FIELD CONTROL**

A. Field Inspections

1. The Dry-Barrel Fire Hydrant and assembly shall perform as intended with no deformation, leaking or damage of any kind for the pressure ranges indicated.
2. City inspector will issue final inspection notice to City staff.
3. City Field Operations Staff and Fire Department Staff shall have the opportunity to inspect and operate the hydrant, to ensure that the fire hydrant was installed in accordance with AWWA Manual of Water Supply Practice M17. This includes but is not limited to:
  - a. Operation of Nozzles and operating nut are not obstructed.
  - b. Drain valve is not obstructed or plugged
4. Keep fire hydrant wrapped or covered to identify that it is out of service until the water line it's connected to is put in service.

B. Non-Conforming Work

1. If access and operation of the Dry-Barrel Fire Hydrant or its appurtenances do not meet the criteria of the AWWA Manual of Water Supply Practice M17, the Contractor will remedy the situation criteria, at the Contractor's expense.

**3.8 SYSTEM STARTUP [NOT USED]**

**3.9 ADJUSTING [NOT USED]**

**3.10 CLEANING [NOT USED]**

**3.11 CLOSEOUT ACTIVITIES [NOT USED]**

**3.12 PROTECTION [NOT USED]**

**3.13 MAINTENANCE**

**3.14 ATTACHMENTS**

**END OF SECTION**

**PART 1 - GENERAL****1.1 SUMMARY**

- A. Section Includes:
  - 1. Polyvinyl Chloride (PVC) pipe 4-inch through 27-inch for gravity sanitary sewer applications
- B. Deviations from this Standard Specification
  - 1. None.
- C. Related Specification Sections include, but are not necessarily limited to:
  - 1. Division 0 – Bidding Requirements, Contract Forms, and Conditions of the Contract
  - 2. Division 1 – General Requirements
  - 3. Section 33 01 30 – Sewer and Manhole Testing
  - 4. Section 33 01 31 – Closed Circuit Television (CCTV) Inspection
  - 5. Section 33 05 10 – Utility Trench Excavation, Embedment and Backfill
  - 6. Section 33 05 26 – Utility Markers/Locators
  - 7. Section 33 31 50 – Sanitary Sewer Service Connections and Service Line

**1.2 PRICE AND PAYMENT PROCEDURES**

- A. Measurement and Payment
  - 1. Measurement
    - a. Measured horizontally along the surface from center line to center line of the manhole or appurtenance
  - 2. Payment
    - a. The work performed and materials furnished in accordance with this Item and measured as provided under “Measurement” will be paid for at the unit price bid per linear foot of “PVC Pipe” installed for:
      - 1) Various sizes
      - 2) Various Standard Dimension Ratios
      - 3) Various embedments
      - 4) Various depths, for miscellaneous projects only
  - 3. The price bid shall include:
    - a. Furnishing and installing PVC gravity pipe with joints as specified by the Drawings
    - b. Pavement removal
    - c. Excavation
    - d. Hauling
    - e. Disposal of excess material
    - f. Furnishing, placement and compaction of embedment
    - g. Furnishing, placement and compaction of backfill
    - h. Trench water stops
    - i. Clean-up
    - j. Cleaning
    - k. Testing

### 1.3 REFERENCES

#### A. Reference Standards

1. Reference standards cited in this Specification refer to the current reference standard published at the time of the latest revision date logged at the end of this Specification, unless a date is specifically cited.
2. American Association of State Highway and Transportation (AASHTO).
3. ASTM International (ASTM):
  - a. D1784, Standard Specification for Rigid Poly(Vinyl Chloride) (PVC) Compounds and Chlorinated Poly(Vinyl Chloride) (CPVC) Compounds.
  - b. D2412, Standard Test Method for Determination of External Loading Characteristics of Plastic Pipe by Parallel-Plate Loading.
  - c. D3034, Standard Specification for Type PSM Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings.
  - d. D3212, Standard Specification for Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals.
  - e. F679, Standard Specification for Poly (Vinyl Chloride) (PVC) Large-Diameter Plastic Gravity Sewer Pipe and Fittings.
4. Texas Commission on Environmental Quality (TCEQ):
  - a. Title 30, Part I, Chapter 217, Subchapter C, Rule 217.53 – Pipe Design.
  - b. Title 30, Part I, Chapter 217, Subchapter C, Rule 217.54 – Criteria for Laying Pipe.
  - c. Title 30, Part I, Chapter 217, Subchapter C, Rule 217.57 – Testing Requirements for Installation of Gravity Collection System Pipes.
5. Underwriters Laboratories, Inc. (UL).

### 1.4 ADMINISTRATIVE REQUIREMENTS [NOT USED]

### 1.5 SUBMITTALS

- A. Submittals shall be in accordance with Section 01 33 00.
- B. All submittals shall be approved by the City prior to delivery.

### 1.6 ACTION SUBMITTALS/INFORMATIONAL SUBMITTALS

#### A. Product Data

1. Product data sheet
2. Manufacturer
3. Nominal pipe diameter
4. Standard dimension ratio (SDR)
5. Cell classification
6. Laying lengths

#### B. Certificates

1. Furnish an affidavit certifying that all PVC Gravity Pipe meets the provisions of this Section and has been air and deflection tested and meets the requirements of ASTM D3034 and ASTM F679.

### 1.7 CLOSEOUT SUBMITTALS [NOT USED]

### 1.8 MAINTENANCE MATERIAL SUBMITTALS [NOT USED]

## **1.9 QUALITY ASSURANCE**

### **A. Qualifications**

#### **1. Manufacturers**

- a. Finished pipe shall be the product of 1 manufacturer for each size per project, unless otherwise approved by the City.
  - 1) Change orders, specials and field changes may be provided by a different manufacturer upon City approval.
- b. Pipe manufacturing operations shall be performed under the control of the manufacturer.
- c. All pipe furnished shall be in conformance with ASTM D3034 (4-inch through 15-inch) and ASTM F679 (18-inch through 27-inch).

## **1.10 DELIVERY, STORAGE, AND HANDLING**

### **A. Storage and Handling Requirements**

1. Gravity pipe shall be stored and handled in accordance with the manufacturer's guidelines.
2. Secure and maintain a location to store the material in accordance with Section 01 66 00.

## **1.11 FIELD [SITE] CONDITIONS [NOT USED]**

## **1.12 WARRANTY [NOT USED]**

## **PART 2 - PRODUCTS**

## **2.1 OWNER-FURNISHED [OR] OWNER-SUPPLIED PRODUCTS [NOT USED]**

## **2.2 EQUIPMENT, PRODUCT TYPES AND MATERIALS**

### **A. Manufacturers**

1. Only the manufacturers as listed in the City's Standard Products List will be considered as shown in Section 01 60 00.
  - a. The manufacturer must comply with this Specification and related Sections.
2. Any product that is not listed on the Standard Products List is considered a substitution and shall be submitted in accordance with Section 01 25 00.

### **B. Performance / Design Criteria**

#### **1. Pipe**

- a. Meet all requirements of TCEQ.
- b. Design in accordance with ASTM D3034 for 4-inch through 15-inch SDR 26 and ASTM F679 for 18-inch through 27-inch 46PS/115PS.
- c. PVC Gravity Sanitary Sewer Pipe shall be approved by the UL.
- d. Assume a standard lay length of 14 feet and 20 feet except for special fittings or closure pieces necessary to comply with the Drawings.
- e. Use green coloring for ground identification as sanitary sewer pipe.
- f. PVC meeting the requirements of ASTM D1784, with a cell classification of 12454 or 12364
- g. Deflection Design
  - 1) Base pipe design on pipe stiffness, soil stiffness and load on the pipe.
  - 2) Design pipe according to the Modified Iowa Formula as detailed by the Uni-Bell PVC Pipe Association in the Handbook of PVC Pipe, using the following parameters:
    - a) Unit Weight of Fill (w) = 130 pounds per cubic foot
    - b) Live Load = AASHTO HS 20

- c) Trench Depth = 12 feet minimum, or as indicated in Drawings
  - d) Maximum (E') = 1,000 max
  - e) Deflection Lag Factor (DL) = 1.0
  - f) Bedding Factor constant (K) = 0.1
  - g) Mean radius of the pipe (r), inches, as indicated in Drawings
  - h) Marston's load per unit length (W), pounds per inch, calculate per Drawings
  - i) PVC modulus of elasticity (E) = 400,000 psi
  - j) Moment of inertia of pipe wall per unit length, (I) =  $t^3/12$ , (in<sup>4</sup>/in), per pipe type and size
    - (1) Where (t) = pipe thickness, inches
  - k) Maximum Calculated Deflection = 5 percent
- h. Pipe Flotation: If the pipe is buried in common saturated soil (about 120 pounds per cubic foot) with at least 1½ pipe diameters of cover, pipe is generally not subject to flotation. If shallower, check groundwater flotation potential. Flotation will occur if:

$$F_b > W_p + W_f + W_d$$

Where:

- $F_b$  = buoyant force, pound per foot
- $W_p$  = empty pipe weight, pound per foot
- $W_f$  = weight of flooded soil, pound per foot
- $W_d$  = weight of dry soil, pound per foot

Values and formulas for the above variables can be obtained from the pipe manufacturer and site specific soil conditions.

- i. Verify trench depths after existing utilities are located.
  - j. Accommodate vertical alignment changes required because of existing utility or other conflicts by an appropriate change in pipe design depth.
  - k. In no case shall pipe be installed deeper than its design allows.
2. Minimum pipe stiffness of 46 psi at 5 percent deflection when test in accordance with ASTM D2412.
  3. Pipe markings
    - a. Meet the minimum requirements of ASTM D3034 and ASTM F679.
    - b. Minimum pipe markings shall be as follows:
      - 1) Manufacturer's Name or Trademark and production record
      - 2) Nominal pipe size
      - 3) PVC cell classification
      - 4) ASTM or Standard Dimension Ratio (SDR) designation
      - 5) Seal of testing agency that verified the suitability of the pipe
  4. Joints
    - a. Joints shall be gasket, bell and spigot, push-on type conforming to ASTM D3212.
    - b. Since each pipe manufacturer has a different design for push-on joints; gaskets shall be part of a complete pipe section and purchased as such.
  5. Connections
    - a. Only use manufactured fittings.
    - b. See Section 33 31 50.
  6. Detectable Metallic Tape
    - a. See Section 33 05 26.

## **2.3 ACCESSORIES [NOT USED]**

## **2.4 SOURCE QUALITY CONTROL [NOT USED]**

# **PART 3 - EXECUTION**

## **3.1 INSTALLERS [NOT USED]**

## **3.2 EXAMINATION [NOT USED]**

## **3.3 PREPARATION [NOT USED]**

## **3.4 INSTALLATION**

### **A. General**

1. Install pipe, specials and appurtenances as specified herein, as specified in Section 33 05 10, and in accordance with the pipe manufacturer's recommendations.
2. Lay pipe to the lines and grades as indicated in the Drawings.
3. Excavate and backfill trenches in accordance with Section 33 05 10.
4. Embed PVC pipe in accordance with Section 33 05 10.

### **B. Pipe Handling**

1. Haul and distribute pipe and fittings at the project site.
2. Handle piping with care to avoid damage.
  - a. Inspect each joint of pipe and reject or repair any damaged pipe prior to lowering into the trench.
  - b. Use only nylon ropes, slings or other lifting devices that will not damage the surface of the pipe for handling the pipe.
3. At the close of each operating day:
  - a. Keep the pipe clean and free of debris, dirt, animals and trash – during and after the laying operation.
  - b. Effectively seal the open end of the pipe using a gasketed night cap.

### **C. Pipe Joint Installation**

- a. Clean dirt and foreign material from the gasketed socket and the spigot end.
- b. Assemble pipe joint by sliding the lubricated spigot end into the gasketed bell end to the reference mark.
- c. Install such that identification marking on each joint are oriented upward toward the trench opening.
- d. When making connection to manhole, use an elastomeric seal or flexible boot to facilitate a seal.

### **D. Connection Installation**

1. See Section 33 31 50.

### **E. Detectable Metallic Tape Installation**

1. See Section 33 05 26.

## **3.5 REPAIR / RESTORATION [NOT USED]**

## **3.6 RE-INSTALLATION [NOT USED]**

## **3.7 FIELD [OR] SITE QUALITY CONTROL**

### **A. Field Tests and Inspections**

1. Video Inspection
  - a. Provide a Post-CCTV inspection in accordance with Section 33 01 31.

2. Air Test and Deflection (Mandrel) Test
  - a. Perform in accordance with Section 33 01 30.

**3.8 SYSTEM STARTUP [NOT USED]**

**3.9 ADJUSTING [NOT USED]**

**3.10 CLEANING [NOT USED]**

**3.11 CLOSEOUT ACTIVITIES [NOT USED]**

**3.12 PROTECTION [NOT USED]**

**3.13 MAINTENANCE [NOT USED]**

**3.14 ATTACHMENTS [NOT USED]**

**END OF SECTION**



**PART 1 - GENERAL****1.1 SCOPE OF WORK**

- A. This section specifies fusible polyvinyl chloride (PVC) pipe, including standards for dimensionality, testing, quality, acceptable fusion practice, safe handling, and storage.

**1.2 PIPE DESCRIPTION**

- B. Pipe supplier shall furnish fusible PVC pipe as manufactured by Underground Solutions, Inc. or approved equal conforming to all standards and procedures and meeting all testing and material properties as described in this specification.

