1. **Description.**

This Section will govern the installation of water and wastewater facilities owned by the City of Fort Worth. The Contractor and approved Subcontractors will construct all required utility adjustments within the limits of this project including any peripheral adjustments that may not have been discovered during the design process. Any references in this specification to the City approving, directing or accepting shall be construed to mean the Engineer. These adjustments shall be paid for directly as detailed below:

1.2001 Water Line Grouting – Per Cubic Yard
1.2002 6” Water Abandonment Plug – per Each
1.2003 8” Water Abandonment Plug – per Each
1.2004 12” Water Abandonment Plug – per Each
1.2005 24” Water Abandonment Plug – per Each
1.2006 Remove 6” Water Valve – per Each
1.2007 Remove 8” Water Valve – per Each
1.2008 Remove 12” Water Valve – per Each
1.2009 Salvage Fire Hydrant – per Each
1.2010 Salvage 1” Water Meter – per Each
1.2011 Salvage 1-1/2” Water Meter – per Each
1.2012 Salvage 2” Water Meter – per Each
1.2013 Salvage Water Sampling Station – per Each
1.2014 Remove Concrete Water Vault – per Each
1.2015 Sanitary Line Grouting – per Cubic Yard
1.2016 10” Sewer Abandonment Plug – per Each
1.2017 36” Sewer Abandonment Plug – per Each
1.2018 42” Sewer Abandonment Plug – per Each
1.2019  Remove 4’ Sewer Manhole – per Each
1.2020  Remove 5’ Sewer Manhole – per Each
1.2021  Remove Sewer Junction Structure – per Lump Sum
1.2022  SWPPP 2 1 Acre – per Lump Sum
1.2023  Temporary Asphalt Paving Repair – per Linear Foot
1.2024  6” Concrete Paving Repair – per Square Yard
1.2025  11” Concrete Paving Repair – per Square Yard
1.2026  4” Concrete Sidewalk – per Square Foot
1.2027  7” Concrete Driveway – per Square Foot
1.2028  7” Concrete Curb and Gutter – per Linear Foot
1.2029  4” Solid Pavement Marking Paint (Y) – per Linear Foot
1.2030  Raised Marker, Type W – per Each
1.2031  Seeding, Hydromulch – per Square Yard
1.2032  Pre-CCTV Inspection – per Linear Foot
1.2033  Post-CCTV Inspection – per Linear Foot
1.2034  Manhole Vacuum Testing – per Each
1.2035  Bypass Pumping – per Lump Sum
1.2036  Exploratory Excavation of Existing Utilities – per Each
1.2037  Trench Safety – per Linear Foot
1.2038  Utility Markers – per Lump Sum
1.2039  Concrete Collar – per Each
1.2040  24” Casing by Other than Open Cut – per Linear Foot
1.2041  42” Casing by Other than Open Cut – per Linear Foot
1.2042 60” Casing/Tunnel Liner Plate by Other than Open Cut – per Linear Foot
1.2038 12” Water Carrier Pipe – per Linear Foot
1.2044 24” Water Carrier Pipe – per Linear Foot
1.2045 42” Sewer Carrier Pipe – per Linear Foot
1.2046 Ductile Iron Water Fittings – per Ton
1.2047 C303 Fittings – per Lump Sum
1.2048 Hydrocarbon Resistant Gaskets – per Lump Sum
1.2049 6” DIP Water – per Linear Foot
1.2050 12” DIP Water – per Linear Foot
1.2051 24” Water Pipe – per Linear Foot
1.2052 Fire Hydrant – per Each
1.2053 Water Sampling Station – per Each
1.2054 Connect to Existing 10” Water Main – per Each
1.2055 Connect to Existing 12” Water Main – per Each
1.2056 Connect to Existing 24” Water Main – per Each
1.2057 1” Water Service, Meter Relocation – per Each
1.2058 1” Water Service – per Each
1.2059 1” Private Service – per Linear Foot
1.2060 1-1/2” Water Service, Meter Relocation – per Each
1.2061 1-1/2” Water Service – per Each
1.2062 1-1/2” Private Service – per Linear Foot
1.2063  2” Water Service, Meter Relocation – per Each
1.2064  2” Water Service – per Each
1.2065  2” Private Service – per Linear Foot
1.2066  6” Gate Valve – per Each
1.2067  12” Gate Valve – per Each
1.2068  24” Gate Valve and Vault – per Each
1.2069  6” Sewer Service – per Each
1.2070  12” DIP Sewer – per Linear Foot
1.2071  42” Fiberglass Sewer Pipe – per Linear Foot
1.2072  Epoxy Manhole Liner – per Vertical Foot
1.2073  4’ Manhole – per Each
1.2074  4’ Extra Depth Manhole – per Vertical Foot
1.2075  5’ Extra Depth Manhole – per Vertical Foot
1.2076  5’ Type A Manhole – per Each
1.2077  5’ Fiberglass Type A Manhole – per Each
1.2078  Sanitary Sewer Junction Structure – per Lump Sum
1.2079  Traffic Control – per Month

2.
01 45 23 – Testing and Inspection Services
01 50 00 – Temporary Facilities and Controls
01 55 26 – Street Use Permit and Modifications to Traffic Control
01 57 13 – Storm Water Pollution Prevention
01 60 00 – Product Requirements
01 66 00 – Product Storage and Handling Requirements
01 71 23 – Construction Staking and Survey
01 74 23 – Cleaning
01 77 19 – Closeout Requirements
01 78 23 – Operation and Maintenance Data
01 78 39 – Project Record Documents
02 41 13 – Selective Site Demolition
02 41 14 – Utility Removal/Abandonment
02 41 15 – Paving Removal
03 30 00 – Cast-in-Place Concrete
03 34 13 – Controlled Low Strength Material (CLSM)
03 34 16 – Concrete Base Material for Trench Repair
03 80 00 – Modifications to Existing Concrete Structures
31 10 00 – Site Clearing
31 23 23 – Borrow
31 25 00 – Erosion and Sediment Control
32 01 18 – Temporary Asphalt Paving Repair
32 01 29 – Concrete Paving Repair
32 11 23 – Flexible Base Courses
32 11 29 – Lime Treated Base Courses
32 12 16 – Asphalt Paving
32 13 13 – Concrete Paving
32 13 20 – Concrete Sidewalks, Driveways and Barrier Free Ramps
32 13 73 – Concrete Paving Joint Sealants
32 16 13 – Concrete Curb and Gutters and Valley Gutters
32 17 23 – Pavement Markings
32 92 13 – Hydromulching, Seeding and Sodding
33 01 30 – Sewer and Manhole Testing
33 01 31 – Closed Circuit Television (CCTV) Inspection
33 03 10 – Bypass Pumping of Existing Sewer Systems
33 04 40 – Cleaning and Acceptance Testing of Water Mains
33 05 10 – Utility Trench Excavation, Embedment, and Backfill
33 05 13 – Frame, Cover, and Grade Rings
33 05 14 – Adjusting Manholes, Inlets, Valve Boxes, and Other Structures to Grade
33 05 16 – Concrete Water Vaults
33 05 17 – Concrete Collars
33 05 20 – Auger Boring
33 05 21 – Tunnel Liner Plate
33 05 22 – Steel Casing Pipe
33 05 23 – Hand Tunneling
33 05 24 – Installation of Carrier Pipe in Casing or Tunnel Liner Plate
33 05 26 – Utility Markers/Locators
33 05 30 – Exploratory Excavation for Existing Utilities
33 11 10 – Ductile Iron Pipe
33 11 11 – Ductile Iron Fittings
33 11 12 – Polyvinyl Chloride (PVC) Pressure Pipe
33 11 13 – Concrete Pressure Pipe, Bar-Wrapped, Steel Cylinder Type
33 12 10 – Water Services 1-inch to 2-inch
33 12 20 – Resilient Seated (Wedge) Gate Valve
33 12 25 – Connection to Existing Water Mains
33 12 40 – Dry-Barrel Fire Hydrants
33 12 50 – Water Sample Stations
33 31 13 – Fiberglass Reinforced Pipe for Gravity Sanitary Sewers
33 31 20 – Polyvinyl Chloride (PVC) Gravity Sanitary Sewer Pipe
33 31 50 – Sanitary Sewer Service Connections and Service Line
33 39 10 – Cast-in-Place Concrete Manhole
33 39 20 – Precast Concrete Manhole
33 39 60 – Epoxy Liners for Sanitary Sewer Structures
34 71 13 – Traffic Control
SECTION 01 45 23
TESTING AND INSPECTION SERVICES

PART 1 - GENERAL

1.1 SUMMARY
   A. Section Includes:
      1. Testing and inspection services procedures and coordination
   B. Deviations from this City of Fort Worth 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. Work associated with this Item is considered subsidiary to the various Items bid.
         No separate payment will be allowed for this Item.
         a. Contractor is responsible for performing, coordinating, and payment of all
            Quality Control testing.
         b. City is responsible for performing and payment for first set of Quality
            Assurance testing.
            1) If the first Quality Assurance test performed by the City fails, the
               Contractor is responsible for payment of subsequent Quality Assurance
               testing until a passing test occurs.
               a) Final acceptance will not be issued by City until all required payments
                  for testing by Contractor have been paid in full.

1.3 REFERENCES [NOT USED]

1.4 ADMINISTRATIVE REQUIREMENTS
   A. Testing
      1. Complete testing in accordance with the Contract Documents.
      2. Coordination
         a. When testing is required to be performed by the City, notify City, sufficiently
            in advance, when testing is needed.
         b. When testing is required to be completed by the Contractor, notify City,
            sufficiently in advance, that testing will be performed.
      3. Distribution of Testing Reports
         a. Electronic Distribution
            1) Confirm development of Project directory for electronic submittals to be
               uploaded to City’s Buzzsaw site, or another external FTP site approved by
               the City.
2) Upload test reports to designated project directory and notify appropriate
City representatives via email of submittal posting.
3) Hard Copies
   a) 1 copy for all submittals submitted to the Project Representative
   b) Hard Copy Distribution (if required in lieu of electronic distribution)
   1) Tests performed by City
      a) Distribute 1 hard copy to the Contractor
   2) Tests performed by the Contractor
      a) Distribute 3 hard copies to City’s Project Representative
4. Provide City’s Project Representative with trip tickets for each delivered load of
Concrete or Lime material including the following information:
   a. Name of pit
   b. Date of delivery
   c. Material delivered

B. Inspection
   1. Inspection or lack of inspection does not relieve the Contractor from obligation to
perform work in accordance with the Contract Documents.

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]

PART 3 - EXECUTION [NOT USED]

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SECTION 01 50 00
TEMPORARY FACILITIES AND CONTROLS

PART 1 - 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. Deviations from this City of Fort Worth 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. 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.

B. 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

C. 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.
      a. Place materials and equipment to permit easy access for identification,
         inspection and inventory.
   4. 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.
   5. Fill and grade site for temporary structures to provide drainage away from
      temporary and existing buildings.
   6. Remove building from site prior to Final Acceptance.

D. Temporary Fencing
   1. Provide and maintain for the duration or construction when required in contract
      documents

E. 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

F. 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]

PART 2 - PRODUCTS [NOT USED]

PART 3 - 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]
3.6 RE-INSTALLATION
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 MAINTENANCE [NOT USED]

3.14 ATTACHMENTS [NOT USED]

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SECTION 01 55 26
STREET USE PERMIT AND MODIFICATIONS TO TRAFFIC CONTROL

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Administrative procedures for:
      a. Street Use Permit
      b. Modification of approved traffic control
      c. Removal of Street Signs

B. Deviations from this City of Fort Worth 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 34 71 13 – Traffic Control

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

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.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Traffic Control
   1. General
      a. When traffic control plans are included in the Drawings, provide Traffic
         Control in accordance with Drawings and Section 34 71 13.
      b. When traffic control plans are not included in the Drawings, prepare traffic
         control plans in accordance with Section 34 71 13 and submit to City for
         review.
         1) Allow minimum 10 working days for review of proposed Traffic Control.

B. Street Use Permit
   1. Prior to installation of Traffic Control, a City Street Use Permit is required.
      a. To obtain Street Use Permit, submit Traffic Control Plans to City
         Transportation and Public Works Department.
1) Allow a minimum of 5 working days for permit review.
2) Contractor’s responsibility to coordinate review of Traffic Control plans for Street Use Permit, such that construction is not delayed.

C. Modification to Approved Traffic Control
   1. Prior to installation traffic control:
      a. Submit revised traffic control plans to City Department Transportation and Public Works Department.
      1) Revise Traffic Control plans in accordance with Section 34 71 13.
      2) Allow minimum 5 working days for review of revised Traffic Control.
      3) It is the Contractor’s responsibility to coordinate review of Traffic Control plans for Street Use Permit, such that construction is not delayed.

D. Removal of Street Sign
   1. If it is determined that a street sign must be removed for construction, then contact City Transportation and Public Works Department, Signs and Markings Division to remove the sign.

E. Temporary Signage
   1. In the case of regulatory signs, replace permanent sign with temporary sign meeting requirements of the latest edition of the Texas Manual on Uniform Traffic Control Devices (MUTCD).
   2. Install temporary sign before the removal of permanent sign.
   3. When construction is complete, to the extent that the permanent sign can be reinstalled, contact the City Transportation and Public Works Department, Signs and Markings Division, to reinstall the permanent sign.

F. Traffic Control Standards
   1. Traffic Control Standards can be found on the City’s Buzzsaw website.

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]

PART 3 - EXECUTION [NOT USED]

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Revision Log
SECTION 01 57 13

STORM WATER POLLUTION PREVENTION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Procedures for Storm Water Pollution Prevention Plans

B. Deviations from this City of Fort Worth 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
      a. 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

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. 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]

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Revision Log
SECTION 01 60 00

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. A listing of the approved products for use in the City

B. Deviations from this City of Fort Worth 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 [NOT USED]

1.3 REFERENCES [NOT USED]

1.4 ADMINISTRATIVE REQUIREMENTS

A. A list of City approved products for use is attached to this Section.

B. 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 Engineer.

C. 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.

D. 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.

E. 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]

PART 2 - PRODUCTS [NOT USED]

PART 3 - EXECUTION [NOT USED]

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Revision Log
SECTION 01 66 00
PRODUCT STORAGE AND HANDLING REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Scheduling of product delivery
   2. Packaging of products for delivery
   3. Protection of products against damage from:
      a. Handling
      b. Exposure to elements or harsh environments

B. Deviations from this City of Fort Worth 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. 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 [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 AND HANDLING

   A. Delivery Requirements
      1. Schedule delivery of products or equipment as required to allow timely installation
         and to avoid prolonged storage.
      2. Provide appropriate personnel and equipment to receive deliveries.
      3. Delivery trucks will not be permitted to wait extended periods of time on the Site
         for personnel or equipment to receive the delivery.
4. Deliver products or equipment in manufacturer's original unbroken cartons or other containers designed and constructed to protect the contents from physical or environmental damage.

5. Clearly and fully mark and identify as to manufacturer, item and installation location.

6. Provide manufacturer's instructions for storage and handling.

B. Handling Requirements

1. Handle products or equipment in accordance with these Contract Documents and manufacturer’s recommendations and instructions.

C. Storage Requirements

1. Store materials in accordance with manufacturer’s recommendations and requirements of these Specifications.

2. Make necessary provisions for safe storage of materials and equipment.
   a. Place loose soil materials and materials to be incorporated into Work to prevent damage to any part of Work or existing facilities and to maintain free access at all times to all parts of Work and to utility service company installations in vicinity of Work.

3. Keep materials and equipment neatly and compactly stored in locations that will cause minimum inconvenience to other contractors, public travel, adjoining owners, tenants and occupants.
   a. Arrange storage to provide easy access for inspection.

4. Restrict storage to areas available on construction site for storage of material and equipment as shown on Drawings, or approved by the Engineer.

5. Provide off-site storage and protection when on-site storage is not adequate.
   a. Provide addresses of and access to off-site storage locations for inspection by City’s Project Representative.

6. Do not use lawns, grass plots or other private property for storage purposes without written permission of owner or other person in possession or control of premises.

7. Store in manufacturers’ unopened containers.

8. Neatly, safely and compactly stack materials delivered and stored along line of Work to avoid inconvenience and damage to property owners and general public and maintain at least 3 feet from fire hydrant.


10. Repair or replace damaged lawns, sidewalks, streets or other improvements to satisfaction of City’s Project Representative.
   a. Total length which materials may be distributed along route of construction at one time is 1,000 linear feet, unless otherwise approved in writing by the Engineer.
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 [NOT USED]

3.4 ERECTION [NOT USED]

3.5 REPAIR / RESTORATION [NOT USED]

3.6 RE-INSTALLATION [NOT USED]

3.7 FIELD [or] SITE QUALITY CONTROL

A. Tests and Inspections
   1. Inspect all products or equipment delivered to the site prior to unloading.

B. Non-Conforming Work
   1. Reject all products or equipment that are damaged, used or in any other way unsatisfactory for use on the project.

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

A. Protect all products or equipment in accordance with manufacturer’s written directions.

B. Store products or equipment in location to avoid physical damage to items while in storage.

C. Protect equipment from exposure to elements and keep thoroughly dry if required by the manufacturer.

3.13 MAINTENANCE [NOT USED]

3.14 ATTACHMENTS [NOT USED]

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1
SECTION 01 71 23
CONSTRUCTION STAKING AND SURVEY

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes:
   1. Requirements for construction staking and surveying.

B. Deviations from this City of Fort Worth Standard Specification
   1. 1.4.A
   2. 3.4

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. 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. Construction Stakes
   1. Construction staking will be performed by the Contractor.
   2. Coordination
      a. Contact City’s Project Representative to coordinate sequencing of Construction
         Staking.
   3. General
      a. It is the Contractor’s responsibility to coordinate staking such that construction
         activities are not delayed or negatively impacted.
      b. Contractor is responsible for preserving and maintaining stakes.
      c. If in the opinion of the City, a sufficient number of stakes or markings have
         been lost, destroyed or disturbed, by Contractor’s neglect such that the
         contracted Work cannot take place, then the Contractor will be required to re-
         stake the Work area.

1.5 SUBMITTALS

A. Submittals, if required, shall be in accordance with Section 01 33 00.
   1. All submittals shall be approved by the Engineer prior to delivery.

1.6 ACTION SUBMITTALS/INFORMATIONAL SUBMITTALS

A. Certificates
1. Provide certificate certifying that elevations and locations of improvements are in
conformance or non-conformance with requirements of the Contract Documents.
   a. Certificate must be sealed by a registered professional land surveyor in the
      State of Texas.

B. Field Quality Control Submittals
   1. Documentation verifying accuracy of field engineering work

1.7 CLOSEOUT SUBMITTALS [NOT USED]

1.8 MAINTENANCE MATERIAL SUBMITTALS [NOT USED]

1.9 QUALITY ASSURANCE
   A. Use adequate numbers of skilled workmen who are thoroughly trained and experienced
      in the necessary crafts and who are completely familiar with the specified requirements
      and the methods needed for proper performance of the Work.

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. Verify location and protect control points before commencing Work.
   B. Notify City’s Project Representative immediately of any discrepancies discovered.

3.4 APPLICATION
   A. Construction Survey
      1. Project Record Survey
         a. Contractor shall maintain complete and accurate log of control and survey
            Work as it progresses. Including, but not limited to the following items:
            1) All: Rim and flowline elevations and coordinates for each manhole or
               junction structure
            2) Water Lines: Top of pipe elevations and coordinates at the following
               intervals:
               a) Every 250 linear feet
               b) Horizontal and vertical points of inflection, curvature, etc. (all fittings)
               c) Cathodic Protection test stations
               d) Sampling stations
               e) Meter boxes/vaults (all sizes)
3) Sanitary Sewer Lines: Top of pipe elevations and coordinates at the
following intervals:
   a) Every 250 linear feet
   b) Horizontal and vertical points of inflection, curvature, etc.
   c) Cleanouts

b. Upon completion of Project Record Survey, provide City with digital GIS file
   of all required attributes for review.

2. Control of Line of Grade
   a. Maintain complete and accurate log of control and survey work associated with
      meeting or exceeding the line and grade required by these Specifications.
   b. Confirm that all established benchmarks and control points provided for the
      Contractor’s use are accurate.
      1) Use these benchmarks to furnish and maintain all reference lines and grades
         for tunneling.
      2) Use lines and grades to establish the location of the pipe using a laser or
         theodolite guidance system.
      3) Submit to the City copies of field notes used to establish all lines and
         grades and allow the City to check guidance system setup prior to
         beginning each tunneling drive.
      4) Provide access for the City to verify the guidance system and the line and
         grade of the carrier pipe on a daily.
      5) The Contractor remains fully responsible for the accuracy of the work and
         the correction of it, as required.
      6) Monitor line and grade continuously during construction.
      7) Record deviation with respect to design line and grade once at each pipe
         joint and submit daily records to City.
      8) If the installation does not meet the specified tolerances, immediately notify
         the City and correct the installation in accordance with the Contract
         Documents.

3.5 REPAIR / RESTORATION [NOT USED]

3.6 RE-INSTALLATION [NOT USED]

3.7 FIELD [or] SITE QUALITY CONTROL

A. Preserve permanent reference points during progress of the Work.
B. Do not change or relocate reference points without approval from the Engineer.
C. Utilize recognized engineering survey practices.
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]

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Revision Log
SECTION 01 74 23
CLEANING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Intermediate and final cleaning for Work not including special cleaning of closed
      systems specified elsewhere
   B. Deviations from this City of Fort Worth 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 92 13 – Hydro-Mulching, Seeding and Sodding

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. Scheduling
   1. Schedule cleaning operations so that dust and other contaminants disturbed by
      cleaning process will not fall on newly painted surfaces.
   2. Schedule final cleaning upon completion of Work and immediately prior to final
      inspection.

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 STORAGE, AND HANDLING

A. Storage and Handling Requirements
   1. Store cleaning products and cleaning wastes in containers specifically designed for
      those materials.
PART 2 - PRODUCTS

2.1 OWNER-FURNISHED [or] OWNER-SUPPLIED PRODUCTS [NOT USED]

2.2 MATERIALS

A. Cleaning Agents
   1. Compatible with surface being cleaned
   2. New and uncontaminated
   3. For manufactured surfaces
      a. Material recommended by manufacturer

PART 3 - EXECUTION

3.1 INSTALLERS [NOT USED]

3.2 EXAMINATION [NOT USED]

3.3 PREPARATION [NOT USED]

3.4 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. Prevent accumulation of wastes that create hazardous conditions.
   2. Conduct cleaning and disposal operations to comply with laws and safety orders of governing authorities.
   3. Do not dispose of volatile wastes such as mineral spirits, oil or paint thinner in storm or sanitary drains or sewers.
   4. Dispose of degradable debris at an approved solid waste disposal site.
   5. Dispose of nondegradable debris at an approved solid waste disposal site or in an alternate manner approved by the Engineer and regulatory agencies.
6. Handle materials in a controlled manner with as few handlings as possible.
7. Thoroughly clean, sweep, wash and polish all Work and equipment associated with
   this project.
8. Remove all signs of temporary construction and activities incidental to construction
   of required permanent Work.
9. If project is not cleaned to the satisfaction of the City, the City reserves the right to
   have the cleaning completed at the expense of the Contractor.
10. Do not burn on-site.

B. Intermediate Cleaning during Construction
1. Keep Work areas clean so as not to hinder health, safety or convenience of
   personnel in existing facility operations.
2. At maximum weekly intervals, dispose of waste materials, debris and rubbish.
3. Confine construction debris daily in strategically located container(s):
   a. Cover to prevent blowing by wind
   b. Store debris away from construction or operational activities
   c. Haul from site at a minimum of once per week
4. Vacuum clean interior areas when ready to receive finish painting.
   a. Continue vacuum cleaning on an as-needed basis, until Final Acceptance.
5. Prior to storm events, thoroughly clean site of all loose or unsecured items, which
   may become airborne or transported by flowing water during the storm.

C. Interior Final Cleaning
1. Remove grease, mastic, adhesives, dust, dirt, stains, fingerprints, labels and other
   foreign materials from sight-exposed surfaces.
2. Wipe all lighting fixture reflectors, lenses, lamps and trims clean.
3. Wash and shine glazing and mirrors.
4. Polish glossy surfaces to a clear shine.
5. Ventilating systems
   a. Clean permanent filters and replace disposable filters if units were operated
      during construction.
   b. Clean ducts, blowers and coils if units were operated without filters during
      construction.
6. Replace all burned out lamps.
7. Broom clean process area floors.
8. Mop office and control room floors.