**PART 2 - QUALITY ASSURANCE****2.1 REFERENCES**

- A. Unless otherwise stated, the latest editions of the following documents are applicable for this specification:
1. American Water Works Association (AWWA):
    - a. C110/A21.10, American National Standard for Ductile-Iron and Gray-Iron Fittings, 3-inch through 48-inch, for Water and Other Liquids
    - b. C111/A21.11, American National Standard for Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings
    - c. C605, Standard for Underground Installation of Polyvinyl Chloride (PVC) Pressure Pipe and Fittings for Water
    - d. C651, Standard for Disinfecting Water Mains
    - e. C900, Standard for Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 4 in. through 12 in. (100mm Through 300mm), for Water Distribution
    - f. C905, Standard for Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 14 in. through 48 in. (350mm Through 1200mm), for Water Distribution and Transmission
    - g. M23, AWWA Manual of Supply Practices PVC Pipe- Design and Installation, Second Edition
  2. American Society for Testing and Materials (ASTM)
    - a. C923, Standard Specification for Resilient Connectors Between Reinforced Concrete Manhole Structures, Pipes and Laterals
    - b. D1784, Rigid Polyvinyl Chloride (PVC) Compounds and Chlorinated Polyvinyl Chloride (CPVC) Compounds
    - c. D1785, Polyvinyl Chloride (PVC) Plastic Pipe, Schedules 40, 80, and 120
    - d. D2152, Test Method for Degree of Fusion of Extruded Poly vinyl Chloride (PVC) Pipe and Molded Fittings by Acetone Immersion
    - e. D2241, Polyvinyl Chloride (PVC) Plastic Pipe (SDR-PR)
    - f. D2665, Polyvinyl Chloride (PVC) Plastic Drain, Waste, and Vent Pipe and Fittings
    - g. D3034, Standard Specification for Type PSM Polyvinyl Chloride (PVC) Sewer Pipe and Fittings
    - h. F477, Elastomeric Seals (Gaskets) for Joining Plastic Pipe
    - i. F679, Standard Specification for Polyvinyl Chloride (PVC) Large Diameter Plastic Gravity Sewer Pipe and Fittings
    - j. F1057, Standard Practice for Estimating the Quality of Extruded Polyvinyl

- Chloride (PVC) Pipe by the Heat Reversion Technique
- k. F1417, Standard Test Method for Installation Acceptance of Plastic Gravity Sewer Lines Using Low-Pressure Air
- 3. UNI
  - a. B-6, Recommended Practice for Low-Pressure Air Testing of Installed Sewer Pipe
  - b. PUB-08, Tapping Guide for PVC Pressure Pipe
- 4. NSF
  - a. 14, Plastics Piping System Components and Related Materials
  - b. 61, Drinking Water System Components--Health Effects
- 5. PPI
  - c. TR-2PVC, Range Composition Listing of Qualified Ingredients

## **2.2 MANUFACTURER REQUIREMENTS**

- A. All piping shall be made from PVC compound conforming to cell classification 12454 per ASTM D1784.
- B. Fusible PVC pipe shall be tested at the extrusion facility for properties required to meet all applicable parameters as outlined in AWWA C900, AWWA C905, and applicable sections of ASTM D2241. Testing priority shall be in conformance with AWWA C900 and AWWA C905.

## **2.3 FUSION TECHNICIAN REQUIREMENTS**

- A. Fusion Technician shall be fully qualified by the pipe manufacturer to install fusible PVC pipe of the type(s) and size(s) being used. Qualification shall be current as of the actual date of fusion performance on the project.

## **2.4 WARRANTY**

- A. A one-year warranty for the pipe shall be included from the Contractor and shall cover the cost of replacement pipe and freight to project site, should the pipe have any defects in material or workmanship.
- B. In addition to the standard pipe warranty, the fusing contractor shall provide in writing a warranty for a period of one year for all the fusion joints, including formation, installation, and pressure testing.
- C. Unless otherwise specified, the warranty periods shall begin after the Certificate of Acceptance is issued for the contract.

## **2.5 PRE-CONSTRUCTION SUBMITTALS**

- A. product data required from the pipe supplier and/or fusion provider
  - 1. Name of pipe manufacturer
  - 2. Pipe diameter
  - 3. Dimension Ratio (DR 14 or as per plans)
  - 4. Pressure Class per applicable standards
  - 5. Color
  - 6. Confirmation/ Recommended minimum bending radius
  - 7. Confirmation/ Recommended maximum safe pull force
  - 8. Fusion technician qualification indicating conformance with this specification

## **2.6 POST-CONSTRUCTION SUBMITTALS**

- A. The following as-recorded data is required from the contractor and/or fusion provider to the owner or pipe supplier upon request

1. Approved data logger device reports
2. Fusion joint documentation containing the following information:
3. Pipe diameter and thickness
4. Machine diameter
5. Fusion technician identification
6. Job identification
7. Fusion joint number
8. Fusion, heating, and drag pressure settings
9. Heat plate temperature
10. Time stamp
11. Heating and cool down time of fusion
12. Ambient temperature

### **PART 3 - PRODUCTS**

#### **3.1 FUSIBLE PVC PRESSURE PIPE FOR POTABLE WATER**

- A. Fusible PVC pipe shall conform to AWWA C900, AWWA C905, ASTM D2241 or ASTM D1785 for standard dimensions, as applicable. Testing shall be in accordance with the referenced AWWA standards for all pipe types.
- B. Pipe shall be manufactured with 100% virgin resin. Pipe shall also have 0% recycled plastics content, and shall not consist of any rework compound, even that obtained from the manufacturer's own production using the same formulation.
- C. Fusible PVC pipe shall be extruded with plain ends. The ends shall be square to the pipe and free of any bevel or chamfer. There shall be no bell or gasket of any kind incorporated into the pipe.
- D. Fusible PVC pipe shall be manufactured in a standard 40' nominal length, or custom lengths as specified in the plans.
- E. Fusible PVC pipe shall be blue in color for potable water use.
- F. Pipe shall be marked as follows:
  1. Nominal pipe size
  2. PVC
  3. Dimension Ratio (DR), Standard Dimension Ratio (SDR), or Schedule
  4. AWWA pressure class, or standard pressure rating for non-AWWA pipe, as applicable
  5. AWWA standard designation number, or pipe type for non-AWWA pipe, as applicable
  6. NSF-61 mark verifying suitability for potable water service
  7. Extrusion production-record code
  8. Trademark or trade name
  9. Cell Classification 12454 and/or PVC material code 1120 may also be included
  10. Pipe shall be homogeneous throughout and be free of visible cracks, holes, foreign material, blisters, or other visible deleterious faults.

### **3.2 FUSIBLE PVC PRESSURE PIPE FOR WASTEWATER NOT CONFORMING TO AWWA C905 DIMENSIONALITY**

- A. Fusible PVC pipe shall conform to AWWA C900, ASTM D2241 or ASTM D1785 for standard dimensionality, as applicable. Testing shall be in accordance with the referenced AWWA standard.
- B. Fusible PVC pipe shall be extruded with plain ends. The ends shall be square to the pipe and free of any bevel or chamfer. There shall be no bell or spigot of any kind incorporated into the pipe.
- C. Fusible PVC pipe shall be manufactured in a standard 40' nominal length, or custom lengths as specified.
- D. Fusible PVC pipe shall be green in color for wastewater use.
- E. Pipe shall be marked as follows:
  - 1. Nominal pipe size
  - 2. PVC
  - 3. Dimension Ratio (DR), Standard Dimension Ratio (SDR), or Schedule
  - 4. AWWA pressure class, or standard pressure rating for non-AWWA pipe, as applicable
  - 5. AWWA standard designation number, or pipe type for non-AWWA pipe, as applicable
  - 6. Extrusion production-record code
  - 7. Trademark or trade name
  - 8. Cell Classification 12454 and/or PVC material code 1120 may also be included
  - 9. Pipe shall be homogeneous throughout and be free of visible cracks, holes, foreign material, blisters, or other visible deleterious faults.

### **3.3 FUSIBLE PVC PRESSURE PIPE FOR WASTEWATER CONFORMING TO AWWA C905 DIMENSIONALITY**

- A. Fusible PVC pipe shall conform to AWWA C905 standard.
- B. Fusible PVC pipe shall be extruded with plain ends. The ends shall be square to the pipe and free of any bevel or chamfer. There shall be no bell or gasket of any kind incorporated into the pipe.
- C. Fusible PVC pipe shall be manufactured in a standard 40' nominal length, or custom lengths as specified.
- D. Fusible PVC pipe shall be green in color for wastewater use.
- E. Pipe shall be marked as follows:
  - 1. Nominal pipe size
  - 2. PVC
  - 3. Dimension Ratio (DR), Standard Dimension Ratio (SDR), or Schedule
  - 4. AWWA pressure class
  - 5. AWWA standard designation number
  - 6. Extrusion production-record code
  - 7. Trademark or trade name
  - 8. Cell Classification 12454 and/or PVC material code 1120 may also be included
  - 9. Pipe shall be homogeneous throughout and be free of visible cracks, holes, foreign material, blisters, or other visible deleterious faults.

### **3.4 FUSION JOINTS**

- A. Unless otherwise specified, fusible PVC pipe lengths shall be assembled in the field with butt-fused joints. The Contractor shall follow the pipe supplier's written guidelines for this procedure. All fusion joints shall be completed as described in this specification.

### **3.5 CONNECTION AND FITTINGS FOR PRESSURE APPLICATIONS**

- A. Connection
  - 1. Connections shall be defined in conjunction with the coupling of project piping, as well as the tie-ins to other piping systems.
- B. Ductile Iron Mechanical and Flanged Fittings
  - 2. Acceptable fittings for use with fusible PVC pipe shall include standard ductile iron fittings conforming to AWWA/ANSI C110/A21.10, or AWWA/ANSI C153/A21.53 and AWWA/ANSI C111/A21.11.
    - a. Connections to fusible PVC pipe may be made using a restrained or non-restrained retainer gland product for PVC pipe, as well as for MJ or flanged fittings.
    - b. Bends, tees, and other ductile iron fittings shall be restrained with the use of thrust blocking or other means as indicated in the construction documents.
    - c. Ductile iron fittings and glands must be installed per the manufacturer's guidelines.
- C. Sleeve-Type Couplings
  - 1. Sleeve-type mechanical couplings shall be manufactured for use with PVC pressure pipe and may be restrained or unrestrained as necessary.
  - 2. Sleeve-type couplings shall be rated at the same or greater pressure carrying capacity as the pipe itself.
- D. Expansion and Flexible Couplings
  - 1. Expansion-type mechanical couplings shall be manufactured for use with PVC pipe and may be restrained or unrestrained as necessary.
  - 2. Expansion-type mechanical couplings shall be rated at the same or greater pressure carrying capacity as the pipe itself.
- E. Connection Hardware
  - 1. Bolts and nuts for buried service shall be made of non-corrosive, high-strength, low-alloy steel having the characteristics specified in ANSI/AWWAC111/A21.11, regardless of any other protective coating.

### **3.6 CONNECTIONS FOR GRAVITY SANITARY SEWER AND NON-PRESSURE APPLICATIONS**

- A. The following connections are to be used in conjunction with tie-ins to other non-pressure, gravity sewer piping and/or structures, and shall be as indicated in the construction documents.
  - 1. PVC Gasketed, Push-On Couplings
    - a. Acceptable couplings for joining fusible PVC pipe to other sections of fusible PVC pipe or other sections of PVC pipe shall include gasketed PVC, push-on type couplings as necessary.
    - b. PVC gasketed, push-on fittings and/or restraint hardware must be installed per the manufacturer's guidelines.
  - 2. Sleeve-Type Couplings
    - a. Sleeve-type mechanical couplings shall be manufactured for use with PVC

- pipe and may be restrained or unrestrained as necessary.
3. Expansion and Flexible Couplings
    - a. Expansion-type mechanical couplings shall be manufactured for use with PVC pipe and may be restrained or unrestrained as necessary.
  4. Connection Hardware
    - a. Bolts and nuts for buried service shall be made of non-corrosive, high-strength, low-alloy steel having the characteristics specified in ANSI/AWWA C111/A21.11, regardless of any other protective coating.
  5. Connection to Sanitary Sewer Manholes and Structures
    - a. Fusible PVC pipe shall be connected to manholes and other structures to provide a leak-free, properly graded flow into or out of the manhole or structure.
    - b. Connections to existing manholes and structures shall be as indicated in the construction documents.
      - 1) For a cored or drilled opening provide a flexible, watertight connection that meets and/or exceeds ASTM C923.
      - 2) For a knock out opening, provide a watertight connection (waterstop or other method) meeting the material requirements of ASTM C923 that is securely attached to the pipe with stainless steel bands or other means.
      - 3) Grout opening in manhole wall with non-shrink grout. Pour concrete collar around pipe and outside manhole opening. Provide flexible pipe joint or flexible connector within 2 feet of the collar.
    - c. Connections to a new manhole or structure shall be as indicated in the construction documents.
      - 1) A flexible, watertight gasket per ASTM C 923 shall be cast integrally with riser section(s) for all precast manhole and structures.
      - 2) Drop connections shall be required where shown on drawings.
      - 3) Grout internal joint space with non-shrink grout.

### 3.7 MAXIMUM ALLOWABLE PULL-IN FORCE

- A. Adhere to the following data regarding maximum allowable pull-in force for fusible PVC pipe used for trenchless application. The confirmation of proposed radius of each bore has to be part of the required submittal prior to construction.

Pipe Diameter (in)	Dimension Ratio (DR)	Max. Working Pressure (psi)	DIPS Series			
			Pipe O.D. (in)	Min. Wall (in)	Pipe I.D. (in)	Max. Pull-in Force (lbs)
4	14	305	4.80	0.34	4.07	13,400
6	14	305	6.90	0.49	5.85	27,700
8	14	305	9.05	0.65	7.68	47,700
10	14	305	11.10	0.79	9.42	71,800
12	14	305	13.20	0.94	11.20	101,600

### 3.8 MINIMUM BENDING RADIUS

- A. Adhere to the following data regarding radius of curvature for fusible PVC pipe used for trenchless application. The confirmation of proposed radius of each bore has to be part of the required submittal prior to construction.

Pipe Diameter (in)	DIPS Series	
	Critical Bucking Pressure (lbs)	Minimum Allowable Bending (ft)
4	426	100
6	426	144
8	425	189
10	426	231
12	426	275

- B. In any case, the deflection radius must not exceed 75% of the maximum allowable curvature allowed for standard C-900 PVC pipe.

## **PART 4 - EXECUTION**

### **4.1 DELIVERY AND OFF-LOADING**

- A. All pipe shall be bundled or packaged in such a manner as to provide adequate protection of the ends during transportation to the site. Any pipe damaged in shipment shall be replaced as directed by the owner or engineer.
- B. Each pipe shipment should be inspected prior to unloading to see if the load has shifted or otherwise been damaged. Notify owner or engineer immediately if more than immaterial damage is found. Each pipe shipment should be checked for quantity and proper pipe size, color, and type.
- C. Pipe should be loaded, off-loaded, and otherwise handled in accordance with AWWA M23, and all of the pipe supplier's guidelines shall be followed.
- D. Off-loading devices such as chains, wire rope, chokers, or other pipe handling implements that may scratch, nick, cut, or gouge the pipe are strictly prohibited.
- E. During removal and handling, be sure that the pipe does not strike anything. Significant impact could cause damage, particularly during cold weather.
- F. If appropriate unloading equipment is not available, pipe may be unloaded by removing individual pieces. Care should be taken to insure that pipe is not dropped or damaged. Pipe should be carefully lowered, not dropped, from trucks.