D. Exterior (Site or Right of Way) Final Cleaning
1. Remove trash and debris containers from site.
   a. Re-seed areas disturbed by location of trash and debris containers in accordance
      with Section 32 92 13.
2. Sweep roadway to remove all rocks, pieces of asphalt, concrete or any other object
   that may hinder or disrupt the flow of traffic along the roadway.
3. Clean any interior areas including, but not limited to, vaults, manholes, structures,
   junction boxes and inlets.
4. If no longer required for maintenance of erosion facilities, and upon approval by the Engineer, remove erosion control from site.

5. Clean signs, lights, signals, etc.

3.11 CLOSEOUT ACTIVITIES [NOT USED]

3.12 PROTECTION [NOT USED]

3.13 MAINTENANCE [NOT USED]

3.14 ATTACHMENTS [NOT USED]

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Revision Log
SECTION 01 77 19
CLOSEOUT REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. The procedure for closing out a contract

B. Deviations from this City of Fort Worth 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. 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. Guarantees, Bonds and Affidavits
   1. No application for final payment will be accepted until all guarantees, bonds, certificates, licenses and affidavits required for Work or equipment as specified are satisfactorily filed with the City.

B. Release of Liens or Claims
   1. No application for final payment will be accepted until satisfactory evidence of release of liens has been submitted to the City.

1.5 SUBMITTALS

A. Submit all required documentation to City’s Project Representative.
1.6 INFORMATIONAL SUBMITTALS [NOT USED]

1.7 CLOSEOUT SUBMITTALS [NOT USED]

PART 2 - PRODUCTS [NOT USED]

PART 3 - EXECUTION

3.1 INSTALLERS [NOT USED]

3.2 EXAMINATION [NOT USED]

3.3 PREPARATION [NOT USED]

3.4 CLOSEOUT PROCEDURE

A. Prior to requesting Final Inspection, submit:
   1. Project Record Documents in accordance with Section 01 78 39
   2. Operation and Maintenance Data, if required, in accordance with Section 01 78 23

B. Prior to requesting Final Inspection, perform final cleaning in accordance with Section 01 74 23.

C. Final Inspection
   1. After final cleaning, provide notice to the City Project Representative that the Work is completed.
      a. The City will make an initial Final Inspection with the Contractor present.
      b. Upon completion of this inspection, the City will notify the Contractor, in writing within 10 business days, of any particulars in which this inspection reveals that the Work is defective or incomplete.
   2. Upon receiving written notice from the City, immediately undertake the Work required to remedy deficiencies and complete the Work to the satisfaction of the City.
   3. Upon completion of Work associated with the items listed in the City’s written notice, inform the City, that the required Work has been completed. Upon receipt of this notice, the City, in the presence of the Contractor, will make a subsequent Final Inspection of the project.
   4. Provide all special accessories required to place each item of equipment in full operation. These special accessory items include, but are not limited to:
      a. Specified spare parts
      b. Adequate oil and grease as required for the first lubrication of the equipment
      c. Initial fill up of all chemical tanks and fuel tanks
      d. Light bulbs
      e. Fuses
      f. Vault keys
      g. Handwheels
      h. Other expendable items as required for initial start-up and operation of all equipment

D. Notice of Project Completion
1. Once the City Project Representative finds the Work subsequent to Final Inspection to be satisfactory, the City will issue a Notice of Project Completion (Green Sheet).

E. Supporting Documentation
1. Coordinate with the City Project Representative to complete the following additional forms:
   a. Final Payment Request
   b. Statement of Contract Time
   c. Affidavit of Payment and Release of Liens
   d. Consent of Surety to Final Payment
   e. Pipe Report (if required)
   f. Contractor's Evaluation of City
   g. Performance Evaluation of Contractor

F. Letter of Final Acceptance
1. Upon review and acceptance of Notice of Project Completion and Supporting Documentation, in accordance with General Conditions, City will issue Letter of Final Acceptance and release the Final Payment Request for payment.

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]

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29
SECTION 01 78 23

OPERATION AND MAINTENANCE DATA

PART 1 - 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. Deviations from this City of Fort Worth 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. 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 Submittal Procedures. All
   submittals shall be approved by the Engineer 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 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]

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Revision Log
SECTION 01 78 39
PROJECT RECORD DOCUMENTS

PART 1 - 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
   2. Deviations from this City of Fort Worth Standard Specification
      1. None.
   3. 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 [NOT USED]

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 Engineer’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]

PART 2 - 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]

PART 3 - 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”.

CITY OF FORT WORTH
STANDARD CONSTRUCTION SPECIFICATION DOCUMENTS
Revised July 1, 2011
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
         Engineer’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
         Engineer’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 Engineer,
      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 Engineer, 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 Engineer.

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]

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Revision Log
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. Standard Details
   1. Paving Removal and Selective Site Demolition – Removal Pay Limits

C. Deviations from City of Fort Worth Standards
   1. None

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 31 23 23 - Fill.

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.
b. Remove Steps: full compensation for saw cutting, removal, hauling, disposal, tools, equipment, labor and incidentals needed to execute work.
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.
d. Remove Driveway: full compensation for saw cutting, removal, hauling, disposal, tools, equipment, labor and incidentals needed to remove improved driveway by type.
e. Remove Fence: full compensation for removal, hauling, disposal, tools, equipment, labor and incidentals needed to remove fence.
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.
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.

h. Remove Mailbox: full compensation for removal, hauling, disposal, tools, equipment, labor and incidentals needed to execute work.
i. Remove Rip Rap: full compensation for saw cutting, removal, hauling, disposal, tools, equipment, labor and incidentals needed to execute work.
j. Remove Miscellaneous Concrete Structure: full compensation for saw cutting, removal, hauling, disposal, tools, equipment, labor and incidentals needed to execute work.

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 wheel chair 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 the Engineer or as shown on plans.
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]

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0SECTION 02 41 14

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 City of Fort Worth 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
   6. Section 33 11 11 – Ductile Iron Fittings
   7. Section 33 11 13 – Concrete Pressure Pipe, Bar-wrapped Pipe, 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. 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
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
   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”.

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Draft 5/14/2012 2:56 PM
Revised July 1, 2011
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 cast iron lid 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 materials
      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 cast iron lid 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) Pavement removal
3) Excavation
4) Hauling
5) Disposal of excess materials
6) Furnishing, placement and compaction of backfill
7) 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
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 cast iron lid 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 cast iron lid 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 cast iron lid 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 sizes

b. Payment
   2) Various sizes

   c. The price bid shall include:
      1) Removal and disposal of inlet
      2) Pavement removal
      3) Excavation
      4) Hauling
      5) Disposal of excess materials
      6) Furnishing, placement and compaction of backfill
      7) Clean-up

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”.

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Draft 5/14/2012 2:56 PM
Revised July 1, 2011
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
   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
      4) Hauling
      5) Disposal of excess materials
      6) Furnishing, placement and compaction of backfill
      7) Clean-up

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. 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 pipe line and properly dispose as approved by the Engineer.

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.

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 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 pipe line and properly dispose as approved by the Engineer.
   4. Sanitary Sewer Manholes Removal
      a. Excavate and backfill in accordance with Section 33 05 10.
      b. Remove and salvage manhole lid.
      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.
   5. Sanitary Sewer Junction Structure Removal
      a. Excavate and backfill in accordance with Section 33 05 10.
      b. Remove and salvage manhole lid.
      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.

C. 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 pipe line and properly dispose as approved by the Engineer.

4. Storm Sewer Manholes Removal
   a. Excavate and backfill in accordance with Section 33 05 10.
   b. Demolish and remove entire concrete manhole.
   c. Cut and plug storm sewer lines to be abandoned.

5. 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.

6. 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.

7. 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 pipe line and properly dispose as approved by the Engineer.

8. 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.

9. Storm Sewer Trench Drain Removal
   a. Excavate and backfill in accordance with Section 33 05 10.
   b. Remove existing pipe line and dispose as approved by the Engineer.

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]

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SECTION 02 41 15
PAVING REMOVAL

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes
1. Removing concrete paving, asphalt paving and brick paving.
2. Removing concrete curb and gutter.
3. Removing concrete valley gutter.
5. Pulverization of existing pavement.

B. Deviations from City of Fort Worth 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 33 - Cement Treated Base Course

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.
   b. Remove Asphalt Paving: full compensation for saw cutting, removal, hauling, disposal, tools, equipment, labor and incidentals needed to execute work.
   c. Remove Brick Paving: full compensation for saw cutting, removal, salvaging, cleaning, hauling, disposal, tools, equipment, labor and incidentals needed to execute work.
d. Remove Concrete Curb and Gutter: full compensation for saw cutting, removal, hauling, disposal, tools, equipment, labor and incidentals needed to execute work.

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.

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 Effort (12 400 ft-lbf/ft3 (600 kN-m/m3))
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 the Engineer 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.

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 Engineer.
   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 Stock pile
      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]

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Revised July 1, 2011
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
      f. Suspended slabs
      g. Blocking

B. Deviations from this City of Fort Worth 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. 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):

5. ASTM International (ASTM):
   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.
   i. C42, Standard Test Method for Obtaining and Testing Drilled Cores and Sawed Beams of Concrete.
   o. C172, Standard Practice for Sampling Freshly Mixed Concrete.
   q. C231, Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method.
u. C618, Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete.


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, blockouts, 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 Engineer 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. ¾-inch x ¾-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
damproofing 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 supports
            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, ¾-
         inch x 1-inch.
      b. Available Products
         1) Colloid Environmental Technologies Company; Volclay Waterstop-RX
         2) Concrete Sealants Inc.; Conseat CS-231
         3) Greenstream; 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.; Hornecure 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, condi-
            tions, 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 Overlay
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 per-
cent
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 0.1 percent by
weight of cement.

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 - 1/1000 times 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.

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 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 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.
      c) Vertical alignment of outside corner of exposed corner columns and control joint grooves in concrete exposed to view - 1/4 inch in 10 feet.
      d) 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 of 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: ± 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 75 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 reshole 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. Reshole 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 laintance, 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 reshope to avoid damage to concrete.
   Locate and provide adequate reshoring to support construction without excessive stress or deflection.

E. Steel Reinforcement
   a. Do not cut or puncture vapor retarding. Repair damage and rescale vapor retarding 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: ±3/8 inch
      2) Members more than 8 inches deep: ±1/2 inch
   b. Concrete Cover to Formed or Finished Surfaces: ±3/8 inches for members 8 inches deep or less; ±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


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. **Curb:** 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, spills, 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.

   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.

   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 Contractor's 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 work day after finishing.
   b. Slabs shall be level within a tolerance of ± 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: ± ¾ inch
      2) Top surfaces of formed slabs measured prior to removal of supporting
         shores: ± ¾ inch
      3) Top surfaces of all other slabs: ± ¾ inch
      4) Slabs specified to slope shall have a tolerance from the specified slope of
         3/8 inch in 10 feet at any point, up to ¾ 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 re-
      placed 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

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Revision Log
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 Fort Worth 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.
   3. C39 - Standard Test Method for Compressive Strength of Cylindrical Concrete
      Specimens.
   5. C231 - Standard Test Method for Air Content of Freshly Mixed Concrete by the
      Pressure Method.
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 Engineer 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.

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.


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

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<th>Specific Gravity</th>
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<td>Fly Ash</td>
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<td>Fine Aggregate</td>
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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 ± 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]

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SECTION 03 34 16
CONCRETE BASE MATERIAL FOR TRENCH REPAIR

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes:
   1. Concrete base material for trench repair
B. Deviations from this City of Fort Worth 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.
   3. C39, Standard Test Method for Compressive Strength of Cylindrical Concrete
      Specimens.
   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.
   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 Engineer 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.


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.
   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]

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SECTION 03 80 00

MODIFICATIONS TO EXISTING CONCRETE STRUCTURES

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes:
   1. Modifications to existing concrete structures, including:
      a. Manholes
      b. Junction boxes
      c. Vaults
      d. Retaining walls
      e. Wing and head walls
      f. Culverts
   2. This section does not include modifications to Reinforced Concrete Pipe.

B. Deviations from this City of Fort Worth 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. 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.
         Concrete.
      c. C882, Standard Test Method for Bond Strength of Epoxy-Resin Systems Used
         with Concrete by Slant Sheer.

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 Engineer 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]

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
      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.

C. Steel Reinforcement
   1. Reinforcing Bars
      a. ASTM A615, Grade 60, deformed.

D. Epoxy Bonding Agent
   1. 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.

   2. Properties of the cured material
      a. Compressive Strength (ASTM D695)
         1) 8,500 psi minimum at 28 days
      b. Tensile Strength (ASTM D638)
         1) 4,000 psi minimum at 14 days
      c. Flexural Strength (ASTM D790 - Modulus of Rupture)
         1) 6,300 psi minimum at 14 days
      d. Shear Strength (ASTM D732)
         1) 5,000 psi minimum at 14 days
      e. Water Absorption (ASTM D570 - 2 hour boil)
         1) 1 percent maximum at 14 days
      f. Bond Strength (ASTM C882) Hardened to Plastic
         1) 1,500 psi minimum at 14 days moist cure
      g. Color
         1) Gray
      h. Available Manufacturers:
         1) Sika Corporation, Lyndhurst, New Jersey - Sikadur 32, Hi-Mod
         2) BASF, Cleveland, Ohio - Concrese 1438

E. Epoxy Paste
   1. 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.

   2. Properties of the cured material
      a. Compressive Properties (ASTM D695): 10,000 psi minimum at 28 days
b. Tensile Strength (ASTM D638): 3,000 psi minimum at 14 days. Elongation at
   Break - 0.3 percent minimum

c. Flexural Strength (ASTM D790 - Modulus of Rupture): 3,700 psi minimum at
   14 days

d. Shear Strength (ASTM D732): 2,800 psi minimum at 14 days

e. Water Absorption (ASTM D570): 1.0 percent maximum at 7 days

f. Bond Strength (ASTM C882): 2,000 psi at 14 days moist cure

g. Color: Concrete grey

h. Available Manufacturers
   1) Overhead Applications
      a) Sika Corporation, Lyndhurst, New Jersey - Sikadur 32, Hi-Mod LV
      b) BASF - Concresis 1438
   2) All Other Applications
      a) Sika Corporation, Lyndhurst, New Jersey - Sikadur Hi-mod LV 31
      b) BASF - Concresis 1401

F. Repair Mortars
   1. Provide an asbestos free, moisture insensitive, polymer-modified, Portland cement-
      based cementitious trowel grade mortar for repairs on horizontal or vertical
      surfaces.
      a. Available Manufacturers
         1) Sika Corporation, Lyndhurst New Jersey - SikaTop 122
         2) BASF – Emaco Nanocrete R3

G. Pipe Penetration Sealants
   1. 1 component polyurethane, extrudable swelling bentonite-free waterstop that is
      chemically resistant, not soluble in water and capable of withstanding wet/dry
      cycling.
      a. Available Manufacturers
         1) Sika Corporation, Lyndhurst New Jersey – SikaSwell S-2
         2) Approved equal

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. 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, jack-hammering, 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]

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SECTION 31 10 00
SITE CLEARING

PART 1 - GENERAL

1.2 PRICE AND PAYMENT PROCEDURES

A. Measurement and Payment
1. Site Clearing
   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 “Site Clearing”.
   c. The price bid shall include:
      1) Pruning of designated trees and shrubs
      2) Removal and disposal of trees, structures and obstructions
      3) Backfilling of holes
      4) Clean-up

2. Tree Removal
   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 “Tree Removal” for:
            a) Various caliper ranges
   c. The price bid shall include:
      1) Pruning of designated trees and shrubs
      2) Removal and disposal of structures and obstructions
      3) Grading and backfilling of holes
1) Measurement for this Item shall be per each.
2) The work performed and the materials furnished in accordance with this Item shall be paid for at the unit price bid per each “Tree Transplant” for:
3) Various caliper ranges
4) The price bid shall include:
5) Pruning of designated trees and shrubs
6) Removal and disposal of structures and obstructions
7) Moving tree with truck mounted tree spade
8) Grading and backfilling of holes
9) Replanting tree at temporary location (determined by Contractor)
10) Maintaining tree until Work is completed
11) Replanting tree into original or designated location
12) Excavation
13) Fertilization
14) Clean-up

1.3 REFERENCES [NOT USED]

1.4 ADMINISTRATIVE REQUIREMENTS

A. Permits
1. Contractor shall obtain Tree Removal Permits and Urban Forestry Permits when required by the City Ordinance No. 18615-05-2009.

B. Preinstallation Meetings
1. Hold a preliminary site clearing meeting and include the Contractor, City Arborist, City Inspector, and the 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 with a Disposal Letter in accordance to Division 01.

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 City, the Engineer and the Landowner, if necessary, to confirm trees to be
saved.

3.4 INSTALLATION

A. Protection of Trees

1. Protect designated trees and prune trees and shrubs as shown on the Drawings.
Refer to the Drawings for tree protection details.

2. If the Drawings do not provide tree protection details, protected trees shall be
fenced by placing 6-foot tall metal T-posts in a square around the tree trunk with
the corners located on the canopy drip line, unless instructed otherwise.

3. When site conditions do not allow for the T-posts to be installed at the drip line, the
T-posts may be installed no less than 8 feet from the tree trunk. 4-foot high 12½
gauge stock fencing or orange plastic snow fence shall be attached to the T-posts to
form the enclosure.

4. Do not park equipment, service equipment, store materials, or disturb the root area
under the branches of trees designated for preservation.

5. When shown on the Drawings, treat cuts on trees with an approved tree wound
dressing within 20 minutes of making a pruning cut or otherwise causing damage to
the tree.

6. Trees and brush shall be mulched on-site.
   a. 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.

5. In areas to be excavated, remove obstructions to 2 feet below the excavation level.

6. In all other areas, remove obstructions to 1 foot below natural ground.

7. 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]
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3.14 ATTACHMENTS [NOT USED]

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SECTION 31 23 23
BORROW

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Furnish, place and compact Borrow material for grading.
B. Deviations from this City of Fort Worth 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
      a. Measurement
         1) Measurement for this Item shall be by the cubic yard of loose Borrow
            material as delivered to the Site and recorded by truck ticket provided to the
            City.
         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” delivered to the Site for:
               a) Various Borrow materials
               c. The price shall include:
                  1) Furnishing, placing, compacting and finishing Borrow
                  2) Hauling
                  3) Reworking
                  4) Disposal of excess or waste material
                  5) 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 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
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 Engineer 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

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Revision Log

22

23
SECTION 31 25 00
EROSION AND SEDIMENT CONTROL

PART 1 - GENERAL

1.3 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. Deviations from this City of Fort Worth 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. Storm Water Pollution Prevention Plan <1 acre

      a. Measurement

      1) This Item is considered subsidiary to the various Items bid.

      b. Payment

      1) The work performed and the materials furnished in accordance with this Item are subsidiary to the structure or Items being bid and no other compensation will be allowed.

   2. Storm Water Pollution Prevention Plan ≥ 1 acre

      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 “SWPPP ≥ 1 acre”.

      c. The price bid shall include:

         1) Preparation of SWPPP

         2) Implementation

         3) Permitting fees

         4) Installation

         5) Maintenance

2. 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:
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
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

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<tr>
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<tr>
<td>100</td>
<td>80 percent</td>
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<tr>
<td>200</td>
<td>95 percent</td>
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G. Temporary Sediment Control Fence

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 wood or steel posts with a minimum length of 48 inches, unless otherwise shown on the Drawings.
      2) Soft wood posts must be at least 3 inches in diameter or nominal 2 x 4 inch
      3) Hardwood posts must have a minimum cross-section of 1-1/2 x 1-1/2 inch
      4) 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.

#### 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 City, 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]

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SECTION 32 01 18
TEMPORARY ASPHALT PAVING REPAIR

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes
1. Utility cuts (water, sanitary sewer, drainage, etc.) along streets programmed for
total reconstruction under a Capital Improvement Program or resurfacing under a
Street Maintenance Program.
2. Repairs of damage caused by CONTRACTOR.
3. Any other temporary pavement repair needed during the course of construction.

B. Deviations from City of Fort Worth 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.
4. Section 32 12 16 - Asphalt Paving.
5. Section 33 05 10 - Utility Trench Excavation, Embedment and Backfill.

1.2 PRICE AND PAYMENT PROCEDURES

A. Measurement and Payment
1. Measurement:
a. Temporary Asphalt Paving Repair: measure by the linear foot.
2. Payment: Contract unit price bid for the work performed and all materials
furnished. No payment for repairs of damage to adjacent pavement caused by
Contractor.

1.3 REFERENCES

A. Definitions
1. H.M.A.C. – Hot Mix Asphalt Concrete

1.4 ADMINISTRATIVE REQUIREMENTS

A. Permitting
1. Obtain Street Use Permit to make utility cuts in the street from the Transportation
and Public Works Department in conformance with current ordinances.
2. The Transportation and Public Works Department will inspect the paving repair
after construction.
1.5 SUBMITTALS [NOT USED]

1.6 ACTION SUBMITTALS/INFORMATIONAL SUBMITTALS

A. Asphalt Pavement Mix Design: submit for approval. Section 32 12 16.

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 mixture when the roadway surface temperature is 40 degrees F or higher and rising unless otherwise approved.

1.12 WARRANTY [NOT USED]

PART 2 - PRODUCTS

2.1 OWNER-FURNISHED [NOT USED]

2.2 MATERIALS

A. Backfill: see Section 33 05 10.

B. Base Material:

1. Flexible Base: Use existing base and add new flexible base as required in accordance with Section 32 11 23.

C. Asphalt Concrete: See Section 32 12 16.

1. H.M.A.C. paving: Type D.

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. Removal:

1. Use an approved method that produces a neat edge.

2. Use care to prevent fracturing existing pavement structure adjacent to the repair area.
B. Base
   1. Install flexible base material per detail.
   2. See Section 32 11 23.
C. Asphalt Paving
   1. H.M.A.C. placement: in accordance with Section 32 12 16.
   2. Type D surface mix.

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]

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SECTION 32 01 29
CONCRETE PAVING REPAIR

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes concrete pavement repair to include but not limited to:
   1. Utility cuts (water, sanitary sewer, drainage, etc.).
   2. Warranty work.
   3. Repairs of damage caused by CONTRACTOR.
   4. Any other concrete pavement repair needed during the course of construction.

B. Deviations from City of Fort Worth 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 01 18 - Temporary Asphalt Paving Repair.
   4. Section 32 12 16 - Asphalt Paving.
   5. Section 32 13 13 - Concrete Paving.
   6. Section 33 05 10 - Utility Trench Excavation, Embedment and Backfill.

1.2 PRICE AND PAYMENT PROCEDURES

A. Measurement and Payment:
   1. Measurement:
      a. Concrete Pavement Repair: measure by the square yard per thickness and type.
         a) Limits of repair based on the time of service of the existing pavement as determined by ENGINEER.
            (1) 10 years or less: repair entire panel.
            (2) Greater than 10 years: repair to limits per plans.
   2. Payment: contract unit price bid for the work performed and all materials including base material

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 Transportation and Public Works Department in conformance with current ordinances.
   2. 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. 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 P 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.
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 facture concrete adjacent to the repair area.
   3. Repairs: In true and straight lines to dimensions shown on the plans.
   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: per detail.

D. Concrete Paving:
   1. Concrete placement: in accordance with Section 32 13 13.
   2. Reinforce concrete replacement: per detail.

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
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<th>SUMMARY OF CHANGE</th>
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</tr>
</tbody>
</table>
SECTION 32 11 23
FLEXIBLE BASE COURSES

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 City of Fort Worth 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

1.2 PRICE AND PAYMENT PROCEDURES
A. Measurement and Payment
   1. Measurement: measured by the square yard of the required depth per plan of completed flexible base course by type and gradation.
   2. Payment: based on the work performed and materials placed and includes full compensation for:
      a. preparation and correction of subgrade
      b. furnishing of material
      c. hauling
      d. blading
      e. sprinkling
      f. compacting
      g. and furnishing all labor and equipment necessary to complete the work.