### **4.2 HANDLING AND STORAGE**

- A. Any length of pipe showing a crack, or which has received a blow that may have caused an incident fracture, even though no such fracture can be seen, shall be marked as rejected and removed at once from the work. Damaged areas, or possible areas of damage may be removed by cutting out and removing the suspected incident fracture area. Limits of the acceptable length of pipe shall be determined by the owner or engineer.
- B. Any scratch or gouge greater than 10% of the wall thickness will be considered significant and can be rejected unless determined acceptable by the owner or engineer.
- C. Pipe lengths should be stored and placed on level ground. Pipe should be stored at the job site in the unit packaging provided by the manufacturer. Caution should be exercised to avoid compression, damage, or deformation to the ends of the pipe. The interior of the pipe, as well as all end surfaces, should be kept free from dirt and foreign matter.

- D. Pipe shall be handled and supported with the use of woven fiber pipe slings or approved equal. Care shall be exercised when handling the pipe to not cut, gouge, scratch or otherwise abrade the piping in any way.
- E. If pipe is to be stored for periods of 1 year or longer, the pipe should be shaded or otherwise shielded from direct sunlight. Covering of the pipe which allows for temperature build-up is strictly prohibited. Pipe should be covered with an opaque material while permitting adequate air circulation above and around the pipe as required to prevent excess heat accumulation.
- F. Pipe shall be stored and stacked per the pipe supplier's guidelines.

### 4.3 FUSION PROCESS

#### A. General

1. Fusible PVC pipe will be handled in a safe and non-destructive manner before, during, and after the fusion process and in accordance with this specification and pipe supplier's guidelines.
2. Fusible polyvinylchloride pipe will be fused by qualified fusion technicians, as documented by the pipe supplier.
3. Each fusion joint shall be recorded and logged by an electronic monitoring device (data logger) connected to the fusion machine.
4. Only appropriately sized and outfitted fusion machines that have been approved by the pipe supplier shall be used for the fusion process. Fusion machines must incorporate the following elements:
  - a. Heat Plate - Heat plates shall be in good condition with no deep gouges or scratches. Plates shall be clean and free of any debris or contamination. Heater controls shall function properly; cord and plug shall be in good condition. The appropriately sized heat plate shall be capable of maintaining a uniform and consistent heat profile and temperature for the size of pipe being fused, per the pipe supplier's guidelines.
  - b. Carriage – Carriage shall travel smoothly with no binding at less than 50 psi. Jaws shall be in good condition with proper inserts for the pipe size being fused. Insert pins shall be installed with no interference to carriage travel.
  - c. General Machine - Overview of machine body shall yield no obvious defects, missing parts, or potential safety issues during fusion.
  - d. Data Logging Device – An approved datalogging device with the current version of the pipe supplier's recommended and compatible software shall be used. Datalogging device operations and maintenance manual shall be with the unit at all times. If fusing for extended periods of time, an independent 110V power source shall be available to extend battery life.
5. Other equipment specifically required for the fusion process shall include the following:
  - a. Pipe rollers shall be used for support of pipe to either side of the machine
  - b. A weather protection canopy that allows full machine motion of the heatplate, fusion assembly and carriage shall be provided for fusion in inclement, extreme temperatures, and /or windy weather, per the pipe supplier's recommendations.
  - c. An infrared (IR) pyrometer for checking pipe and heat plate temperatures.
  - d. Fusion machine operations and maintenance manual shall be kept with the fusion machine at all times.
  - e. Facing blades specifically designed for cutting fusible polyvinylchloride pipe shall be used.

#### B. Joint Recording



1. Each fusion joint shall be recorded and logged by an electronic monitoring device (data logger) connected to the fusion machine. The fusion data logging and joint report shall be generated by software developed specifically for the butt-fusion of fusible polyvinyl chloride pipe. The software shall register and/or record the parameters required by the pipe supplier and these specifications. Data not logged by the data logger shall be logged manually and be included in the Fusion Technician's joint report.

#### **4.4 GENERAL INSTALLATION**

- A. Installation guidelines from the pipe supplier shall be followed for all installations.
- B. The fusible PVC pipe will be installed in a manner so as not to exceed the recommended bending radius.
- C. Where fusible PVC pipe is installed by pulling in tension, the recommended Safe Pulling Force established by the pipe supplier shall not be exceeded.

#### **4.5 PREPARATION PRIOR TO MAKING CONNECTIONS INTO EXISTING PIPING SYSTEMS**

- A. Approximate locations for existing piping systems are shown in the construction documents. Prior to making connections into existing piping systems, the contractor shall:
  1. Field verify location, size, piping material, and piping system of the existing pipe.
  2. Obtain all required fittings, which may include saddles, sleeve type couplings, flanges, tees, or others as shown in the construction documents.
  3. Have installed all temporary pumps and/or pipes in accordance with established connection plans.
  4. Unless otherwise approved, new piping systems shall be completely assembled and successfully tested prior to making connections into existing pipe systems.

#### **4.6 PIPE SYSTEM CONNECTIONS**

- A. Pipe connections shall be installed per applicable standards and regulations, as well as per the connection manufacturer's guidelines and as indicated in the construction documents. Pipe connections to structures shall be installed per applicable standards and regulations, as well as per the connection manufacturer's guidelines.

#### **4.7 TAPPING FOR POTABLE AND NON-POTABLE WATER APPLICATIONS**

- A. Tapping shall be performed using standard tapping saddles designed for use on PVC piping in accordance with AWWA C605. Tapping shall be performed only with use of tap saddles or sleeves. NO DIRECT TAPPING WILL BE PERMITTED. Tapping shall be performed in accordance with the applicable sections for saddle tapping as per "Uni-Pub-8: Tapping Guide for PVC Pressure Pipe by Uni-Bell PVC Pipe Association".
- B. All connections requiring a larger diameter than that recommended by the pipe supplier, shall be made with a pipe connection as specified and indicated on the drawings.
- C. Equipment used for tapping shall be made specifically for tapping PVC pipe:
  1. Tapping bits shall be slotted "shell" style cutters, specifically made for PVC pipe. 'Hole saws' made for cutting wood, steel, ductile iron, or other materials are strictly prohibited.
  2. Taps may be performed while the pipeline is filled with water and under pressure ('wet' tap,) or when the pipeline is not filled with water and not under pressure ('dry' tap).

#### **4.8 TESTING**

- A. Testing shall comply with all applicable jurisdictional building codes, statutes, standards, regulations, and laws.
  - 1. Hydrostatic Testing and Leakage Testing for Pressure Piping
    - a. All hydrostatic and leakage testing shall be in accordance to Sec 506.5 COD (Hydrostatic Test) as specified in City of Dallas Addendum to the North Central Texas Council of Governments (NCTCOG) Public Works Construction Standards, Latest Edition.
  - 2. Deflection Testing for Non-Pressure Piping
    - a. After completion of the backfill, the engineer or owner may require that a deflection test be performed.
    - b. Deflection tests should be conducted using a go/no-go mandrel. The mandrel's outside dimension shall be sized to permit no more than 7.5 percent deflection. The percent deflection shall be established from the base inside diameter of the pipe. If the internal beading of the fused joints for the pipe is not required to be removed, the mandrel shall account for this clearance as well. The mandrel shall be approved by the owner or engineer prior to use. Lines that permit safe entry may allow other deflection test options, such as direct measurements.

#### **PART 5 - METHOD OF MEASUREMENT AND PAYMENT**

Method of Measurement and Payment for the work included in this section will be in accordance with the payment schedule in the Bid Proposal.

**\*\*END OF SECTION\*\***

**PART 1 - GENERAL****1.1 SUMMARY**

## A. Section Includes:

1. Sanitary sewer service connection, service line and 2-way cleanout from the main to the right-of-way, as shown on the Drawings, directed by the Engineer and specified herein for:
  - a. New Service
  - b. New Service (Bored)
  - c. Private Service Relocation
  - d. Service Reinstatement

## B. Deviations from this Standard Specification

1. None.

## C. Related Specification Sections include, but are not necessarily limited to:

1. Division 0 – Bidding Requirements, Contract Forms and Conditions of the Contract
2. Division 1 – General Requirements
3. Section 33 05 10 – Utility Trench Excavation, Embedment and Backfill
4. Section 33 11 10 – Ductile Iron Pipe
5. Section 33 11 11 – Ductile Iron Fittings
6. Section 33 31 20 – Polyvinyl Chloride (PVC) Gravity Sanitary Sewer Pipe

**1.2 PRICE AND PAYMENT PROCEDURES**

## A. Measurement and Payment

1. New Sewer Service
  - a. Measurement
    - 1) Measurement for this Item shall be per each “Sewer Service” complete in place.
  - b. Payment
    - 1) The work performed and materials furnished in accordance with this Item will be paid for at the unit price bid per each “Sewer Service” installed for:

- a) Various sizes
  - c. The price bid shall include:
    - 1) Furnishing and installing New Sanitary Sewer Service Line as specified by the Drawings
    - 2) Pavement removal
    - 3) Excavation
    - 4) Hauling
    - 5) Disposal of excess material
    - 6) Tee connection to main
    - 7) Fittings
    - 8) 2-way cleanout and cap with concrete pad
    - 9) Surface restoration, excluding grass (seeding, sodding or hydro-mulch paid separately)
    - 10) Furnishing, placing and compaction of embedment
    - 11) Furnishing, placing and compaction of backfill
    - 12) Clean-up
2. New Ductile Iron Sewer Service
- a. Measurement
    - 1) Measurement for this Item shall be per each Ductile Iron Sewer Service complete in place.
  - b. Payment
    - 1) The work performed and materials furnished in accordance with this Item will be paid for at the unit price bid per each "DIP Sewer Service" installed for:
      - a) Various sizes
  - c. The price bid shall include:
    - 1) Furnishing and installing New DIP Sanitary Sewer Service Line as specified by the Drawings
    - 2) Pavement removal
    - 3) Excavation
    - 4) Hauling
    - 5) Disposal of excess material
    - 6) Tee connection to main

- 7) Fittings
  - 8) 2-way cleanout and cap with concrete pad
  - 9) Surface restoration, excluding grass (seeding, sodding or hydro-mulch paid separately)
  - 10) Furnishing, placing and compaction of embedment
  - 11) Furnishing, placing and compaction of backfill
  - 12) Clean-up
3. New Bored Sewer Service
- a. Measurement
    - 1) Measurement for this Item shall be per each Bored Sewer Service complete in place.
  - b. Payment
    - 1) The work performed and materials furnished in accordance with this Item and measured as provided under "Measurement" will be paid for at the unit price bid per each "Bored Sewer Service" installed for:
      - a) Various sizes
      - b) Various materials
  - c. The price shall include:
    - 1) Furnishing and installing New Sanitary Sewer Service Line as specified by the Drawings
    - 2) Pavement removal
    - 3) Excavation
    - 4) Hauling
    - 5) Disposal of excess material
    - 6) Tee connection to main
    - 7) Service Line
    - 8) Fittings
    - 9) 2-way cleanout and cap with concrete pad
    - 10) Surface restoration surrounding 2-way cleanout
    - 11) Furnishing, placing and compaction of embedment and backfill
    - 12) Clean-up
4. Private Service Relocation
- a. Measurement

- 1) Measured horizontally along the surface from center line to center line of the fitting, manhole or appurtenance
- b. Payment
- 1) The work performed and the materials furnished in accordance with this Item and measured as provided under "Measurement" will be paid for at the unit price bid per linear foot for "Private Sewer Service" installed for:
    - a) Various sizes
    - b) Various materials
- c. The price shall include:
- 1) Obtaining appropriate Permit
  - 2) Obtaining Right of Entry
  - 3) Performing relocation as specified in the Drawings
  - 4) Excavation
  - 5) Hauling
  - 6) Disposal of excess material
  - 7) Service Line - private side by plumber
  - 8) Fittings
  - 9) Furnishing, placing and compaction of embedment
  - 10) Furnishing, placing and compaction of backfill
  - 11) Clean-up – surface restoration, excluding grass (seeding, sodding or hydro-mulch paid separately)
5. Sewer Service Reconnection
- a. Measurement
- 1) Measurement for this Item shall be per each "Sewer Service Reconnection" complete in place from public service line connection to private service line connection.
- b. Payment
- 1) The work performed in conjunction with the relocation of a sewer service, associated with private service line, fittings and cleanout 5 feet or less in any direction from the centerline of the existing service line and the materials furnished in accordance with this Item will be paid for at the unit price per each "Sewer Service, Reconnection" performed for:
    - a) Various service sizes
- c. The price bid shall include:
- 1) Private service line

- 2) Fittings
  - 3) Private connection to sewer service
  - 4) Pavement removal
  - 5) Excavation
  - 6) Hauling
  - 7) Disposal of excess material
  - 8) Surface restoration, excluding grass (seeding, sodding or hydro-mulch paid separately)
  - 9)
  - 10)
  - 11) Clean-up
6. 2-way Cleanout
- a. Measurement
    - 1) Measurement for this Item shall be per each when only a "2-way Cleanout" is installed.
  - b. Payment
    - 1) The work performed and the materials furnished in accordance with this Item shall be paid for at the unit price bid per each "2-way Cleanout" installed for:
      - a) Various sizes
      - b) Various materials
  - c. The price bid shall include:
    - 1) Furnishing and installing the 2-way Cleanout and cap as specified in the Drawings
    - 2) Pavement removal
    - 3) Concrete pad
    - 4) Surface restoration, excluding grass (seeding, sodding or hydro-mulch paid separately)
    - 5) Hauling
    - 6) Disposal of excess material
    - 7) Furnishing, placing and compaction of backfill
    - 8) Clean-up
7. Service Reinstatement

- a. Measurement
  - 1) Measurement for this Item shall be per each Reinstatement of Service associated with the sewer main being rehabilitated by a trenchless method.
- b. Payment
  - 1) The work performed and materials furnished in accordance with this item and measured as provided under "Measurement" will be paid for at the unit price bid per each "Sewer Service, Reinstatement" for:
    - a) Various sizes
- c. The price bid shall include:
  - 1) Tap to existing main (if required)
  - 2) Pavement removal
  - 3) Excavation
  - 4) Hauling
  - 5) Disposal of excess material
  - 6) Tee connection to main
  - 7) Service line (if required)
  - 8) Fittings
  - 9) Furnishing, placing and compaction of embedment and backfill
  - 10) Clean-up – surface restoration, excluding grass (seeding, sodding or hydro-mulch paid separately)references

B. Definitions

- 1. New Service
  - a. New service applies to the installation of a service with connection to a new or existing sewer main.
  - b. The service materials would include service line, fittings and cleanout.
- 2. Bored Service
  - a. Bored service applies to the installation of a service with connection to a new or existing sewer main including a bore under an existing road.
  - b. The service materials would include service line, fittings and cleanout.
- 3. Private Service Relocation
  - a. Private service relocation applies to the replacement of the existing sewer service line on private property typically associated with the relocation of the existing main.



b. Typical main relocation will be from a rear lot easement or alley to the street.