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/ft³ (600 kN-m/m³))
   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/INFO-NATIONAL 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 plans 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 plans 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 plans.
Table 1

<table>
<thead>
<tr>
<th>Material Requirements</th>
</tr>
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</table>

<table>
<thead>
<tr>
<th>Property</th>
<th>Test Method</th>
<th>Grade 1</th>
<th>Grade 2</th>
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<tbody>
<tr>
<td>Master gradation sieve size (% retained)</td>
<td>Tex-110-E</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2-1/2 in.</td>
<td></td>
<td>–</td>
<td>0</td>
</tr>
<tr>
<td>1-3/4 in.</td>
<td></td>
<td>0</td>
<td>0–10</td>
</tr>
<tr>
<td>7/8 in.</td>
<td></td>
<td>10–35</td>
<td>–</td>
</tr>
<tr>
<td>3/8 in.</td>
<td></td>
<td>30–50</td>
<td>–</td>
</tr>
<tr>
<td>No. 4</td>
<td></td>
<td>45–65</td>
<td>45–75</td>
</tr>
<tr>
<td>No. 40</td>
<td></td>
<td>70–85</td>
<td>60–85</td>
</tr>
<tr>
<td>Liquid limit, % max.</td>
<td>Tex-104-E</td>
<td>35</td>
<td>40</td>
</tr>
<tr>
<td>PlastiCity index, % max.</td>
<td>Tex-106-E</td>
<td>10</td>
<td>12</td>
</tr>
<tr>
<td>Wet ball mill, % max.</td>
<td></td>
<td>40</td>
<td>45</td>
</tr>
<tr>
<td>Wet ball mill, % max. increase passing the No. 40 sieve</td>
<td>Tex-116-E</td>
<td>20</td>
<td>20</td>
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<tr>
<td>Classification (V)</td>
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<td>1.1–2.3</td>
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<tr>
<td>Min. compressive strength, psi</td>
<td>Tex-117-E</td>
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<td></td>
</tr>
<tr>
<td>lateral pressure 0 psi</td>
<td></td>
<td>45</td>
<td>35</td>
</tr>
<tr>
<td>lateral pressure 15 psi</td>
<td></td>
<td>175</td>
<td>175</td>
</tr>
</tbody>
</table>

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 plans, test material in accordance with Tex-411-A.
3. Meet both the classification and the minimum compressive strength, unless otherwise shown on the plans.

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 plans, 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 plans 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% RAP by weight unless shown on plans.
      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 plans 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.
      (1) 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 Engineer.

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 plans or as directed.

3. Haul approved flexible base in clean, covered trucks.

B. Equipment

1. General: 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 plans 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 plans, while maintaining the shape of the course.

4. Where subbase or base course exceeds 6 inches in thickness, construct in two 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 plans.
   b. Multiple lifts are permitted when shown on the plans 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 plans 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 recompacted 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 plans 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

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Revision Log

24

25
SECTION 32 11 29
LIME TREATED BASE COURSES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes
1. Treating subgrade, subbase and base courses by the pulverization, addition of lime, 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 plans.

B. Deviations from City of Fort Worth 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 31 23 23 - Fill
4. Section 32 11 23 - Flexible Base Courses

1.2 PRICE AND PAYMENT PROCEDURES

A. Measurement and Payment
1. Measurement
   a. Lime.
      1) Hydrated Lime
         a) Slurry: measure by the ton (dry weight) of the hydrated lime used to prepare the slurry at the job site.
      2) Commercial Lime Slurry: measure by the ton (dry weight) as calculated from the minimum percent dry solids content of the slurry, multiplied by the weight of the slurry in tons delivered.
      3) Quicklime.
         a) Dry: measure by the ton (dry weight) of the quicklime.
         b) Slurry: measured by the ton (dry weight) of the quicklime used to prepare the slurry.
   b. Lime Treatment.
      1) Measure by the square yard of surface area.
      2) The dimensions for determining the surface area are established by the widths shown on the plans and the lengths measured at placement.

2. Payment
   a. Lime: paid for at the unit price bid and full compensation for:
      1) furnishing the material
      2) all freight involved
      3) all unloading, storing, and handling
   b. Lime Treatment: based on the work performed and placed and includes full compensation for:
1) preparing the roadbed,
2) loosening, pulverizing application of lime, water content in the slurry mixture and the mixing water
3) mixing, shaping, sprinkling, compacting, finishing, curing and maintaining
4) for manipulations required
5) and for all labor, equipment, fuels, tools and incidentals necessary to complete the work.

1.3 REFERENCES

A. Definitions
1. Hydrated Lime: dry powdered material consisting of calcium hydroxide.
2. Commercial Lime Slurry: liquid mixture of hydrated lime solids and water delivered to a project in slurry form.
3. Quicklime: dry material consisting of calcium oxide furnished in either of two grades:
   a. Grade DS – grade of “pebble” quicklime suitable for use in the preparation of slurry for wet placing.
   b. Grade S – finely graded quicklime for use only in the preparation of slurry for wet placing.

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/ft³ (600 kN-m/m³))
   b. D6938, Standard Test Method for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth)
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 Pavement Layer
   c. Tex-600-J, Sampling and Testing of Hydrated Lime, Quicklime and Commercial Lime Slurry

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 SUBMITTALAS [NOT USED]

1.9 QUALITY ASSURANCE [NOT USED]

1.10 DELIVERY AND STORAGE

A. Truck Delivered Lime
1. Each truck ticket shall bear the weight of lime measured on certified scales.
2. Submit delivery tickets, certified by supplier, that include weight with each bulk delivery of lime to the site.
1.11 SITE CONDITIONS

A. Start lime application only when the air temperature is at least 35°F and rising or is at least 40°F. Measure temperature in the shade and away from artificial heat.

B. 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 plans 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. Lime

1. Hydrated Lime
   a. pumpable suspension of solids in water
   b. solids portion of the mixture when considered as a basis of “solids content,” shall consist of principally hydrated lime of a quality and fineness sufficient to meet the chemical and physical requirements.

2. Dry Lime: Do not use unless approved by the Engineer.

3. Quicklime
   a. Use quicklime only when specified by the Engineer.
   b. dry material consisting of essentially calcium oxide.
   c. Furnished in either of two grades:
      1) Grade DS
      2) Grade S

4. Furnish lime that meets the following requirements
   a. Chemical Requirements

Table 2
Lime Chemical Requirements

<table>
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<tr>
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<th>Hydrated Lime</th>
<th>Commercial Lime Slurry</th>
<th>Quicklime</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total “active” lime content, percent by weight</td>
<td>90.0 Min</td>
<td>87.0 Min</td>
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<tr>
<td>Unhydrated lime content, percent by weight CaO</td>
<td>5.0 Max</td>
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<td>87.0 Min</td>
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<tr>
<td>“Free Water” content, percent by weight water</td>
<td>5.0 Max</td>
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b. Physical Requirements

<table>
<thead>
<tr>
<th>Table 3</th>
<th>Lime Physical Requirements</th>
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<tr>
<td><strong>Table 3</strong></td>
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<tr>
<td><strong>Lime Physical Requirements</strong></td>
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<tr>
<td>Wet Sieve Requirement, As percentage by Weight Residue:</td>
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<tr>
<td>Retained on No. 6 sieve</td>
<td>0.2 Max</td>
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<tr>
<td>Retained on No. 30 sieve</td>
<td>4.0 Max</td>
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<tr>
<td><strong>Dry Sieve Requirement, As percentage by Weight Residue:</strong></td>
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<tr>
<td>Retained on a 1-in sieve</td>
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</tr>
<tr>
<td>Retained on a 3/4 –in sieve</td>
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<tr>
<td>Retained on a No. 100 sieve</td>
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<tr>
<td>Retained on a No. 6 sieve</td>
<td>0.2 Max</td>
</tr>
</tbody>
</table>

¹ The amount total "active" lime content, as CaO, in the material retained on the No. 6 sieve must not exceed 2.0% by weight of the original quicklime.

c. Slurry Grades

<table>
<thead>
<tr>
<th>Table 4</th>
<th>Lime Slurry Grades</th>
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<tbody>
<tr>
<td><strong>Table 4</strong></td>
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<tr>
<td><strong>Lime Slurry Grades</strong></td>
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<tr>
<td>Minimum Dry Solids Contents by Percentage of the Slurry</td>
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</tr>
<tr>
<td>Grade 1</td>
<td>31</td>
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<tr>
<td>Grade 2</td>
<td>35</td>
</tr>
<tr>
<td>Grade 3</td>
<td>46</td>
</tr>
</tbody>
</table>

C. Flexible Base Courses: Furnish base material that meets the requirements of Section 32 11 26, for the type and grade shown on the plans, before the addition of lime.

D. Water: Furnish water free of industrial wastes and other objectionable material.

E. Fill: 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

A. Shape the subgrade or existing base to conform to the typical sections shown on the plans or as directed.

3.4 INSTALLATION

A. General

1. Produce a completed course of treated material containing:
a. uniform lime 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 lime treatment in single layer: 8 inches.

3. For treated subgrade exceeding 8 inches deep, pulverize, apply lime, mix, compact and finish in equal layers not exceeding 5 inches deep.

B. Equipment

1. General: 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 plans 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.


   a. Use slurry tanks equipped with agitation devices to slurry hydrated lime or quicklime on the project or other approved location.
   b. The Engineer may approve other slurrying methods.
   c. Provide a pump for agitating the slurry when the distributor truck is not equipped with an agitator.

5. 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, and uniformly mixes the materials.

C. Pulverization.

1. Pulverize or scarify existing material after shaping so that 100 percent passes a 2 1/2 inch sieve.

2. If the material cannot be uniformly processed to the required depth in a single pass, excavate and windrow the material to expose a secondary grade to achieve processing to plan depth.

D. Application of Lime.

1. Uniformly apply lime as shown on the plans or as directed.

2. Add lime at the percentage specified in plans.
3. Apply lime only on an area where mixing can be completed during the same working day.

4. Minimize dust and scattering of lime by wind. Do not apply lime when wind conditions, in the opinion of the City, cause blowing lime to become dangerous to traffic or objectionable to adjacent property owners.

5. Slurry Placement.
   a. Hydrated Lime
      1) Mix Lime with water and apply slurry
      2) Apply Type B, commercial lime slurry, with a lime percentage not less applicable for grade used
      3) Distribute lime at the rate shown on the plans
      4) Make successive passes over a measured surface of roadway until the proper moisture and lime content have been achieved.
   b. Quicklime
      1) Spread the residue for the Quicklime slurring procedure uniformly over the length of the roadway.
      2) Residue is primarily inert material with little stabilizing value; however, may contain a small amount of Quicklime particles that slake slowly. A concentration of these particles could cause the compacted stabilized material to swell during slaking.

E. Mixing.
   1. Begin mixing within 6 hours of application of lime.
   2. Hydrated lime exposed to the open air for 6 hours or more between application and mixing, or that experiences excessive loss due to washing or blowing, will not be accepted for payment.
   3. Thoroughly mix the material and lime using approved equipment.
   4. Mix until a homogeneous, friable mixture of material and lime is obtained, free from all clods and lumps.
   5. Do not mix greater than 1 inch deeper than the stabilization depth specified.
   6. Materials containing plastic clay or other materials that are not readily mixed with lime shall be mixed as thoroughly as possible at the time of lime application, brought to the proper moisture content and sealed with a pneumatic roller.
   7. Allow the mixture to cure for 72 hours or as directed by City.
   8. When pebble grade quicklime is used, allow the mixture to cure for 2 to 4 days.
   9. Sprinkle the treated materials during the mixing and curing operation to achieve adequate hydration and proper moisture content.
  10. After curing, resume mixing until a homogeneous, friable mixture is obtained.
  11. After mixing, City will 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 5.

| Table 5 |
|-------------------|---|
| Gradation Requirements (Minimum % Passing) | |
| Sieve Size | Base |
| 1-3/4 in. | 100 |
| 3/4 in. | 85 |
| No. 4 | 60 |
F. Compaction.

1. General
   a. Begin compaction immediately after final mixing.
   b. Aerate and sprinkle as necessary to provide optimum moisture content.
   c. Multiple lifts are permitted when shown on the plans or approved.
   d. Bring each layer to the moisture content directed.

2. Rolling
   a. Begin rolling longitudinally at the sides and proceed toward the center, overlapping on successive trips by at least one-half 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 or as directed.
   e. Rework, recompact, and refinsh 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.
      1) Continue work until specification requirements are met.
      2) Rework in accordance with Maintenance item of this Section.
   f. Proof roll the lime treated base course 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. Density Control
   a. Compact until the entire depth of the mixture has achieved a uniform density of not less than 95 percent of the maximum density as determined by ASTM D698.
   b. Moisture content: minus 2 to plus 4 optimum.

G. Maintenance

1. Maintain the completed soil lime base in good condition, satisfactory to the City as to grade, crown and cross section until the overlaying or next course is constructed.
2. Keep surface of the compacted course moist until covered by other base or pavement.
3. Reworking a Section.
   a. When a section is reworked within 72 hours after completion of compaction, rework the section to provide the required density.
   b. When a section is reworked more than 72 hours after completion of compaction, add additional lime at 25 percent of the percentage specified.
3. Reworking includes loosening, adding material or removing unacceptable material if necessary, mixing as directed, compacting, and finishing.