4. Service Reinstatement

a. Service reinstatement applies to the reconnection of an existing service to an existing main that has been rehabilitated by trenchless methods such as pipe enlargement (pipe bursting), slip lining or CIPP.

C. Reference Standards

1. Reference standards cited in this Specification refer to the current reference standard published at the time of the latest revision date logged at the end of this Specification, unless a date is specifically cited.

2. ASTM International (ASTM):

- a. ASTM D3034 Standard Specification for Type PSM Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings
- b. ASTM D1785 Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80 and 120.
- c. ASTM D2321 Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications
- d. ASTM D2412 Standard Test Method for Determination of External Loading Characteristics of Plastic Pipe by Parallel-Plate Loading
- e. ASTM D3212 Standard Specification for Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals

3. Texas Commission on Environmental Quality

- a. Title 30, Part I, Chapter 217, Subchapter C, Rule 217.54 – Criteria for Laying Pipe and Rule
- b. Title 30, Part I, Chapter 217, Subchapter C, 217.55 – Manholes and Related Structures

**1.3 ADMINISTRATIVE REQUIREMENTS**

A. Scheduling

1. Provide advance notice for service interruption to property owner and meet requirements of Division 0.

**1.4 SUBMITTALS**

A. Submittals shall be in accordance with Section 01 33 00.

B. All submittals shall be approved by the City prior to delivery.

**1.5 ACTION SUBMITTALS/INFORMATIONAL SUBMITTALS**

A. Product data shall include, if applicable:

1. Tee connection or saddle
2. Fittings (including type of cleanout)
3. Service line

B. Certificates

1. Furnish an affidavit certifying that service line and fittings meet the provisions of this Section.

**1.6 CLOSEOUT SUBMITTALS [NOT USED]**

**1.7 MAINTENANCE MATERIAL SUBMITTALS [NOT USED]**

**1.8 QUALITY ASSURANCE [NOT USED]**

**1.9 DELIVERY, STORAGE, AND HANDLING**

A. Storage and Handling Requirements

1. Gravity pipe shall be stored and handled in accordance with the manufacturer's guidelines.
2. Protect all parts such that no damage or deterioration will occur during a prolonged delay from the time of shipment until installation is completed and the units and equipment are ready for operation.
3. Protect all equipment and parts against any damage during a prolonged period at the site.
4. Prevent plastic and similar brittle items from being directly exposed to sunlight or extremes in temperature.
5. Secure and maintain a location to store the material in accordance with Section 01 66 00.

**1.10 FIELD [SITE] CONDITIONS [NOT USED]**

**1.11 WARRANTY [NOT USED]**

**PART 2 - PRODUCTS**

**2.1 OWNER-FURNISHED [NOT USED]**

**2.2 EQUIPMENT, PRODUCT TYPES, MATERIALS**

A. Manufacturers

1. Only the manufacturers as listed on the City's Standard Products List will be considered as shown in Section 01 60 00.
  - a. The manufacturer must comply with this Specification and related Sections.
2. Any product that is not listed on the Standard Products List is considered a substitution and shall be submitted in accordance with Section 01 25 00.
3. The services and appurtenances shall be new and the product of a manufacturer regularly engaged in the manufacturing of services and appurtenances having similar service and size.

B. Materials/Design Criteria

1. Service Line and Fittings (including tee connections)
  - a. PVC pipe and fittings on public property shall be in accordance with Section 33 31 20.
  - b. PVC pipe and fittings on private property shall be Schedule 40 in accordance with ASTM D1785.
  - c. Ductile iron pipe and fittings shall be coated with ceramic epoxy in accordance with Section 33 11 10 and Section 33 11 11.
2. Service saddle
  - a. Service saddles shall only be allowed when connecting a new service to an existing sanitary sewer main and shall:
    - 1) Be a 1-piece prefabricated saddle, either polyethylene or PVC, with neoprene gasket for seal against main
    - 2) Use saddle to fit outside diameter of main
    - 3) Use saddle with grooves to retain band clamps
    - 4) Use at least 2 stainless steel band clamps for securing saddles to the main
  - b. Inserta tees service connections may not be used.
3. Cleanout
  - a. Cleanout stack material should be in accordance with City Standard Details or as shown on Drawings.
  - b. For paved areas, provide a cast iron cleanout and cast iron lid.
  - c. For unpaved areas, provide PVC cleanout and polyethylene lid.
4. Coupling
  - a. For connections between new PVC pipe stub out and existing service line, use rubber sleeve couplings with stainless steel double-band repair sleeves to connect to the line.

**2.3 ACCESSORIES [NOT USED]**

**2.4 SOURCE QUALITY CONTROL [NOT USED]**

**PART 3 - EXECUTION [NOT USED]**

**3.1 INSTALLERS**

- A. A licensed plumber is required for installations of the service line on private property.

**3.2 EXAMINATION [NOT USED]**

**3.3 PREPARATION [NOT USED]**

**3.4 INSTALLATION**

A. General

- 1. Install service line, fittings and cleanout as specified herein, as specified in Section 33 05 10 and in accordance with the pipe manufacturer's recommendations.

B. Handling

- 1. Haul and distribute service lines, fittings and cleanouts at the project site and handle with care to avoid damage.
  - a. Inspect each segment of service line and reject or repair any damaged pipe prior to lowering into the trench.
- 2. Do not handle the pipe in such a way that will damage the pipe.

C. Service Line

- 1. Lay service line at a minimum grade of 2 percent, as shown on City Standard details, or at lines and grades as indicated in the Drawings.
- 2. If service line is installed by bore as an alternative to open cut, the cost associated with open cut installation, such as pavement removal, trenching, embedment and backfill and pavement patch will not be included as part of the bore installation.
- 3. Excavate and backfill trenches in accordance with 33 05 10.
- 4. Embed PVC Pipe in accordance with 33 05 10.

D. Cleanout

- 1. Install out of traffic areas such as driveways, streets and sidewalks whenever possible.
  - a. When not possible, install cast iron cleanout stack and cap.
- 2. Install 2-way cleanout in non-paved areas in accordance with City Standard Details.

3. Install 2-way cleanout in paved areas in accordance with City Standard Details.

E. Service line connection to main

1. New service on new or replacement main
  - a. Determine location of service connections before main installation so the service fittings can be installed during main installation.
  - b. Connect service line to main with a molded or fabricated tee fitting.
2. Reconnection to main after pipe enlargement
  - a. Tapping the existing main and installing a strap on tee connection may be used.
  - b. Allow the new main to recover from imposed stretch before tapping and service installation.
    - 1) Follow manufacturer's recommendation for the length of time needed.
  - c. Tap main at 45 degree angle to horizontal when possible.
    - 1) Avoid tapping the top of main.
  - d. Extend service line from main to property line or easement line before connecting to the existing service line.
3. New service on existing main
  - a. Connect service line to main with a molded or fabricated tee fitting if possible.
  - b. Tapping the existing main and installing a strap on tee connection may be used.

F. Private Service Relocation

1. Requirements for the relocation of service line on private property
  - a. A licensed plumber must be used to install service line on private property.
  - b. Obtain permit from the Development Department for work on private property.
  - c. Pay for any inspection or permit fees associated with work on private property.
  - d. Verify (by Exploratory Excavation of Existing Utilities) the elevations at the building cleanout and compare to data on the Drawings before beginning service installation.
  - e. Submit elevation information to the City inspector.
  - f. Verify that the 2 percent slope installation requirement can be met.
    - 1) If the 2 percent slope cannot be met, verify with the Engineer that line may be installed at the lesser slope.

**3.5 REPAIR / RESTORATION [NOT USED]**

**3.6 RE-INSTALLATION**

A. Service Relocation

1. All relocations that are not installed as designed or fail to meet the City code shall be reinstalled at the Contractor's expense.

**3.7 FIELD QUALITY CONTROL**

A. Inspections

1. Private property service line requires approval by the City plumbing inspector before final acceptance.

**3.8 SYSTEM STARTUP [NOT USED]**

**3.9 ADJUSTING [NOT USED]**

**3.10 CLEANING [NOT USED]**

**3.11 CLOSEOUT ACTIVITIES [NOT USED]**

**3.12 PROTECTION [NOT USED]**

**3.13 MAINTENANCE [NOT USED]**

**3.14 ATTACHMENTS [NOT USED]**

**END OF SECTION**

## **33 39 20      PRECAST CONCRETE MANHOLES**

### **PART 1 - GENERAL**

#### **1.1 SUMMARY**

- A. Section Includes:
  - 1. Sanitary Sewer, Water Appurtenance, or Reclaimed Water Appurtenance Precast Concrete Manholes
- B. Deviations from this Standard Specification
  - 1. None.
- C. Related Specification Sections include, but are not necessarily limited to:
  - 1. Division 0 – Bidding Requirements, Contract Forms, and Conditions of the Contract
  - 2. Division 1 – General Requirements
  - 3. Section 03 30 00 – Cast-in-Place Concrete
  - 4. Section 03 80 00 – Modifications to Existing Concrete Structures
  - 5. Section 33 01 30 – Sewer and Manhole Testing
  - 6. Section 33 05 13 – Frame, Cover, and Grade Rings
  - 7. Section 33 39 60 – Epoxy Liners for Sanitary Sewer Structures

#### **1.2 PRICE AND PAYMENT PROCEDURES**

- A. Measurement and Payment
  - 1. Manhole
    - a. Measurement
      - 1) Measurement for this Item shall be per each concrete manhole installed.
    - b. Payment
      - 1) The work performed and the materials furnished in accordance with this Item shall be paid for at the unit price bid per each “Manhole” installed for:
        - a) Various sizes
        - b) Various types
    - c. The price bid will include:
      - 1) Manhole structure complete in place
      - 2) Excavation
      - 3) Forms
      - 4) Reinforcing steel (if required)
      - 5) Concrete
      - 6) Backfill
      - 7) Foundation
      - 8) Drop pipe
      - 9) Stubs
      - 10) Frame
      - 11) Cover
      - 12) Grade rings

- 13) Pipe connections
  - 14) Pavement removal
  - 15) Hauling
  - 16) Disposal of excess material
  - 17) Placement and compaction of backfill
  - 18) Clean-up
2. Extra Depth Manhole
- a. Measurement
    - 1) Measurement for added depth beyond 6 feet will be per vertical foot, measured to the nearest 1/10 foot.
  - b. Payment
    - 1) The work performed and materials furnished in accordance with this Item and measured as provided under "Measurement" will be paid for at the unit price bid per vertical foot for "Extra Depth Manhole" specified for:
      - a) Various sizes
  - c. The price bid will include:
    - 1) Manhole structure complete in place
    - 2) Excavation
    - 3) Forms
    - 4) Reinforcing steel (if required)
    - 5) Concrete
    - 6) Backfill
    - 7) Foundation
    - 8) Drop pipe
    - 9) Stubs
    - 10) Frame
    - 11) Cover
    - 12) Grade rings
    - 13) Pipe connections
    - 14) Pavement removal
    - 15) Hauling
    - 16) Disposal of excess material
    - 17) Placement and compaction of backfill
    - 18) Clean-up

### 1.3 REFERENCES

#### A. Definitions

- 1. Manhole Type
  - a. Standard Manhole (See City Standard Details)
    - 1) Greater than 4 feet deep up to 6 feet deep
  - b. Standard Drop Manhole (See City Standard Details)
    - 1) Same as Standard Manhole with external drop connection(s)
  - c. Type "A" Manhole (See City Standard Details)
    - 1) Manhole set on a reinforced concrete block placed around 39-inch and larger sewer pipe.
  - d. Shallow Manhole (See City Standard Details)
    - 1) Less than four 4 deep with formed invert for sewer pipe diameters smaller than 39-inch
- 2. Manhole Size



- a. 4-foot diameter
  - 1) Used with pipe ranging from 8-inch to 15-inch
- b. 5-foot diameter
  - 1) Used with pipe ranging from 18-inch to 36-inch
  - 2) See specific manhole design on Drawings for pipes larger than 36-inch.

**B. Reference Standards**

- 1. Reference standards cited in this Specification refer to the current reference standard published at the time of the latest revision date logged at the end of this Specification unless a date is specifically cited.
- 2. ASTM International (ASTM):
  - a. C443, Standard Specification for Joint for Concrete Pipe and Manholes, Using Rubber Gaskets
  - b. C478, Standard Specification for Precast Reinforced Concrete Manhole Sections.
  - c. C923, Standard Specification for Resilient Connectors Between Reinforced Concrete Manholes Structures, Pipes, and Laterals.
  - d. D1187, Standard Specification for Asphalt-Base Emulsion for Use as Protective Coatings for Metal
  - e. D1227, Standard Specification for Emulsified Asphalt Used as a Protective Coating for Roofing

**1.4 ADMINISTRATIVE REQUIREMENTS [NOT USED]**

**1.5 SUBMITTALS**

- A. Submittals shall be in accordance with Section 01 33 00.
- B. All submittals shall be approved by the City prior to delivery.

**1.6 ACTION SUBMITTALS/INFORMATIONAL SUBMITTALS**

- A. Product Data
  - 1. Precast Concrete Manhole
  - 2. Drop connection materials
  - 3. Pipe connections at manhole walls
  - 4. Stubs and stub plugs
  - 5. Admixtures
  - 6. Concrete Mix Design

**1.7 CLOSEOUT SUBMITTALS [NOT USED]**

**1.8 MAINTENANCE MATERIAL SUBMITTALS [NOT USED]**

**1.9 QUALITY ASSURANCE [NOT USED]**

**1.10 DELIVERY, STORAGE, AND HANDLING [NOT USED]**

**1.11 FIELD [SITE] CONDITIONS [NOT USED]**

**1.12 WARRANTY**

- A. Manufacturer Warranty

1. Manufacturer's Warranty shall be in accordance with Division 1.

## **PART 2 - PRODUCTS**

### **2.1 OWNER-FURNISHED [OR] OWNER-SUPPLIED PRODUCTS [NOT USED]**

### **2.2 EQUIPMENT, PRODUCT TYPES, AND MATERIALS**

#### **A. Manufacturers**

1. Only the manufacturers as listed on the City's Standard Products List will be considered as shown in Section 01 60 00.
  - a. The manufacturer must comply with this Specification and related Sections.
2. Any product that is not listed on the Standard Products List is considered a substitution and shall be submitted in accordance with Section 01 25 00.