H. Finishing.
1. After completing compaction of the final course, clip, skin, or tight-blade the surface of the lime-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 until a smooth surface is attained.
4. Add small amounts of water as needed during rolling.
5. Shape and maintain the course and surface in conformity with the typical sections, lines, and grades shown on the plans or as directed.

I. Curing.
1. Cure for the minimum number of days shown in Table 6 and by 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.
   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.

Table 6
Minimum Curing Requirements Before Placing Subsequent Courses¹

<table>
<thead>
<tr>
<th>Untreated Material</th>
<th>Curing (Days)</th>
</tr>
</thead>
<tbody>
<tr>
<td>PI ≤ 35</td>
<td>2</td>
</tr>
<tr>
<td>PI &gt; 35</td>
<td>5</td>
</tr>
</tbody>
</table>

¹. Subject to the approval of the Engineer. Proof rolling may be required as an indicator of adequate curing.

2. Begin paving operations or add courses within 14 calendar days of final compaction.

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

3.6 RE-INSTALLATION [NOT USED]

3.7 QUALITY CONTROL

A. Density Test
1. City Project Representative must be on site during density testing
2. City to measure density of lime 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. In-place depth will be evaluated for each 500-foot roadway section
2. Determine in accordance with Tex-140-E in hand excavated holes.
3. For each 500-foot section, 3 phenolphthalein tests will be performed.
4. 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

<table>
<thead>
<tr>
<th>DATE</th>
<th>NAME</th>
<th>SUMMARY OF CHANGE</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Revision Log
SECTION 32 12 16
ASPHALT PAVING

PART 1 - GENERAL

1.1 SUMMARY

A. Construct a pavement layer composed of a compacted, dense-graded mixture of aggregate and asphalt binder for surface or base courses.

B. Standard Detail

1. H.M.A.C. Pavement Construction Details

C. Deviations from City of Fort Worth Standards

1. None

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 32 01 17 - Permanent Asphalt Paving Repair

1.2 PRICE AND PAYMENT PROCEDURES

A. Measurement and Payment

1. Measurement

a. Asphalt Pavement: measure by the square yard of completed and accepted asphalt pavement in its final position for various thicknesses and types.

b. H.M.A.C. Transition: measure by the ton of composite hot mix.

c. Asphalt Base Course: measure by the square yard of completed and accepted in its final position for various thicknesses.

d. H.M.A.C. Pavement Level Up: measure by the ton of completed and accepted in its final position.

e. H.M.A.C. Speed Cushion: measure by each completed and accepted in its final position.

2. Payment: Based on the work performed and all materials furnished and subsidiary work and materials include:

a. shaping and fine grading the roadbed

b. furnishing, loading and unloading, storing, hauling and handling all materials including all freight and royalty

c. traffic control for all testing

d. asphalt, aggregate, and additive

e. materials and work needed for corrective action,

f. equipment, labor, tools
g. trial batches,
h. tack coat,
i. 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)

3. ASTM International (ASTM):

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 μm (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
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

<table>
<thead>
<tr>
<th>Originally Specified High Temperature Binder Grade</th>
<th>Minimum Pavement Surface Temperatures in Degrees Fahrenheit</th>
</tr>
</thead>
<tbody>
<tr>
<td>PG64 or lower</td>
<td>Subsurface Layers or Night Paving Operations: 45</td>
</tr>
<tr>
<td>PG 70</td>
<td>Surface Layers Placed in Daylight Operations: 50</td>
</tr>
<tr>
<td>PG 76 or higher</td>
<td>Subsurface Layers or Night Paving Operations: 50</td>
</tr>
<tr>
<td></td>
<td>Surface Layers Placed in Daylight Operations: 60</td>
</tr>
</tbody>
</table>

1 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 plans, 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 plans 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 two 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 plans.
   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 plan 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 plans.
   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

<table>
<thead>
<tr>
<th>Property</th>
<th>Test Method</th>
<th>Requirement</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Coarse Aggregate</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SAC</td>
<td>AQMP</td>
<td>As shown on plans</td>
</tr>
<tr>
<td>Deleterious material, percent, max</td>
<td>Tex-217-F, Part I</td>
<td>1.5</td>
</tr>
<tr>
<td>Decantation, percent, max</td>
<td>Tex-217-F, Part II</td>
<td>1.5</td>
</tr>
<tr>
<td>Micro-Deval abrasion, percent, max</td>
<td>Tex-461-A</td>
<td>Note 1</td>
</tr>
<tr>
<td>Los Angeles abrasion, percent, max</td>
<td>Tex-410-A</td>
<td>40</td>
</tr>
<tr>
<td>Magnesium sulfate soundness, 5 cycles, percent, max</td>
<td>Tex-411-A</td>
<td>30^2</td>
</tr>
<tr>
<td>Coarse aggregate angularity, 2 crushed faces, percent, min</td>
<td>Tex 460-A, Part I</td>
<td>85^3</td>
</tr>
<tr>
<td>Flat and elongated particles @ 5:1, percent, max</td>
<td>Tex-280-F</td>
<td>10</td>
</tr>
<tr>
<td><strong>Fine Aggregate</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Linear shrinkage, percent, max</td>
<td>Tex-107-E</td>
<td>3</td>
</tr>
<tr>
<td><strong>Combined Aggregate</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sand equivalent, percent, min</td>
<td>Tex-203-F</td>
<td>45</td>
</tr>
</tbody>
</table>

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 plans.
3. Unless otherwise shown on the plans. 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 nonlisted 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 nonlisted 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 plans.
12) SAC requirements apply only to aggregates used on the surface of travel lanes, unless otherwise shown on the plans.

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 plans.
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 plans.
5) City-owned RAP, if allowed for use, will be available at the location shown on the plans.
6) When RAP is used, determine asphalt content and gradation for mixture design purposes.
7) Perform other tests on RAP when shown on the plans.
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 plans.
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

<table>
<thead>
<tr>
<th>Sieve Size</th>
<th>percent Passing by Weight or Volume</th>
</tr>
</thead>
<tbody>
<tr>
<td>3/8&quot;</td>
<td>100</td>
</tr>
<tr>
<td>#8</td>
<td>70–100</td>
</tr>
<tr>
<td>#200</td>
<td>0–30</td>
</tr>
</tbody>
</table>

Table 4
Gradation Requirements for Mineral Filler

<table>
<thead>
<tr>
<th>Sieve Size</th>
<th>percent Passing by Weight or Volume</th>
</tr>
</thead>
<tbody>
<tr>
<td>#8</td>
<td>100</td>
</tr>
<tr>
<td>#200</td>
<td>55–100</td>
</tr>
</tbody>
</table>

2. Mineral Filler. Mineral filler consists of finely divided mineral matter such as agricultural lime, crusher fines, hydrated lime, cement, or fly ash. Mineral filler is allowed unless otherwise shown on the plans. Do not use more than 2 percent hydrated lime or cement, unless otherwise shown on the plans. The plans may require or disallow specific mineral fillers. When used, provide mineral filler that:
   a. is sufficiently dry, free-flowing, and free from clumps and foreign matter;
   b. does not exceed 3 percent linear shrinkage when tested in accordance with Tex-107-E; and meets the gradation requirements in Table 4.

3. Baghouse Fines. Fines collected by the baghouse or other dust-collecting equipment may be reintroduced into the mixing drum.

4. Asphalt Binder. Furnish the type and grade of performance-graded (PG) asphalt binder specified as follows:
   a. Performance-Graded Binders. PG binders must be smooth and homogeneous, show no separation when tested in accordance with Tex-540-C, and meet Table 5 requirements.
### Table 5
Performance-Graded Binders

<table>
<thead>
<tr>
<th>Property and Test Method</th>
<th>PG 58</th>
<th>PG 64</th>
<th>PG 70</th>
<th>PG 76</th>
<th>PG 82</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average 7-day max pavement design temperature, °C¹</td>
<td>&lt; 58</td>
<td>&lt; 64</td>
<td>&lt; 70</td>
<td>&lt; 76</td>
<td>&lt; 82</td>
</tr>
<tr>
<td>Min pavement design temperature, °C¹</td>
<td>22</td>
<td>28</td>
<td>34</td>
<td>16</td>
<td>22</td>
</tr>
</tbody>
</table>

**ORIGINAL BINDER**

- Flash point, T 48, Min, °C
- Viscosity, T 316²,³
  - Max, 3.0 Pans, test temperature, °C
- Dynamic shear, T 315,⁴
  - G*/sin(d), Min, 1.00 kPa
  - Test temperature @ 10 rad/sec., °C
- Elastic recovery, D 6084, 50°F, percent
  - Min
- Mass loss, Tex-541-C, Max, percent

**ROLLING THIN-FILM OVEN (Tex-541-C)**

- Dynamic shear, T 315:
  - G*/sin(d), Min, 2.20 kPa
  - Test temperature @ 10 rad/sec., °C

---

1. ², ³, ⁴ Refer to the specific testing methods and standards used for each property.

---

**Notes:**
- Revised July 1, 2011
- Draft 5/14/2012 3:13 PM
Table 5 (continued)

Performance-Graded Binders

<table>
<thead>
<tr>
<th>Property and Test Method</th>
<th>PG 58</th>
<th>PG 64</th>
<th>PG 70</th>
<th>PG 76</th>
<th>PG 82</th>
</tr>
</thead>
<tbody>
<tr>
<td>PAV aging temperature, °C</td>
<td>-22</td>
<td>-28</td>
<td>-34</td>
<td>-16</td>
<td>-22</td>
</tr>
<tr>
<td>Dynamic shear, T 315: G*/sin(d), Max, 5000 kPa</td>
<td>25</td>
<td>22</td>
<td>19</td>
<td>28</td>
<td>25</td>
</tr>
<tr>
<td>Test temperature @ 10 rad/sec., °C</td>
<td>100</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Creep stiffness, T 313: $S$, m-value, min, 0.300</td>
<td>-12</td>
<td>-18</td>
<td>-24</td>
<td>-6</td>
<td>-12</td>
</tr>
<tr>
<td>Test temperature @ 60 sec., °C</td>
<td>-18</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Direct tension, T 314: Failure strain, min, 1.0 percent</td>
<td>-12</td>
<td>-18</td>
<td>-24</td>
<td>-6</td>
<td>-12</td>
</tr>
<tr>
<td>Test temperature @ 1.0 mm/min., °C</td>
<td>-18</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

1. Pavement temperatures are estimated from air temperatures using an algorithm contained in a Department-supplied computer program, may be 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 plans or approved, furnish CSS-1H, SS-1H, or a
      PG binder with a minimum high-temperature grade of PG 58 for tack coat
      binder in accordance with Section 2.2.A.5.

6. Additives.
   a. General:
      1) When shown on the plans, 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 plans, 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**

<table>
<thead>
<tr>
<th>Sieve Size</th>
<th>B Fine Base</th>
<th>C Coarse Surface</th>
<th>D Fine Surface</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-1/2&quot;</td>
<td>--</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>1&quot;</td>
<td>98.0–100.0</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>3/4&quot;</td>
<td>84.0–98.0</td>
<td>95.0–100.0</td>
<td>--</td>
</tr>
<tr>
<td>1/2&quot;</td>
<td>--</td>
<td>--</td>
<td>98.0–100.0</td>
</tr>
<tr>
<td>3/8&quot;</td>
<td>60.0–80.0</td>
<td>70.0–85.0</td>
<td>85.0–100.0</td>
</tr>
<tr>
<td>#4</td>
<td>40.0–60.0</td>
<td>43.0–63.0</td>
<td>50.0–70.0</td>
</tr>
<tr>
<td>#8</td>
<td>29.0–43.0</td>
<td>32.0–44.0</td>
<td>35.0–46.0</td>
</tr>
<tr>
<td>#30</td>
<td>13.0–28.0</td>
<td>14.0–28.0</td>
<td>15.0–29.0</td>
</tr>
<tr>
<td>#50</td>
<td>6.0–20.0</td>
<td>7.0–21.0</td>
<td>7.0–20.0</td>
</tr>
<tr>
<td>#200</td>
<td>2.0–7.0</td>
<td>2.0–7.0</td>
<td>2.0–7.0</td>
</tr>
</tbody>
</table>

**Design VMA**, percent Minimum

- 13.0

**Plant-Produced VMA**, percent Minimum

- 12.0

---


### Table 7
**Laboratory Mixture Design Properties**

<table>
<thead>
<tr>
<th>Property</th>
<th>Test Method</th>
<th>Requirement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Target laboratory-molded density, percent</td>
<td>Tex-207-F</td>
<td>96.0⁴</td>
</tr>
<tr>
<td>Tensile strength (dry), psi (molded to 93 percent ±1 percent density)</td>
<td>Tex-226-F</td>
<td>85–200²</td>
</tr>
<tr>
<td>Boil test³</td>
<td>Tex-530-C</td>
<td>--</td>
</tr>
</tbody>
</table>

---

1. Unless otherwise shown on the plans.
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.
4. WMA is defined as additives or processes that allow a reduction in the temperature at which asphalt mixtures are produced and placed.
5. WMA is allowed for use at the CONTRACTOR’s option unless otherwise shown on the plans.
6. Produce an asphalt mixture within the temperature range of 215 degrees F and 275 degrees F.
d. When WMA is not required as shown on plans, 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 Engineer.
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.
   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.
   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.

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; and
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; and
      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, and
      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 plans.
   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.

    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 plans
       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.

   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 plans, 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:
         1) 3 consecutive tests on any individual sieve,
         2) 4 consecutive tests on any of the sieves, or
         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.
      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.
      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 plans or allowed.

<table>
<thead>
<tr>
<th>Table 9</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Compacted Lift Thickness and Required Core Height</strong></td>
</tr>
<tr>
<td><strong>Mixture Type</strong></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>B</td>
</tr>
<tr>
<td>C</td>
</tr>
<tr>
<td>D</td>
</tr>
</tbody>
</table>


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 Operations.

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

<table>
<thead>
<tr>
<th>High-Temperature Binder Grade</th>
<th>Minimum Placement Temperature (Before Entering Paver)</th>
</tr>
</thead>
<tbody>
<tr>
<td>PG 64 or lower</td>
<td>260°F</td>
</tr>
<tr>
<td>PG 70</td>
<td>270°F</td>
</tr>
<tr>
<td>PG 76</td>
<td>280°F</td>
</tr>
<tr>
<td>PG 82 or higher</td>
<td>290°F</td>
</tr>
</tbody>
</table>

F. Compaction.

1. Use air void control unless ordinary compaction control is specified on the plans.

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 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 plans.
      3) Use additional rollers as required to remove any roller marks.
   c. Air Void Determination.
      1) Unless otherwise shown on the plans, 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 mi. 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 plans 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 plans 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 one 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 one 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

<table>
<thead>
<tr>
<th>Percent Rice</th>
<th>Percent of Contract Price Allowed</th>
</tr>
</thead>
<tbody>
<tr>
<td>89 and lower</td>
<td>remove and replace at the entire cost and expense of CONTRACTOR as directed by OWNER.</td>
</tr>
<tr>
<td>90</td>
<td>75-percent</td>
</tr>
<tr>
<td>91-93</td>
<td>100-percent</td>
</tr>
<tr>
<td>94</td>
<td>90-percent</td>
</tr>
<tr>
<td>95</td>
<td>75-percent</td>
</tr>
<tr>
<td>Over 95</td>
<td>remove and replace at the entire cost and expense of CONTRACTOR as directed by OWNER.</td>
</tr>
</tbody>
</table>

3. The amount of penalty shall be deducted from payment due to CONTRACTOR.
4. These requirements are in addition to the requirements of Section 1.2 Measurement and Payment.

C. Pavement Thickness Test.
1. City measure each core thickness by averaging at least three 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 plans.
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

<table>
<thead>
<tr>
<th>Deficiency in Thickness Determined by Cores</th>
<th>Proportional Part Of Contract Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>Greater Than 0 percent - Not More than 10 percent</td>
<td>90 percent</td>
</tr>
<tr>
<td>Greater Than 10 percent - Not More than 15 percent</td>
<td>80 percent</td>
</tr>
<tr>
<td>Greater Than 15 percent</td>
<td>remove and replace at the entire cost and expense of CONTRACTOR as directed by OWNER.</td>
</tr>
</tbody>
</table>

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 plans.
7. No additional payment over the contract unit price shall be made for any pavement of a thickness exceeding that required by the plans.
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

<table>
<thead>
<tr>
<th>DATE</th>
<th>NAME</th>
<th>SUMMARY OF CHANGE</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Revision Log
SECTION 32 13 13
CONCRETE PAVING

PART 1 - GENERAL

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
   o. C1064, Standard Test Method for Temperature of Freshly Mixed Hydraulic-Cement Concrete
   q. D698, Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lb/ft3)

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 Engineer 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 Engineer 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 Engineer.

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:
   3. Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete: ASTM C618.
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 plans 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.
      a. See following table for approved producers of epoxies and adhesives

<table>
<thead>
<tr>
<th>Pre-Qualified Producers of Epoxies and Adhesives</th>
</tr>
</thead>
<tbody>
<tr>
<td>Product Name</td>
</tr>
<tr>
<td>Concreseive 1420</td>
</tr>
<tr>
<td>HTE-50</td>
</tr>
<tr>
<td>T 308 +</td>
</tr>
<tr>
<td>P E 1000+</td>
</tr>
<tr>
<td>C-6</td>
</tr>
<tr>
<td>Epcon G-5</td>
</tr>
<tr>
<td>Pro-Poxy-300 Fast Tube</td>
</tr>
<tr>
<td>Shep-Poxy TxIII</td>
</tr>
<tr>
<td>Ultrabond 1300 Tubes</td>
</tr>
<tr>
<td>Ultrabone 2300 N.S. A-22-2300 Slow Set</td>
</tr>
<tr>
<td>Dynapoxy EP-430</td>
</tr>
<tr>
<td>EDOT</td>
</tr>
<tr>
<td>ET22</td>
</tr>
<tr>
<td>SET 22</td>
</tr>
<tr>
<td>SpecPoxy 300FS</td>
</tr>
</tbody>
</table>

   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; and

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 plans 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 plans; the width shall be not less than that shown on the plans, 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.
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/cu. yd. and type.
      4) Dry weight of fly ash/cu. yd. and type, if used.
      5) Saturated surface dry weight of fine and coarse aggregates/cu. yd.
      6) Design water/cu. yd.
      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 the Engineer, 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 the Engineer.

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, and
      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 Engineer 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 plans or detailed specifications, the standard
      class for concrete paving for streets and alleys is shown in the following
      table.
2) Machine-Laid concrete: Class P
3) Hand-Laid concrete: Class H.

c. High Early Strength Concrete (HES).
   1) When shown on the plans 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 plans allowed.
   3) No strength overdesign is required.

   Standard Classes of Pavement Concrete

<table>
<thead>
<tr>
<th>Class of Concrete¹</th>
<th>Minimum Cementitious Lb./CY</th>
<th>28 Day Min. Compressive Strength² psi</th>
<th>Maximum Water/Cementitious Ratio</th>
<th>Course Aggregate Maximum Size inch</th>
</tr>
</thead>
<tbody>
<tr>
<td>P</td>
<td>517</td>
<td>3600</td>
<td>0.49</td>
<td>1-1/2</td>
</tr>
<tr>
<td>H</td>
<td>564</td>
<td>4500</td>
<td>0.45</td>
<td>1-1/2</td>
</tr>
</tbody>
</table>

   1. All exposed horizontal concrete shall have entrained-air.
   2. Minimum Compressive Strength Required.

   d. Slump.
   1) Slump requirements for pavement and related concrete shall be as specified in the following table.

   Concrete Pavement Slump Requirements

<table>
<thead>
<tr>
<th>Concrete Use</th>
<th>Recommended Design and Placement Slump, inch</th>
<th>Maximum Acceptable Placement Slump, inch</th>
</tr>
</thead>
<tbody>
<tr>
<td>Slip-Form/Form-Riding Paving</td>
<td>1-1/2</td>
<td>3</td>
</tr>
<tr>
<td>Hand Formed Paving</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>Sidewalk, Curb and Gutter, Concrete Valley Gutter and Other Miscellaneous Concrete</td>
<td>4</td>
<td>5</td>
</tr>
</tbody>
</table>

   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% and 85% 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 plans, 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 plans 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 plans.
   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 plans.
   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 plans.
   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 documents.

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 plans.
   b. Chairs Assembly. The chair assembly shall be similar and equal to that shown on the plans and shall be approved by the Engineer prior to extensive fabrication.
   c. After the reinforcing steel is securely installed above the subgrade as specified in plans 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 plans.

6. Epoxy for Tie and Dowel Bar Installation
   a. Epoxy bars as shown on the plans.
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 plans 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.
   a. The width of the joint shall be shown on the plans, creating the joint sealant reservoir.
   b. The depth of the joint shall be shown on the plans.
   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 plans, or as approved by the Engineer.
   b. Joints shall be of the design width, and spacing shown on the plans, or as approved by the Engineer.
   c. Dowel bars, shall be of the size and type shown on the plans, or as approved by the Engineer, 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, expansions joints shall be constructed in accordance with the details shown on the plans.
6. Transverse Contraction Joints.
   a. Contraction or dummy joints shall be installed at the locations and at the intervals shown on the plans.
   b. Joints shall be of the design width, and spacing shown on the plans, or as approved by the Engineer.
   c. Dowel bars, shall be of the size and type shown on the plans, or as approved by the Engineer, 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 plans.
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.

   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 plans.

   a. Joint filler shall be as specified in 2.21 of the size and shape shown on the
plans.
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 plans.
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 plans, 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.

<table>
<thead>
<tr>
<th>Temperature – Time Requirements</th>
</tr>
</thead>
<tbody>
<tr>
<td>Concrete Temperature (at point of placement)</td>
</tr>
<tr>
<td>------------------------------------------------</td>
</tr>
<tr>
<td>All temperatures</td>
</tr>
<tr>
<td>Agitated Concrete</td>
</tr>
<tr>
<td>Above 90°F</td>
</tr>
<tr>
<td>-</td>
</tr>
<tr>
<td>Above 75°F thru 90°F</td>
</tr>
<tr>
<td>75°F and Below</td>
</tr>
</tbody>
</table>

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

   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 plans 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 plans.
   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 Engineer 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 plans.

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 plans, and with the following additional provisions:
   a. Alley paving shall be constructed to the typical cross sections shown on the plans.
   b. Transverse expansion joints of the type shown on the plans 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 plans.
   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 plans 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 paving details 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 Engineer.
   b. Screeds will not be allowed except if approved by the Engineer.

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 plans.
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 plans.

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.

<table>
<thead>
<tr>
<th>Deficiency in Thickness Determined by Cores</th>
<th>Proportional Part Of Contract Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inches</td>
<td></td>
</tr>
<tr>
<td>0.00 – 0.20</td>
<td>100 percent</td>
</tr>
<tr>
<td>0.21 – 0.30</td>
<td>80 percent</td>
</tr>
<tr>
<td>0.31 – 0.40</td>
<td>70 percent</td>
</tr>
<tr>
<td>0.41 – 0.50</td>
<td>60 percent</td>
</tr>
</tbody>
</table>

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 plan thickness, 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 plans.

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 plans.

11. No additional payment over the contract unit price shall be made for any pavement of a thickness exceeding that required by the plans.

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, one of the cylinders shall be tested at 7 days, two cylinders shall be
tested at 28 days, and one 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% of the minimum specified strength, with
no individual core resulting in less than 90% 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.

<table>
<thead>
<tr>
<th>Percent Deficient</th>
<th>Percent of Contract Price Allowed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Greater Than 0% - Not More Than 10%</td>
<td>90-percent</td>
</tr>
<tr>
<td>Greater Than 10% - Not More Than 15%</td>
<td>80-percent</td>
</tr>
<tr>
<td>Greater Than 15%</td>
<td>0-percent or removed and replaced at the entire cost and expense of CONTRACTOR as directed by City</td>
</tr>
</tbody>
</table>

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 plans 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% 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
<table>
<thead>
<tr>
<th>DATE</th>
<th>NAME</th>
<th>SUMMARY OF CHANGE</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
SECTION 32 13 20
CONCRETE SIDEWALKS, DRIVEWAYS AND BARRIER FREE RAMPS

PART 1 - GENERAL

1.1 SUMMARY
A. Section Includes
   1. Concrete sidewalks
   2. Driveways
   3. Barrier free ramps
B. Deviations from City of Fort Worth 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 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. Measurement
      a. Concrete sidewalk: measure by the square foot of completed and accepted sidewalk in its final position by thickness and type.
      b. Driveway: measure by the square foot of completed and accepted driveway in its final position by thickness and type.
      1) From back of projected curb, including the area of the curb radii and extend to the limits specified in plans.
      2) Sidewalk portion of drive included in driveway measurement
      3) Curb on driveways included in driveway measurement.
      c. Barrier free ramps: measure by each unit of completed and accepted barrier free ramp per type by width of connecting sidewalk including:
         1) curb ramp
         2) landing and detectable warning surface as shown on the plans.
         3) adjacent flares or side curb
   2. Payment: contract unit price bid for the work performed and all materials furnished. Subsidiary work and materials include:
      a. excavating and preparing the subgrade
      b. furnishing and placing all materials
      c. manipulation, labor, tools, equipment and incidentals necessary to complete the work.