#### **B. Materials**

1. Precast Reinforced Concrete Sections – Conform to ASTM C478.
2. Precast Joints
  - a. Provide gasketed joints in accordance with ASTM C443.
  - b. Minimize number of segments.
  - c. Use long joints at the bottom and shorter joints toward the top.
  - d. Include manufacturer's stamp on each section.
3. Lifting Devices
  - a. Manhole sections and cones may be furnished with lift lugs or lift holes.
    - 1) If lift lugs are provided, place 180 degrees apart.
    - 2) If lift holes are provided, place 180 degrees apart and grout during manhole installation.
4. Frame and Cover – Conform to Section 33 05 13.
5. Grade Ring – Conform to Section 33 05 13 and ASTM C478.
6. Pipe Connections
  - a. Utilize either an integrally cast embedded pipe connector or a boot-type connector installed in a circular block out opening conforming to ASTM C923.
7. Steps
  - a. No steps are allowed.
8. Interior Coating or Liner – Conform to Section 33 39 60.
9. Exterior Coating
  - a. Coat with non-fibered asphaltic emulsion in accordance with ASTM D1187 Type I and ASTM D1227 Type III Class I.

### **2.3 ACCESSORIES [NOT USED]**

### **2.4 SOURCE QUALITY CONTROL [NOT USED]**

## **PART 3 - EXECUTION**

### **3.1 INSTALLERS [NOT USED]**

### **3.2 EXAMINATION**

#### **A. Evaluation and Assessment**

1. Verify lines and grades are in accordance with the Drawings.

### 3.3 PREPARATION

- A. Foundation Preparation
  - 1. Excavate 8 inches below manhole foundation.
  - 2. Replace excavated soil with course aggregate; creating a stable base for manhole construction.
    - a. If soil conditions or ground water prevent use of course aggregate base a 2-inch mud slab may be substituted.

### 3.4 INSTALLATION

- A. Manhole
  - 1. Construct manhole to dimensions shown on Drawings.
  - 2. Precast Sections
    - a. Provide bell-and-spigot design incorporating a pre-molded joint sealing compound for wastewater use.
    - b. Clean bell spigot and gaskets, lubricate and join.
    - c. Minimize number of segments.
    - d. Use long joints used at the bottom and shorter joints toward the top.
- B. Invert
  - 1. Construct invert channels to provide a smooth waterway with no disruption of flow at pipe-manhole connections.
  - 2. For direction changes of mains, construct channels tangent to mains with maximum possible radius of curvature.
    - a. Provide curves for side inlets.
  - 3. For all standard manholes provide full depth invert.
  - 4. For example, if 8-inch pipe is connected to manhole construct the invert to full 8 inches in depth.
- C. Drop Manhole Connection
  - 1. Install drop connection when sewer line enters manhole higher than 24 inches above the invert.
- D. Final Rim Elevation
  - 1. Install concrete grade rings for height adjustment.
    - a. Construct grade ring on load bearing shoulder of manhole.
    - b. Use sealant between rings as shown on Drawings.
  - 2. Set frame on top of manhole or grade rings using continuous water sealant.
  - 3. Remove debris, stones and dirt to ensure a watertight seal.
  - 4. Do not use steel shims, wood, stones or other unspecified material to obtain the final surface elevation of the manhole frame.
- E. Internal coating
  - 1. Internal coating application will conform to Section 33 39 60, if required by Drawings.
- F. External coating
  - 1. Remove dirt, dust, oil and other contaminants that could interfere with adhesion of the coating.
  - 2. Cure manhole for 3 days before backfilling around the structure.
  - 3. Application will follow manufacturer's recommendation.

G. Modifications and Pipe Penetrations

1. Conform to Section 03 80 00.

**3.5 REPAIR / RESTORATION [NOT USED]**

**3.6 RE-INSTALLATION [NOT USED]**

**3.7 FIELD QUALITY CONTROL**

A. Field Tests and Inspections

1. Perform vacuum test in accordance with Section 33 01 30.

**3.8 SYSTEM STARTUP [NOT USED]**

**3.9 ADJUSTING [NOT USED]**

**3.10 CLEANING [NOT USED]**

**3.11 CLOSEOUT ACTIVITIES [NOT USED]**

**3.12 PROTECTION [NOT USED]**

**3.13 MAINTENANCE [NOT USED]**

**3.14 ATTACHMENTS [NOT USED]**

**END OF SECTION**

**PART 1 - GENERAL****1.1 SUMMARY**

- A. Section Includes:
  - 1. This section governs all work, materials and testing required for the pressure grouting of manhole defects. Manholes designated for grouting are listed on the Manhole Rehabilitation Schedule or will be designated by the Engineer for manhole grouting.
- B. Related Specification Sections include, but are not necessarily limited to:
  - 1. Division 00 – Procurement and Contracting Requirements
  - 2. Division 01 – General Requirements

**1.2 PRICE AND PAYMENT PROCEDURES**

Will be in accordance with specifications.

**1.3 SUBMITTALS**

- A. Submittals shall be in accordance with Section 01 33 00.
- B. All submittals shall be approved by Owner prior to construction.

**1.4 ACTION SUBMITTALS/INFORMATIONAL SUBMITTALS**

- A. Product Data
  - 1. Submit product data, including each material, component construction, features, configurations, and dimension, from pre-approved manufacturer for all materials to be installed.
- B. Contractor Data

**1.5 FIELD [SITE] CONDITIONS**

- A. Existing Conditions
  - 1. Contractor is responsible for locating and uncovering all manholes. If the contractor is unable to locate manholes the Contractor shall notify the Engineer in writing.
  - 2. Manholes to be grouted may be of brick, block, pre-cast, or poured concrete construction.
  - 3. Provide confined space entry, flow diversion and/or bypass plans as necessary to perform the specified work. Perform work in accordance with OSHA Standards.

**1.6 QUALITY ASSURANCE**

- A. Obtain all materials from a single manufacturer.
- B. At a minimum, products and installers must meet all of the following criteria to be deemed commercially acceptable:
  - 1. For a Product to be considered commercially acceptable, the product must have a minimum of eighty thousand (80,000) vertical feet and five (5) year history of successful wastewater collection system installations in the United States. In addition, products must provide Third Party test Results supporting the long-term performance and structural strength of the product and such data shall be satisfactory to the Owner. No product will be allowed without Independent Third Party Testing verification.

2. For an installing contractor to be considered commercially acceptable, the installer must satisfy all insurance, financial and bonding requirements for the Owner. The Contractor must have a certification from the manufacturer as a licensed and fully installer of the product. The installer must also have a minimum of eighty thousand (80,000) vertical feet of successful wastewater collection system installations and five (5) year of rehabilitation experience.
- C. Personnel shall have confined space entry certification.
  - D. Field verification shall be completed by the contractor prior to commencement of work.
  - E. Contractor shall verify the finished thickness of each rehabilitation method prior to starting the next layer and upon completion of the work. The Engineer may obtain core samples at his discretion.

## **PART 2 - PRODUCTS**

### **2.1 MATERIALS**

#### **A. Materials**

##### **1. Grouting Materials**

##### **a. Urethane Gel Grout**

- 1) Urethane gel grout, such as AV-350 Multigel by Avanti International or equal shall be a hydrophilic polymer. The chemical shall be mixed within the range of from 8 to 10 parts of water and shall contain a reinforcing agent supplied by the same manufacturer. The material shall gel and cure to a tough flexible elastomeric condition. When wet, the gel shall exhibit strength properties of at least 25 psi tensile at 150 percent elongation. The material shall not change in linear dimension more than eight percent when subjected to wet and dry cycles.
- 2) The chemical grout shall be applied so as to have the grout material flow freely into the defects. To avoid any wastage of the material flowing through the defects gel control agent may be added. The following properties shall be exhibited by the grout:
  - a) Documented service of satisfactory performance in similar usage.
  - b) Controllable reaction times and shrinkage through the use of chemicals supplied by the same manufacturer. The minimum gel set time shall be established so that adequate grout travel is achieved.
  - c) Resistance to chemicals; resistant to most organic solvents, mild acids and alkali.
  - d) Compressive recovery return to original shape after repeated deformation.
  - e) The chemical shall be essentially nontoxic in a cured form.
  - f) Sealing material shall not be rigid or brittle when subjected to dry atmosphere. The material shall be able to withstand freeze/thaw and moving load conditions.
  - g) Sealing material shall be noncorrosive.

- 3) A reinforcing agent such as AV-257 Icoset by Avanti International reinforcing agent or equivalent shall be utilized in accordance with manufacturer's recommendations. Any 257 reinforcing agent which contains lumps must be discarded. Care must be taken to be sure that the pH of the water in the tank is from 5 to 9. As a precaution against the possibility of the pH being outside this range, take a small amount of water from the tank to which Gel Reinforcing Agent 257 is to be added. Add a few drops of 257 to this test sample. Avanti Gel Reinforcing Agent 257 should disperse readily. If precipitation occurs, drain the tank and retest. Repeat as necessary until dispersion occurs. If dispersion does not occur, do not use the water source.
  - 4) A filler material such as Celite 292 (diatomaceous earth) from John Mansville or equivalent shall be utilized. The addition of the filler material shall not exceed the quantity specified by the manufacturer, and continuous agitation of the water side of the mixture is required. The filler material may also be utilized as a reinforcing agent in accordance with the urethane gel grout manufacturer's recommendations.
2. Grout – Octocrete as manufactured by IPA Systems, Inc. or approved equivalent.
    - 1) Minimum Physical Properties
      - a) ASTM C109 Compressive Strength 5,800 psi (28 days)
      - b) ASTM C348 Flexural Strength 900 psi (28 days)
      - c) ASTM C882 Bond Strength 1,640 psi (28 day)
  3. Additives
    - 1) Grout additions may be utilized for catalyzing the gel reaction, inhibiting the gel reaction, buffering the solution, lowering the freezing temperature of the solution, acting as a filler, providing strength or for inhibition of root growth.
  4. Root Control
    - 1) A root inhibiting chemical such as dichlobenil, Avanti AC-50W or equivalent shall be added to the chemical grout mixture at a safe level of concentration and shall have the ability to remain active within the grout for a minimum of 12 months, for all area we're protruding roots are found.
  5. Material Identification
    - 1) Contractor shall completely identify the types of grout, mortar, sealant, and/or root control chemicals used and provide case histories of successful use or defend the choice of grouting materials based on chemical and physical properties, ease of application, and expected performance, to the satisfaction of the Engineer.
  6. Mixing and Handling
    - 1) Mixing and handling of chemical grout and forming constituents, which may be toxic under certain conditions shall be in accordance with the recommendations of the manufacturer and in such a manner as to minimize hazard to personnel. It is the responsibility of the Contractor to provide appropriate protective measures to ensure that chemicals or gels produced by the chemicals are under control at all times and are not available to unauthorized personnel or animals. All equipment shall be subject to the approval of the Engineer. Only personnel thoroughly familiar with the handling of the grout material and additives shall perform the grouting operations.
  7. Portland Cement

- 1) As specified in Section 03 30 00.
8. Oakum
  - 1) Activated oakum, such as Fibrotite Oakum as manufactured by Avanti International or equivalent shall be utilized as a carrier that assists in sealing grout holes while it cures.
9. Non-Shrink Grout
  - 1) As specified in Section 03 30 00.

## **PART 3 - EXECUTION**

### **3.1 EXAMINATION**

- A. Notify Owner and/or Engineer immediately of any changed condition that impacts installation of the proposed frame and cover replacement.

### **3.2 PREPARATION**

- A. The contractor shall be responsible for supplying the required material for the replacement of manhole frames and covers, including the unloading, temporary storage, and transporting of the materials.
- B. Manhole grouting shall not be performed until sealing of manhole frame and grade adjustments or partial manhole replacement is complete.

### **3.3 INSTALLATION**

- A. Preliminary Repairs
  1. Seal all unsealed lifting holes, unsealed step holes, precast manhole section joints, and voids larger than approximately one half (1/2) inch in thickness with Octocrete or approved equal. All cracked or deteriorated material shall be removed from the area to be patched and replaced with Octocrete, as manufactured by IPA Systems, Inc. or equal, in accordance with manufacturer's specifications.
  2. Cut and trim all roots within the manhole.
- B. Temperature
  1. Normal grouting operations including application of interior coating shall be performed at temperatures of 40F or greater. If grouting is performed below temperatures of 40F, then it must be performed in accordance with manufacturer's recommendations.
- C. Grouting Materials Usage
  1. Grouting of the manhole may include frame seal, frame and grade adjustments, corbel, wall, pipe seals, and/or bench/trough. Areas of the manhole designated to be grouted will be directed by the Engineer. If entire manhole is scheduled for grouting, grouting shall include the entire manhole including corbel, wall, pipe seals and bench/trough.
- D. Drilling and Injection



1. Injection holes shall be drilled through the manhole at 120-degree angles from each other at the same plane of elevation. Rows shall be separated no more than three vertical feet, and the holes shall be staggered with the holes in the rows above and below. Provide additional injection holes near observed defects, bench and trough, and at pipe seals. A minimum of 6 injection holes shall be provided in the walls/corbel and three injection holes at each pipe seal and at the bench/trough. Manholes shall be grouted from the top of the corbel or bottom of flattop to the pipe invert.
2. Grout shall be injected through the holes under pressure with a suitable probe. Injection pressure shall not cause damage to the manhole structure or surrounding surface features. Grout shall be injected through the lowest holes first. The procedure shall be repeated until the manhole is externally sealed with grout.
3. Grouting from the ground surface shall not be allowed.
4. Grout travel shall be verified by observation of grout to defects or adjacent injection holes. Provide additional injection holes, if necessary, to ensure grout travel.
5. Injection holes shall be cleaned with a drill and patched with a waterproof quick setting mortar.
6. All grout shall be removed from interior surfaces of the manhole. After the grouting is completed, the interior of the manhole shall be coated with ½" thick quick setting mortar such as Hyperform as manufactured by Quadex (A Vortex Company), or equal. The coating shall cover at least 6" past the joint each side.

#### **3.4 FIELD QUALITY CONTROL**

- A. Testing of rehabilitated manholes for watertightness shall be performed by the Contractor in the presence of the Engineer in accordance with the requirement of Section 33 01 30.

**END OF SECTION**

**PART 1 - GENERAL**

**1.1 SUMMARY**

- A. Section Includes:
  - 1. Application of a high-build epoxy coating system to concrete utility structures such as manholes, lift station wet wells, junction boxes or other concrete facilities that may need protection from corrosive materials.
- B. Deviations from this Standard Specification
  - 1. None.
- C. Related Specification Sections include but are not necessarily limited to:
  - 1. Division 0 – Bidding Requirements, Contract Forms, and Conditions of the Contract
  - 2. Division 1 – General Requirements
  - 3. Section 33 01 30 – Sewer and Manhole Testing

**1.2 PRICE AND PAYMENT PROCEDURES**

- A. Measurement and Payment
  - 1. Manholes
    - a. Measurement
      - 1) Measurement for this Item shall be per vertical foot of coating as measured from the bottom of the frame to the top of the bench.
    - b. Payment
      - 1) The work performed and materials furnished in accordance with this Item and measured as provided under “Measurement” will be paid for at the unit price bid per vertical foot of “Epoxy Manhole Liner” applied.
    - c. The price bid shall include:
      - 1) Furnishing and installing Liner as specified by the Drawings.
      - 2) Hauling
      - 3) Disposal of excess material
      - 4) Clean-up
      - 5) Cleaning
      - 6) Testing
  - 2. Non-Manhole Structures
    - a. Measurement
      - 1) Measurement for this Item shall be per square foot of area where the coating is applied.
    - b. Payment
      - 1) The work performed and materials furnished in accordance with this Item and measured as provided under “Measurement” shall be paid for at the unit price bid per square foot of “Epoxy Structure Liner” applied.
    - c. The price bid shall include:
      - 1) Furnishing and installing Liner as specified by the Drawings.

- 2) Hauling
- 3) Disposal of excess material
- 4) Clean-up
- 5) Cleaning
- 6) Testing

### **1.3 REFERENCES**

#### **A. Reference Standards**

1. Reference standards cited in this Specification refer to the current reference standard published at the time of the latest revision date logged at the end of this Specification unless a date is specifically cited.
2. ASTM International (ASTM):
  - a. D543, Standard Practices for Evaluating the Resistance of Plastics to Chemical Reagents.
  - b. D638, Standard Test Method for Tensile Properties of Plastics.
  - c. D695, Standard Test Method for Compressive Properties of Rigid Plastics.
  - d. D790, Standard Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials.
  - e. D4060, Standard Test Method for Abrasion Resistance of Organic Coatings by the Taber Abraser.
  - f. D4414, Standard Practice for Measurement of Wet Film Thickness by Notch Gages.
  - g. D4541, Standard Test Method for Pull-off Strength of Coatings Using Portable Adhesion Testers.
3. Environmental Protection Agency (EPA).
4. NACE International (NACE).
5. Occupational Safety and Health Administration (OSHA).
6. Resource Conservation and Recovery Act, (RCRA).
7. The Society for Protective Coatings/NACE International (SSPC/NACE):
  - a. sp 13/NACE No. 6, Surface Preparation of Concrete.

### **1.4 ADMINISTRATIVE REQUIREMENTS [NOT USED]**

### **1.5 SUBMITTALS**

- A. Submittals shall be in accordance with Section 01 33 00.
- B. All submittals shall be approved by the City prior to delivery.

### **1.6 ACTION SUBMITTALS/INFORMATIONAL SUBMITTALS**

#### **A. Product Data**

1. Technical data sheet on each product used.
2. Material Safety Data Sheet (MSDS) for each product used.
3. Copies of independent testing performed on the coating product indicating the product meets the requirements as specified herein.
4. Technical data sheet and project specific data for repair materials to be top coated with the coating product including application, cure time and surface preparation procedures.

B. Contractor Data

1. Current documentation from coating product manufacturer certifying Contractor's training and equipment complies with the Quality Assurance requirements specified herein.
2. Five (5) recent references of Contractor indicating successful application of coating product(s) of the same material type as specified herein, applied by spray application within the municipal wastewater environment.

**1.7 CLOSEOUT SUBMITTALS [NOT USED]**

**1.8 MAINTENANCE MATERIAL SUBMITTALS [NOT USED]**

**1.9 QUALITY ASSURANCE**

A. Qualifications

1. Contractor
  - a. Be trained by, or have training approved and certified by, the coating product manufacturer for the handling, mixing, application and inspection of the coating product(s) to be used as specified herein.
  - b. Initiate and enforce quality control procedures consistent with the coating product(s) manufacturer recommendations and applicable NACE or SSPC standards as referenced herein.

**1.10 DELIVERY, STORAGE, AND HANDLING**

- A. Keep materials dry, protected from weather, and stored under cover.
- B. Store coating materials between 50 degrees F and 90 degrees F.
- C. Do not store near flame, heat, or strong oxidants.
- D. Handle coating materials according to their material safety data sheets.

**1.11 FIELD [SITE] CONDITIONS**

- A. Provide confined space entry, flow diversion and/or bypass plans as necessary to perform the specified work.

**1.12 WARRANTY**

- A. Contractor Warranty
  1. Contractor's Warranty shall be in accordance with Division 0.

**PART 2 - PRODUCTS**

**2.1 OWNER-FURNISHED [OR] OWNER-SUPPLIED PRODUCTS [NOT USED]**

**2.2 EQUIPMENT, PRODUCT TYPES, MATERIALS**

- A. Repair and Resurfacing Products
  1. Compatible with the specified coating product(s) in order to bond effectively, thus forming a composite system.
  2. Used and applied in accordance with the manufacturer's recommendations.
  3. The repair and resurfacing products must meet the following:
    - a. 100 percent solids, solvent-free epoxy grout specifically formulated for epoxy top coating compatibility.
    - b. Factory blended, rapid setting, high early strength, fiber reinforced, non-shrink

repair mortar that can be troweled or pneumatically spray applied and specifically formulated to be suitable for top coating with the specified coating product used.

**B. Coating Product**

1. Capable of being installed and curing properly within a manhole or concrete utility environment.
2. Resistant to all forms of chemical or bacteriological attack found in municipal sanitary sewer systems; and, capable of adhering to typical manhole structure substrates.
3. The 100 percent solids, solvent-free ultra-high-build epoxy system shall exhibit the following characteristics:
  - a. Application Temperature – 50 degrees F, minimum
  - b. Thickness – 125 mils minimum
  - c. Color – White, Light Blue, or Beige
  - d. Compressive Strength (per ASTM D695) – 8,800 psi minimum
  - e. Tensile Strength (per ASTM D638) – 7,500 psi minimum
  - f. Hardness, Shore D (per ASTM D4541) – 70 minimum
  - g. Abrasion Resistance (per ASTM D4060 CS 17F Wheel) – 80 mg loss maximum
  - h. Flexural Modulus (per ASTM D790) – 400,000 psi minimum
  - i. Flexural Strength (per ASTM D790) – 12,000 psi minimum
  - j. Adhesion to Concrete, mode of failure (ASTM D4541): Substrate (concrete) failure
  - k. Chemical Resistance (ASTM D543/G20) all types of service for:
    - 1) Municipal sanitary sewer environment
    - 2) Sulfuric acid, 30 percent
    - 3) Sodium hydroxide, 5 percent

**C. Coating Application Equipment**

1. Manufacturer approved heated plural component spray equipment.
2. Hard to reach areas, primer application and touch-up may be performed using hand tools.

**2.3 ACCESSORIES [NOT USED]**

**2.4 SOURCE QUALITY CONTROL**

1. Testing
  - a. Take wet film thickness gauge per ASTM D4414 at 3 locations within the manhole, 2 spaced equally apart along the wall and 1 on the bench.
    - 1) Document and attest measurements and provide to the City.
  - b. After coating has set, repair all visible pinholes by lightly abrading the surface and brushing the lining material over the area.
  - c. Repair all blisters and evidence of uneven cover according to the manufacturer's recommendations.
  - d. Test manhole for final acceptance according to Section 33 01 30.

**PART 3 - EXECUTION**

**3.1 INSTALLERS**

- A. All installers shall be certified applicators approved by the manufacturers.

**3.2 EXAMINATION [NOT USED]**

### 3.3 PREPARATION

- A. Manhole Preparation
  - 1. Stop active flows via damming, plugging, or diverting as required to ensure all liquids are maintained below or away from the surfaces to be coated.
  - 2. Maintain temperature of the surface to be coated between 40- and 120-degrees F.
  - 3. Shield specified surfaces to avoid exposure of direct sunlight or other intense heat source.
    - a. Where varying surface temperatures do exist, coating installation should be scheduled when the temperature is falling versus rising.
- B. Surface Preparation
  - 1. Remove oils, grease, incompatible existing coatings, waxes, form release, curing compounds, efflorescence, sealers, salts, or other contaminants which may affect the performance and adhesion of the coating to the substrate.
  - 2. Remove concrete and/or mortar damaged by corrosion, chemical attack, or other means of degradation so that only sound substrate remains.
  - 3. Surface preparation method, or combination of methods, that may be used include high pressure water cleaning, high pressure water jetting, abrasive blasting, shotblasting, grinding, scarifying, detergent water cleaning, hot water blasting, and others as described in SSPC SP 13/NACE No. 6.
  - 4. All methods used shall be performed in a manner that provides a uniform, sound, clean, neutralized, surface suitable for the specified coating product.

### 3.4 INSTALLATION

- A. General
  - 1. Perform coating after the sewer line replacement/repairs, grade adjustments and grouting are complete.
  - 2. Perform application procedures per recommendations of the coating product manufacturer, including environmental controls, product handling, mixing and application.
- B. Temperature
  - 1. Only perform application if surface temperature is between 40- and 120-degrees F.
  - 2. Make no application if freezing is expected to occur inside the manhole within 24 hours after application.
- C. Coating
  - 1. Spray apply per manufacturer's recommendation at a minimum film thickness of 125 mils.
  - 2. Apply coating from bottom of manhole frame to the bench/trough, including the bench/trough.
  - 3. After walls are coated, remove bench covers and spray bench/trough to at least the same thickness as the walls.
  - 4. Apply any topcoat or additional coats within the product's recoat window.
    - a. Additional surface preparation is required if the recoat window is exceeded.
  - 5. Allow a minimum of three (3) hours of cure time or be set hard to touch before reactivating flow.

### 3.5 REPAIR / RESTORATION [NOT USED]

### 3.6 RE-INSTALLATION [NOT USED]

**3.7 FIELD [OR] SITE QUALITY CONTROL**

- A. Each structure will be visually inspected by the City the same day following the application.
- B. The inspector will check for deficiencies, pinholes, and thin spots.
- C. If leaks are detected they will be chipped back, plugged, and coated immediately with protective epoxy resin coating.
  - 1. Make repair 24 hours after leak detection.

**3.8 SYSTEM STARTUP [NOT USED]**

**3.9 ADJUSTING [NOT USED]**

**3.10 CLEANING [NOT USED]**

**3.11 CLOSEOUT ACTIVITIES**

- A. Upon final completion of the work, the manufacturer will provide a written certification of proper application to the City.
- B. The certification will confirm that the deficient areas were repaired in accordance with the procedure set forth in this Specification.

**3.12 PROTECTION [NOT USED]**

**3.13 MAINTENANCE [NOT USED]**

**3.14 ATTACHMENTS [NOT USED]**

**END OF SECTION**

**PART 1 - GENERAL****1.1 SUMMARY**

- A. Section Includes:
  - 1. This section governs all work, materials and testing required for the cementitious coating of Manholes. Manholes designated for interior coating are listed on the Manhole Rehabilitation Schedule. Manholes designated for interior coating shall be first coated with a cementitious coating follow up an epoxy coating as detailed in Section 33 3960.
- B. Related Specification Sections include, but are not necessarily limited to:
  - 1. Division 00 – Procurement and Contracting Requirements
  - 2. Division 01 – General Requirements
  - 3. Section 33 39 60 – Epoxy Liners for Sanitary Sewer Structures

**1.2 PRICE AND PAYMENT PROCEDURES**

Measurement and Payment shall be in accordance with Section 01 11 00.

**1.3 SUBMITTALS**

- A. Submittals shall be in accordance with Section 01 33 00.
- B. All submittals shall be approved by District prior to construction.

**1.4 ACTION SUBMITTALS/INFORMATIONAL SUBMITTALS**

- A. Product Data
  - 1. Submit product data, including each material, component construction, features, configurations, and dimension, from pre-approved manufacturer for all materials to be installed.
- B. Contractor Data

**1.5 FIELD [SITE] CONDITIONS**

- A. Existing Conditions
  - 1. Contractor is responsible for locating and uncovering all manholes. If the contractor is unable to locate manholes the Contractor shall notify the Engineer in writing.
  - 2. Manholes to be interior coated may be of brick, block, pre-cast, or poured concrete construction. Some may have a previously applied interior mortar coating.
  - 3. Provide confined space entry, flow diversion and/or bypass plans as necessary to perform the specified work. Perform work in accordance with OSHA Standards.

**1.6 QUALITY ASSURANCE**

- A. Obtain all materials from a single manufacturer.
- B. At a minimum, products and installers must meet all of the following criteria to be deemed commercially acceptable:



1. For a Product to be considered commercially acceptable, the product must have a minimum of eighty thousand (80,000) vertical feet and five (5) year history of successful wastewater collection system installations on manholes in the United States. In addition, products must provide Third Party test Results supporting the long-term performance and structural strength of the product and such data shall be satisfactory to the Owner. No product will be allowed without Independent Third-Party Testing verification.
  2. For an installing contractor to be considered commercially acceptable, the installer must satisfy all insurance, financial and bonding requirements for the Owner. The Contractor must have a certification from the manufacturer as a licensed and fully installer of the product. The installer must also have a minimum of eighty thousand (80,000) vertical feet of successful wastewater collection system installations and five (5) year of rehabilitation experience on manholes.
- C. Personnel shall have confined space entry certification.
- D. Field verification shall be completed by the contractor prior to commencement of work.
- E. Contractor shall verify the finished thickness of each rehabilitation method prior to starting the next layer and upon completion of the work. The Engineer may obtain core samples at his discretion.

## **PART 2 - PRODUCTS**

### **2.1 MATERIALS**

- A. Materials
1. Cementitious Interior Coating
    - a. Quadex QM-1s Restore proprietary pre-blended cement based synthetic granite (Donnafill) enhanced polypropylene fiber reinforced coatings as manufactured by Quadex, LLC (A Vortex Company). or approved equal shall be used on this project. No material (other than clean potable water) shall be used with or added to the coating material without prior approval or recommendation from the coating material manufacturer.
  2. Material Identification
    - a. Contractor shall completely identify the types of grout, mortar, patching compounds, sealant, and/or root control chemicals used and provide case histories of successful use or defend the choice of grouting materials based on chemical and physical properties, ease of application, and expected performance, to the satisfaction of the Owner's Representative.
  3. Mixing and Handling
    - a. Mixing and handling of interior coating, which may be toxic under certain conditions shall be in accordance with the recommendations of the manufacturer and in such a manner as to minimize hazard to personnel. It is the responsibility of the Contractor to provide appropriate protective measures to ensure that materials are under control at all times and are not available to unauthorized personnel or animals. All equipment shall be subject to the approval of the Owner's Representative. Only personnel thoroughly familiar with the handling of the coating material shall perform the coating operations.

## **PART 3 - EXECUTION**

### **3.1 EXAMINATION**

- A. Notify District and/or Engineer immediately of any changed condition that impacts installation of the proposed frame and cover replacement.

### 3.2 PREPARATION

- A. The contractor shall be responsible for supplying the required material for the replacement of manhole frames and covers, including the unloading, temporary storage, and transporting of the materials.
- B. Manhole coating shall not be performed until sealing of manhole frame and grade adjustments and/or pressure grouting, or replacement is complete.

### 3.3 INSTALLATION

- A. Preliminary Repairs
  - 1. All foreign materials shall be removed from the manhole interior using high pressure water spray (minimum 3500 psi). Loose and protruding brick, mortar and concrete shall be removed using a masonry hammer and chisel and/or scrapers. Existing roots and manhole steps shall be removed by cutting them flush with the wall of the manhole.
    - a. All unsealed lifting holes, unsealed step holes, voids larger than approximately one-half (1/2) inch in thickness shall be filled with patching compound at least one hour (1) prior to spray application of the first coat.
    - b. Active leaks shall be grouted in accordance with Section 33 3950.
    - c. After all repairs have been completed, remove all loose material.
  - 2. Temperature
    - a. Normal interior coating operation shall be performed at temperatures of 40°F or greater. No application shall be made when freezing is expected within 24 hours. If ambient temperatures are in excess of 90°F, precautions shall be taken to keep mixing water below 85°F, using ice if necessary.
  - 3. Interior Manhole Coating
    - a. Manholes scheduled for interior coating are shown on the Manhole Rehabilitation Schedule. The interior coating shall be applied to the manhole from the bench and trough (including the bench/trough) to the bottom of the frame of the first-grade adjustment ring.
    - b. The interior coating shall be applied in accordance with the manufacturer's recommendations and the following procedure.
      - 1) The surface shall be thoroughly cleaned of all foreign materials and matter. Cleaning shall be accomplished by using high pressure water spray (minimum 3500 psi.)
      - 2) Place covers over invert to prevent extraneous material from entering the sewer.
      - 3) The surface prior to application shall be damp without noticeable free water droplets or running water. Coating material shall be spray applied to a minimum uniform thickness of ½-inch minimum. Troweling shall begin immediately following the spray application. The troweled surface shall be smooth with no evidence of previous void areas.
      - 4) After the walls are coated, the invert/bench covers shall be removed, and the bench sprayed with epoxy material in such a manner as to produce a bench having a gradual slope from the walls to the invert with the wall/bench intersection built up and rounded to a uniform radius for the full circumference of the intersection. The thickness of the bench shall be no less than 1/2 inch at the invert and shall increase in the direction of the wall so as to provide the required slope. Trough area shall be coated as required to seal all cracks and to provide a smooth surface.
      - 5) The material shall have a minimum of four (4) hours cure time before being subjected to active flow. Ambient conditions in the manhole are adequate for curing as long as the manhole is covered.
      - 6) Traffic shall not be allowed over manholes for 12 hours after reconstruction is complete.

- 7) Caution should be taken to minimize exposure of applied product to sunlight and air movement. At no time should the finished product be exposed to sunlight or air movement for longer than 15 minutes before replacing the manhole cover. In extremely hot and arid climates manhole should be shaded while reconstruction is in process.
- 8) No application shall be made to frozen surfaces or if freezing is expected to occur inside the manhole within 24 hours after application. If ambient temperatures are in excess of 95 degrees F, precautions shall be taken to keep the mix temperature at time of application below 90 degrees F. Mix water temperature shall not exceed 85 degrees F. Chill with ice if necessary.

### **3.4 FIELD QUALITY CONTROL**

- A. Testing of rehabilitated manholes for watertightness shall be performed by the Contractor in the presence of the Engineer in accordance with the requirement of Section 33 01 30.
- B. At least two 2-inch cubes shall be taken from each day's work with the date, location and job recorded on each. The cubes shall be sent to a certified testing laboratory for testing. A compression test will be made per ASTM C109, and the results will be furnished to the Owner. Test results shall equal or exceed the manufacturer's published values.
- C. Vacuum testing of rehabilitated manholes for watertightness shall be performed by the Contractor after operations are complete in accordance with the Manhole Testing Section 33 01 30.

**END OF SECTION**

**PART 1 - GENERAL****1.1 SUMMARY**

- A. Section Includes:
  - 1. Direction for the removal, abandonment (decommissioning) or salvaging of the following utilities:
    - a. Sanitary Sewer Lines
    - b. Sanitary Sewer Manholes
    - c. Sanitary Sewer Junction Boxes
- B. Deviations from this Specification
  - 1. None.
- C. Related Specification Sections include, but are not necessarily limited to:
  - 1. Division 0 – Procurement and Contracting Requirements
  - 2. Division 1 – General Requirements
  - 3. Section 03 34 13 – Controlled Low Strength Material (CLSM)
  - 4. Section 33 05 10 – Utility Trench Excavation, Embedment and Backfill

**1.2 PRICE AND PAYMENT PROCEDURES**

- A. Utility Lines
  - 1. Decommissioning of Utility Line by Grouting
    - a. Measurement
      - 1) Measurement for this Item shall be per cubic yard of existing utility line to be grouted. Measure by tickets showing cubic yards of grout applied.
    - b. Payment
      - 1) The work performed and materials furnished in accordance with this Item and measured as provided under “Measurement” shall be paid for at the unit price per cubic yard of “Line Grouting” for:
        - 1) Various types of utility line
    - c. The price bid shall include:
      - 1) Low density cellular grout
      - 2) End seals
      - 3) Water
      - 4) Pavement removal
      - 5) Excavation
      - 6) Hauling
      - 7) Disposal of excess materials
      - 8) Furnishing, placement and compaction of backfill
      - 9) Clean-up
  - 2. Utility Line Removal, Separate Trench
    - a. Measurement
      - 1) Measurement for this Item shall be per linear foot of existing utility line to be removed.
    - b. Payment
      - 1) The work performed and materials furnished in accordance with this Item and measured as provided under “Measurement” shall be paid for at the unit price bid per linear foot of “Remove Line” for:

- 1) Various types of existing utility line
    - 2) Various sizes
  - c. The price bid shall include:
    - 1) Removal and disposal of existing utility pipe
    - 2) Pavement removal
    - 3) Excavation
    - 4) Hauling
    - 5) Disposal of excess materials
    - 6) Furnishing, placement and compaction of backfill
    - 7) Clean-up
- 3. Utility Line Removal, Same Trench
  - a. Measurement
    - 1) This Item is considered subsidiary the proposed utility line being installed.
  - b. Payment
    - 1) The work performed and materials furnished in accordance with this Item are subsidiary to the installation of proposed utility pipe and shall be subsidiary to the unit price bid per linear foot of pipe complete in place, and no other compensation will be allowed.
- 4. Manhole Decommission
  - a. Measurement
    - 1) Measurement for this Item will be per each manhole to be Decommissioned.
  - b. Payment
    - 1) The work performed and materials furnished in accordance with this Item and measured as provided under "Measurement" shall be paid for at the unit price bid per each "Decommission Manhole" for:
      - 1) Various diameters
      - 2) Various types
      - 3) Paved or unpaved surface
  - c. The price bid shall include:
    - 1) Removal and disposal of manhole cone
    - 2) Removal, salvage and delivery of frame and cover to Authority, if applicable
    - 3) Cutting and plugging of existing sewer lines
    - 4) Concrete
    - 5) Acceptable material for backfilling manhole void
    - 6) Pavement removal
    - 7) Excavation
    - 8) Hauling
    - 9) Disposal of excess materials
    - 10) Furnishing, placement and compaction of backfill
    - 11) Surface restoration
    - 12) Clean-up
- B. Sanitary Sewer Lines and Appurtenances
  - 1. Decommission of Sanitary Sewer Line by Cut and installation of Decommission Plug
    - a. Measurement
      - 1) Measurement for this Item shall be per each cut and abandonment plug installed.
    - b. Payment
      - 1) The work performed and materials furnished in accordance with this Item and measured as provided under "Measurement" shall be paid for at the unit price bid for each "Sewer Abandonment Plug" for:

- 1) Various sizes
- c. The price bid shall include:
  - 1) Furnishing and installing abandonment plug
  - 2) Pavement removal
  - 3) Excavation
  - 4) Hauling
  - 5) CLSM
  - 6) Disposal of excess material
  - 7) Furnishing, placement and compaction of backfill
  - 8) Clean-up
- 2. Sanitary Sewer Manhole Removal
  - a. Measurement
    - 1) Measurement for this Item will be per each sanitary sewer manhole to be removed.
  - b. Payment
    - 1) The work performed and materials furnished in accordance with this Item and measured as provided under "Measurement" shall be paid for at the unit price bid per each "Remove Sewer Manhole" for:
      - 1) Various diameters
      - 2) Manholes removed due to pipeline rehabilitation are not paid separately and the removal cost is considered subsidiary to the manhole installation bid item.
  - c. The price bid shall include:
    - 1) Removal and disposal of manhole
    - 2) Removal, salvage and delivery of frame and cover to Authority, if applicable
    - 3) Cutting and plugging of existing sewer lines
    - 4) Pavement removal
    - 5) Excavation
    - 6) Hauling
    - 7) Disposal of excess materials
    - 8) Furnishing, placement and compaction of backfill
    - 9) Clean-up
- 3. Sanitary Sewer Junction Structure Removal
  - a. Measurement
    - 1) Measurement for this Item will be per each sanitary sewer junction structure being removed.
  - b. Payment
    - 1) The work performed and materials furnished in accordance with this Item and measured as provided under "Measurement" shall be paid for at the lump sum bid per each "Remove Sewer Junction Box" location.
  - c. The price bid shall include:
    - 1) Removal and disposal of junction box
    - 2) Removal, salvage and delivery of frame and cover to Authority.
    - 3) Pavement removal
    - 4) Excavation
    - 5) Hauling
    - 6) Disposal of excess materials
    - 7) Furnishing, placement and compaction of backfill
    - 8) Clean-up

**1.3 REFERENCES [NOT USED]**

**1.4 ADMINISTRATIVE REQUIREMENTS**

A. Coordination

1. Contact Authority or Authority Representative for coordination of salvage material return.

**1.5 SUBMITTALS**

- A. Submittals shall be in accordance with Section 01 33 00.
- B. All submittals shall be approved by the Authority/Engineer prior to delivery.

**1.6 ACTION SUBMITTALS/INFORMATIONAL SUBMITTALS**

- A. Product Data
  1. Grout Mix
    - a. Material Data
- B. Shop Drawings
  1. Submit Work Plan describing the decommissioning activities, installation equipment, materials and construction methods to be employed.
  2. End seal or bulkhead designs and locations.
  3. Grouting Work Plan and Methods including:
    - a. Grouting methods
    - b. Details of equipment
    - c. Grouting procedures and sequences including:
      - 1) Injection methods
      - 2) Injection pressures
      - 3) Monitoring and recording equipment
      - 4) Pressure gauge calibration data
      - 5) Materials
    - d. Grout mix details including:
      - 1) Proportions
      - 2) Admixtures including:
        - 1) Manufacturer's literature
        - 2) Laboratory test data verifying the strength of the proposed grout mix
        - 3) Proposed grout densities
        - 4) Viscosity
        - 5) Initial set time of grout
          - (a) Data for these requirements shall be derived from trial batches from an approved testing laboratory.
    - e. Submit a minimum of 3 other similar projects where the proposed grout mix design was used.
    - f. Submit anticipated volumes of grout to be pumped for each application and reach grouted.

**1.7 CLOSEOUT SUBMITTALS [NOT USED]**

**1.8 MAINTENANCE MATERIAL SUBMITTALS [NOT USED]**

**1.9 QUALITY ASSURANCE [NOT USED]**

**1.10 DELIVERY, STORAGE, AND HANDLING**

- A. Storage and Handling Requirements
  1. Protect and salvage all materials such that no damage occurs during delivery to the Authority.

**1.11 FIELD [SITE] CONDITIONS [NOT USED]**

**1.12 WARRANTY [NOT USED]**

**PART 2 - PRODUCTS**

**2.1 AUTHORITY-FURNISHED [OR] AUTHORITY-SUPPLIED PRODUCTS [NOT USED]**

**2.2 MATERIALS**

1. Grout Mixes
  - a. Low Density Cellular Grout (LDCC)
    - 1) Decommissioning pipeline grout shall be LDCC.
    - 2) The LDCC shall be Portland cement-based grout mix with the addition of a foaming agent designed for this application.
    - 3) Develop 1 or more grout mixes designed to completely fill the annular space based on the following requirements:
      - 1) Provide adequate retardation to completely fill the annular space in 1 monolithic pour.
      - 2) Provide less than 1 percent shrinkage by volume.
      - 3) Compressive Strength
        - (a) Minimum strength of 10 psi in 24 hours, 300 psi in 28 days
      - 4) Design grout mix with the proper density and use proper methods to prevent floating of the carrier pipe.
      - 5) Proportion grout to flow and to completely fill all voids within the carrier pipe.
  2. End Seals
    - a. Provide end seals at each end of the pipeline to be decommissioned to contain the grout backfill or to close the ends to prevent the inflow of water or soil.
    - b. Design end seals to withstand the anticipated soil or grouting pressure and be watertight to prevent groundwater from entering the casing.

**2.3 ACCESSORIES [NOT USED]**

**2.4 SOURCE QUALITY CONTROL [NOT USED]**

**PART 3 - EXECUTION**

**3.1 INSTALLERS [NOT USED]**

**3.2 EXAMINATION [NOT USED]**

**3.3 PREPARATION [NOT USED]**

**3.4 REMOVAL, SALVAGE, AND ABANDONMENT**

- A. General
  1. Manhole Decommissioning
    - a. All manholes that are to be taken out of service are to be decommissioned unless specifically requested and/or approved by Authority.
    - b. Excavate and backfill in accordance with Section 33 05 10.
    - c. Remove and salvage manhole frame and cover as coordinated with Authority.
    - d. Deliver salvaged material to the Authority.



- e. Cut and plug sewer lines to be Decommissioned.
  - f. Backfill manhole void in accordance as shown on plans.
    - 1) NOT USED.
- B. Sanitary Sewer Lines and Appurtenances
1. Sanitary Sewer Line Abandonment Plug
    - a. Excavate and backfill in accordance with Section 33 05 10.
    - b. Remove and dispose of any sewage.
    - c. Plug with CLSM in accordance with Section 03 34 13.
  2. Sanitary Sewer Line Decommission by Grouting
    - a. Excavate and backfill in accordance with Section 33 05 10.
    - b. Dewater and dispose of any sewage from the existing line to be grouted.
    - c. Fill line with Low Density Cellular Grout in accordance with Section 33 05 24 or CLSM in accordance with 03 34 13.
    - d. Dispose of any excess material.
  3. Sanitary Sewer Line Removal
    - a. Excavate and backfill in accordance with Section 33 05 10.
    - b. Cut existing line from the utility system prior to removal.
    - c. Cut any services prior to removal.
    - d. Remove existing pipe line and properly dispose as approved by Authority.
  4. Sanitary Sewer Manholes Removal
    - a. Excavate and backfill in accordance with Section 33 05 10.
    - b. Remove and salvage manhole frame and cover.
    - c. Deliver salvaged material to the location designated by the Authority.
    - d. Demolish and remove entire concrete manhole.
    - e. Cut and plug sewer lines to be abandoned.
  5. Sanitary Sewer Junction Structure Removal
    - a. Excavate and backfill in accordance with Section 33 05 10.
    - b. Remove and salvage manhole frame and cover.
    - c. Deliver salvaged material to the location designated by the Authority.
    - d. Demolish and remove concrete structure as shown on the plans.
    - e. Cut and plug sewer lines to be abandoned.
  6. Backfill Decommissioned pipe with Grout
    - a. After the carrier pipe is removed from service, the remaining space (all voids) inside the carrier pipe shall be filled with LDCC grout.
      - 1) Grout shall be pumped through a pipe or hose.
      - 2) Use grout pipes, or other appropriate materials, to avoid damage to carrier pipe during grouting.
  7. Injection of LDCC Grout
    - a. Grout injection pressure shall not exceed the carrier pipe manufacturer's approved recommendations or 5 psi (whichever is lower).
    - b. Pumping equipment shall be of a size sufficient to inject grout at a volume, velocity and pressure compatible with the size/volume of the space.
    - c. Once grouting operations begin, grouting shall proceed uninterrupted, unless grouting procedures require multiple stages.
    - d. Grout placements shall not be terminated until the estimated annular volume of grout has been injected.

**3.5 REPAIR / RESTORATION [NOT USED]**

**3.6 RE-INSTALLATION [NOT USED]**

**3.7 FIELD [OR] SITE QUALITY CONTROL**

- A. Reports and Records required

1. Maintain and submit daily logs of grouting operations.
    - a. Include:
      - 1) Grouting locations
      - 2) Pressures
      - 3) Volumes
      - 4) Grout mix pumped
      - 5) Time of pumping
  2. Note any problems or unusual observations on logs.
- B. Grout Strength Tests
1. Authority will perform testing for 24-hour and 28-day compressive strength tests for the cylinder molds or grout cubes obtained during grouting operations.
  2. Authority will perform field sampling during annular space grouting.
    - a. Authority will collect at least one (1) set of four (4) cylinder molds or grout cubes for each 100 cubic yards of grout injected but not less than one (1) set for each grouting shift.
    - b. Authority will perform 24-hour and 28-day compressive strength tests per ASTM C39 (cylindrical specimens) or ASTM C109 (cube specimens).
    - c. Remaining samples shall be tested as directed by the Authority.

**3.8 SYSTEM STARTUP [NOT USED]**

**3.9 ADJUSTING [NOT USED]**

**3.10 CLEANING [NOT USED]**

**3.11 CLOSEOUT ACTIVITIES [NOT USED]**

**3.12 PROTECTION [NOT USED]**

**3.13 MAINTENANCE [NOT USED]**

**3.14 ATTACHMENTS [NOT USED]**

**END OF SECTION**

**DIVISION 34**  
**TRANSPORTATION**



**PART 1 - GENERAL**

**1.1 SUMMARY**

- A. Section Includes:
  - 1. Installation of Traffic Control Devices and preparation of Traffic Control Plans
- B. Deviations from this Standard Specification
  - 1. None.
- C. Related Specification Sections include, but are not necessarily limited to:
  - 1. Division 0 – Bidding Requirements, Contract Forms and Conditions of the Contract
  - 2. Division 1 – General Requirements

**1.2 PRICE AND PAYMENT PROCEDURES**

- A. Measurement and Payment
  - 1. Installation of Traffic Control Devices
    - a. Measurement
      - 1) Measurement for Traffic Control Devices shall be per month for the Project duration.
        - a) A month is defined as 30 calendar days.
    - b. Payment
      - 1) The work performed and materials furnished in accordance with this Item and measured as provided under “Measurement” shall be paid for at the unit price bid for “Traffic Control”.
    - c. The price bid shall include:
      - 1) Traffic Control implementation
      - 2) Installation
      - 3) Maintenance
      - 4) Adjustments
      - 5) Replacements
      - 6) Removal
      - 7) Police assistance during peak hours

2. Portable Message Signs
  - a. Measurement
    - 1) Measurement for this Item shall be per week for the duration of use.
  - b. Payment
    - 1) The work performed and materials furnished in accordance to this Item and measured as provided under "Measurement" shall be paid for at the unit price bid per week for "Portable Message Sign" rental.
  - c. The price bid shall include:
    - 1) Delivery of Portable Message Sign to Site
    - 2) Message updating
    - 3) Sign movement throughout construction
    - 4) Return of the Portable Message Sign post-construction.
3. Preparation of Traffic Control Plan Details
  - a. Measurement
    - 1) Measurement for this Item be per each Traffic Control Detail prepared.
  - b. Payment
    - 1) The work performed and materials furnished in accordance with this Item shall be paid for at the unit price bid per each "Traffic Control Detail" prepared.
  - c. The price bid shall include:
    - 1) Preparing the Traffic Control Plan Details for closures of 24 hours or longer
    - 2) Adherence to City and Texas Manual on Uniform Traffic Control Devices (TMUTCD)
    - 3) Obtaining the signature and seal of a licensed Texas Professional Engineer
    - 4) Incorporation of City comments

### 1.3 REFERENCES

#### A. Reference Standards

1. Reference standards cited in this Specification refer to the current reference standard published at the time of the latest revision date logged at the end of this Specification unless a date is specifically cited.
2. Texas Manual on Uniform Traffic Control Devices (TMUTCD).
3. Item 502, Barricades, Signs, and Traffic Handling of the Texas Department of Transportation, Standard Specifications for Construction and Maintenance of Highways, Streets, and Bridges.

#### **1.4 ADMINISTRATIVE REQUIREMENTS**

- A. Coordination
  - 1. Contact Traffic Services Division (972-219-5027) a minimum of 48 hours prior to implementing Traffic Control within 500 feet of a traffic signal.
- B. Sequencing
  - 1. Any deviations to the Traffic Control Plan included in the Drawings must be first approved by the City and design Engineer before implementation.

#### **1.5 SUBMITTALS**

- A. Provide the City with a current list of qualified flaggers before beginning flagging activities. Use only flaggers on the qualified list.
- B. Obtain a Street Use Permit from the Street Management Section of the Traffic Engineering Division, 151 W. Church Street. The Traffic Control Plan (TCP) for the Project shall be as detailed on the Traffic Control Plan Detail sheets of the Drawing set. A copy of this Traffic Control Plan shall be submitted with the Street Use Permit.
- C. Traffic Control Plans shall be signed and sealed by a licensed Texas Professional Engineer.
- D. Contractor shall prepare Traffic Control Plans if required by the Drawings or Specifications. The Contractor will be responsible for having a licensed Texas Professional Engineer sign and seal the Traffic Control Plan sheets.
- E. Lane closures 24 hours or longer shall require a site-specific traffic control plan.
- F. Contractor responsible for having a licensed Texas Professional Engineer sign and seal changes to the Traffic Control Plan(s) developed by the Design Engineer.
- G. Design Engineer will furnish standard details for Traffic Control.

**1.6 ACTION SUBMITTALS/INFORMATIONAL SUBMITTALS [NOT USED]**

**1.7 CLOSEOUT SUBMITTALS [NOT USED]**

**1.8 MAINTENANCE MATERIAL SUBMITTALS [NOT USED]**

**1.9 QUALITY ASSURANCE [NOT USED]**

**1.10 DELIVERY, STORAGE, AND HANDLING [NOT USED]**

**1.11 FIELD [SITE] CONDITIONS [NOT USED]**

**1.12 WARRANTY [NOT USED]**

## **PART 2 - PRODUCTS**

**2.1 OWNER-FURNISHED [OR] OWNER-SUPPLIED PRODUCTS [NOT USED]**

**2.2 ASSEMBLIES AND MATERIALS**

A. Description

1. Regulatory Requirements

- a. Provide Traffic Control Devices that conform to details shown on the Drawings, the TMUTCD, and TxDOT's Compliant Work Zone Traffic Control Device List (CWZTCDL).

2. Materials

- a. Traffic Control Devices must meet all reflectivity requirements included in the TMUTCD and TxDOT Specifications – Item 502 at all times during construction.
- b. Electronic message boards shall be provided in accordance with the TMUTCD.

**2.3 ACCESSORIES [NOT USED]**

**2.4 SOURCE QUALITY CONTROL [NOT USED]**

## **PART 3 - EXECUTION**

**3.1 EXAMINATION [NOT USED]**

**3.2 PREPARATION**

A. Protection of In-Place Conditions

- 1. Protect existing traffic signal equipment.

**3.3 INSTALLATION**

A. Follow the Traffic Control Plan (TCP) and install Traffic Control Devices as shown on the Drawings and as directed.

B. Install Traffic Control Devices straight and plumb.



- C. Do not make changes to the location of any device or implement any other changes to the Traffic Control Plan without the approval of the Engineer.
  - 1. Minor adjustments to meet field constructability and visibility are allowed.
- D. Maintain Traffic Control Devices by taking corrective action as soon as possible.
  - 1. Corrective action includes but is not limited to cleaning, replacing, straightening, covering, or removing Devices.
  - 2. Maintain the Devices such that they are properly positioned, spaced, and legible, and that retroreflective characteristics meet requirements during darkness and rain.
- E. If the Inspector discovers that the Contractor has failed to comply with applicable federal and state laws (by failing to furnish the necessary flagmen, warning devices, barricades, lights, signs, or other precautionary measures for the protection of persons or property), the Inspector may order such additional precautionary measures be taken to protect persons and property.
- F. Subject to the approval of the Inspector, portions of this Project, which are not affected by or in conflict with the proposed method of handling traffic or utility adjustments, can be constructed during any phase.
- G. Barricades and signs shall be placed in such a manner as to not interfere with the sight distance of drivers entering the highway from driveways or side streets.
- H. To facilitate shifting, barricades and signs used in lane closures or traffic staging may be erected and mounted on portable supports.
  - 1. The support design is subject to the approval of the Engineer.
- I. Lane closures shall be in accordance with the approved Traffic Control Plans.
- J. If at any time the existing traffic signals become inoperable as a result of construction operations, the Contractor shall provide portable stop signs with 2 orange flags, as approved by the Engineer, to be used for Traffic Control.
- K. Contractor shall make arrangements for police assistance to direct traffic if traffic signal turn-ons, street light pole installation, or other construction will be done during peak traffic times (AM: 7 am – 9 am, PM: 4 pm - 6 pm).
- L. Flaggers
  - 1. Provide a Contractor representative who has been certified as a flagging instructor through courses offered by the Texas Engineering Extension Service, the American Traffic Safety Services Association, the National Safety Council, or other approved organizations.
    - a. Provide the certificate indicating course completion when requested.
    - b. This representative is responsible for training and assuring that all flaggers are qualified to perform flagging duties.

2. A qualified flagger must be independently certified by 1 of the organizations listed above or trained by the Contractor's certified flagging instructor.
3. Flaggers must be courteous and able to effectively communicate with the public.
4. When directing traffic, flaggers must use standard attire, flags, signs, and signals and follow the flagging procedures set forth in the TMUTCD.
5. Provide and maintain flaggers at such points and for such periods of time as may be required to provide for the safety and convenience of public travel and Contractor's personnel, and as shown on the Drawings or as directed by the Engineer.
  - a. These flaggers shall be located at each end of the lane closure.

M. Removal

1. Upon completion of Work, remove from the Site all barricades, signs, cones, lights and other Traffic Control Devices used for work-zone traffic handling in a timely manner, unless otherwise shown on the Drawings.

- 3.4 REPAIR / RESTORATION [NOT USED]**
- 3.5 RE-INSTALLATION [NOT USED]**
- 3.6 FIELD [OR] SITE QUALITY CONTROL [NOT USED]**
- 3.7 SYSTEM STARTUP [NOT USED]**
- 3.8 ADJUSTING [NOT USED]**
- 3.9 CLEANING [NOT USED]**
- 3.10 CLOSEOUT ACTIVITIES [NOT USED]**
- 3.11 PROTECTION [NOT USED]**
- 3.12 MAINTENANCE [NOT USED]**
- 3.13 ATTACHMENTS [NOT USED]**

**END OF SECTION**