1.3 REFERENCES
A. Abbreviations and Acronyms
1. TAS – Texas Accessibility Standards
2. TDLR – Texas Department of Licensing and Regulation

B. Reference Standards
1. 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/ft3)

1.4 ADMINISTRATIVE REQUIREMENTS [NOT USED]

1.5 SUBMITTALS [NOT USED]

1.6 ACTION SUBMITTALS/INFORMATIONAL SUBMITTALS
13. B. Product Data: submit product data and sample for pre-cast detectable warning for
    barrier free ramp.

1.7 CLOSEOUT SUBMITTALS

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]

PART 2 - 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 plans or detailed specifications, the standard class
   for concrete sidewalks, driveways and barrier free ramps is shown in the following
   table.

<table>
<thead>
<tr>
<th>Class of Concrete</th>
<th>Minimum Cementitious, Lb./CY</th>
<th>28 Day Min. Compressive Strength</th>
<th>Maximum Water/Cementitious Ratio</th>
<th>Course Aggregate Maximum Size, inch</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>470</td>
<td>3000</td>
<td>0.58</td>
<td>1-1/2</td>
</tr>
</tbody>
</table>

   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.

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.
      b. Pre-molded asphalt board filler: ASTM D545.
      c. Install the required size and uniform thickness and as specified in plans.
      d. Include two 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 plans.

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. 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 plans 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.

3.4 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 plans 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 plans and details.
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 Engineer.
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.
3.5 [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

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SECTION 32 13 73
CONCRETE PAVING JOINT SEALANTS

PART 1 - GENERAL

1.0 SUMMARY

A. Section Includes

B. Standard Detail
   1. Typical Street Construction Details

C. Deviations from City of Fort Worth Standards
   1. None

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 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 OWNER FURNISHED PRODUCTS [NOT USED]

2.2 MATERIALS & EQUIPMENT

A. Materials


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 OWNER 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 City.
5. Do not allow traffic on the fresh sealant until it becomes tack-free.

F. Approval of Joints
1. The 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 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]

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END OF SECTION
SECTION 32 16 13
CONCRETE CURB AND GUTTERS AND VALLEY GUTTERS

PART 1 - GENERAL

1.1 SUMMARY
A. Section Includes
   1. Concrete Curbs and Gutters
   2. Concrete Valley Gutters
B. Standard Detail
   1. Typical Street Construction Details
C. Deviations from City of Fort Worth Standards
   1. None
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 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. Measurement
      a. Concrete Curb and Gutter: measure by the linear foot of the height specified complete and in place.
      b. Concrete Valley Gutter: measure by the square yard per thickness complete and in place.
   2. Payment: contract unit price bid for the work performed and all materials furnished.
      a. Subsidiary work and materials include:
         1) preparing the subgrade
         2) furnishing and placing all materials, including foundation course, reinforcing steel, and expansion material
         3) all manipulation, labor, tools, equipment, and incidentals necessary to complete the work.
1.3 REFERENCES [NOT USED]
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 CONDITIONS
   A. Weather Conditions: see Section 32 13 13.
1.12 WARRANTY [NOT USED]

PART 2 - PRODUCTS

2.1 OWNER FURNISHED PRODUCTS [NOT USED]

2.2 EQUIPMENT AND MATERIALS
   A. Forms: see Section 32 13 13.
   B. Concrete: see Section 32 13 13.
   C. Reinforcement: see Section 32 13 13.
   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.
         b. Pre-molded asphalt board filler: ASTM D545.
         c. Install the required size and uniform thickness and as specified in plans.
         d. Include two 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.
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


3.4 INSTALLATION

A. Forms

1. Extend forms the full depth of concrete.
2. Wood forms: minimum of 1-1/2 inches in thickness.
3. Metal Forms: a gauge that shall provide equivalent rigidity and strength.
4. Use acceptable wood or metal forms for curves with a radius of less than 250 feet.
5. All forms showing a deviation of 1/8 inch in 10 feet from a straight line shall be rejected.

B. Reinforcing Steel.

1. Place all necessary reinforcement for the Engineer approval prior to depositing concrete.
2. All steel must be free from paint and oil and all loose scale, rust, dirt and other foreign substances.
3. Remove foreign substances from steel before placing.
4. Wire all bars at their intersections and at all laps or splices.
5. Lap all bar splices a minimum of 20 diameters of the bar or 12 inches, whichever is greater.

C. Concrete Placement

1. Deposit concrete to maintain a horizontal surface.
2. Work concrete into all spaces and around any reinforcement to form a dense mass free from voids.
3. Work coarse aggregate away from contact with the forms
   a. Shape and compact subgrade to the lines, grades and cross section shown on the plans.
   b. Lightly sprinkle subgrade material immediately before concrete placement.
   c. Deposit concrete into forms.
   d. Strike off with a template 1/4 to 3/8 inch less than the dimensions of the finished curb unless otherwise approved.
   a. Hand-tamp and sprinkle subgrade material before concrete placement.
   b. Provide clean surfaces for concrete placement.
   c. Place the concrete with approved self-propelled equipment.
1) The forming tube of the extrusion machine or the form of the slipform machine must easily be adjustable vertically during the forward motion of the machine to provide variable heights necessary to conform to the established gradeline.

d. Attach a pointer or gauge to the machine so that a continual comparison can be made between the extruded or slipform work and the grade guideline.

e. Brush finish surfaces immediately after extrusion or slipforming.

6. Hand-Laid Concrete – Concrete Valley Gutter: see Section 32 13 13.

7. Expansion joints

a. Place expansion joints in the curb and gutter at 200-foot intervals and at intersection returns and other rigid structures.
b. Place tooled joints at 15-foot intervals or matching abutting sidewalk joints and pavement joints to a depth of 1 ½ inches.
c. Place expansion joints at all intersections with concrete driveways, curbs, buildings and other curb and gutters.
d. Make expansion joints no less than 1/2 inch in thickness, extending the full depth of the concrete.
e. Make expansion joints perpendicular and at right angles to the face of the curb.
f. Neatly trim any expansion material extending above the finished to the surface of the finished work.
g. Make expansion joints in the curb and gutter coincide with the concrete expansion joints.
h. Longitudinal dowels across the expansion joints in the curb and gutter are required.
i. Install 3 No. 4 round, smooth bars, 24 inches in length, for dowels at each expansion joint.
j. Coat 1/2 of the dowel with a bond breaker and terminate with a dowel cap that provides a minimum of 1 inch free expansion.
k. Support dowels by an approved method.

D. Curing: see Section 32 13 13.

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]

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SECTION 32 17 23
PAVEMENT MARKINGS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Pavement Markings
      a. Thermoplastic, hot-applied, spray (HAS) pavement markings
      b. Thermoplastic, hot-applied, extruded (HAE) pavement markings
      c. Preformed polymer tape
      d. Preformed heat-activated thermoplastic tape
      e. Painted markings
   2. Raised markers
   3. Work zone markings
   4. Removal of pavement markings and markers

B. Deviations from this City of Fort Worth 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. Pavement Markings
      a. Measurement
      1) Measurement for this Item shall be per linear foot of material placed.
      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 “Pvmt Marking” installed for:
         a) Various Widths
         b) Various Types
         c) Various Materials
         d) Various Colors
      c. The price bid shall include:
         1) Installation of Pavement Marking
         2) Glass beads, when required
         3) Surface preparation
         4) Clean-up
         5) Testing (when required)
   2. Legends
      a. Measurement
      1) Measurement for this Item shall be per each Legend installed.
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 “Legend” installed for:
      a) Various types
      b) Various applications
   c. The price bid shall include:
      1) Installation of Pavement Marking
      2) Glass beads, when required
      3) Surface preparation
      4) Clean-up
      5) Testing

3. Raised Markers
   a. Measurement
      1) Measurement for this Item shall be per each Raised Marker installed.
   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 “Raised Marker” installed
         for:
         a) Various types
   c. The price bid shall include:
      1) Installation of Raised Markers
      2) Surface preparation
      3) Clean-up
      4) Testing

4. Work Zone Tab Markers
   a. Measurement
      1) Measurement for this Item shall be per each Tab Marker installed.
   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 “Tab Marker” installed for:
         a) Various types
   c. The price bid shall include:
      1) Installation of Tab Work Zone Markers

5. Fire Lane Markings
   a. Measurement
      1) Measurement for this Item shall be per the linear foot.
   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 “Fire Lane Marking” installed.
   c. The price bid shall include:
      1) Surface preparation
      2) Clean-up
      3) Testing

6. Pavement Marking Removal
   a. Measurement
      1) Measure for this Item shall be per linear foot.
   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 Pavnt Marking” performed for:
   a) Various widths
   c. The price bid shall include:
      1) Removal of Pavment Markings
      2) Clean-up
7. Raised Marker Removal
   a. Measurement
      1) Measurement for this Item shall be per each Pavment Marker removed.
   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 “Remove Raised Marker” performed for:
         a) Various types
     c. The price bid shall include:
         1) Removal of each Marker
         2) Disposal of removed materials
         3) Clean-up
8. Legend Removal
   a. Measurement
      1) Measure for this Item shall be per each Legend 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 Legend” performed for:
         a) Various types
         b) Various applications
     c. The price bid shall include:
         1) Removal of Pavment Markings
         2) 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.
      a. Part 3, Markings
   3. American Association of State Highway and Transportation Officials (AASHTO)
      a. Standard Specification for Glass Beads Used in Pavement Markings, M 247-09
   4. Federal Highway Administration (FHWA)
      a. 23 CFR Part 655, FHWA Docket No. FHWA-2009-0139
   5. Texas Department of Transportation (TxDOT)
      a. DMS-4200, Pavement Markers (Reflectorized)
      b. DMS-4300, Traffic Buttons
      c. DMS-8220, Hot Applied Thermoplastic
      d. DMS-8240, Permanent Prefabricated Pavement Markings
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 Engineer prior to delivery and/or fabrication for specials.

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. The Contractor shall secure and maintain a location to store the material in accordance with Section 01 50 00.

1.11 FIELD [SITE] CONDITIONS [NOT USED]

1.12 WARRANTY [NOT USED]

PART 2 - PRODUCTS

2.1 OWNER-SUPPLIED PRODUCTS

A. New Products

1. Refer to Drawings to determine if there are owner-supplied products for the Project.

2.2 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. Materials

1. Pavement Markings

a. Thermoplastic, hot applied, spray

1) Refer to Drawings and City Standard Detail Drawings for width of longitudinal lines.

2) Product shall be especially compounded for traffic markings.
3) When placed on the roadway, the markings shall not be slippery when wet, lift from pavement under normal weather conditions nor exhibit a tacky exposed surface.

4) Cold ductility of the material shall permit normal road surface expansion and contraction without chipping or cracking.

5) The markings shall retain their original color, dimensions and placement under normal traffic conditions at road surface temperatures of 158 degrees Fahrenheit and below.

6) Markings shall have uniform cross-section, clean edges, square ends and no evidence of tracking.

7) The density and quality of the material shall be uniform throughout the markings.

8) The thickness shall be uniform throughout the length and width of the markings.

9) The markings shall be 95 percent free of holes and voids, and free of blisters for a minimum of 60 days after application.

10) The material shall not deteriorate by contact with sodium chloride, calcium chloride or other chemicals used to prevent roadway ice or because of the oil content of pavement markings or from oil droppings or other effects of traffic.

11) The material shall not prohibit adhesion of other thermoplastic markings if, at some future time, new markings are placed over existing material.

   a) New material shall bond itself to the old line in such a manner that no splitting or separation takes place.

12) The markings placed on the roadway shall be completely retroreflective both internally and externally with traffic beads and shall exhibit uniform retro-directive reflectance.

13) Traffic beads

   a) Manufactured from glass

   b) Spherical in shape

   c) Essentially free of sharp angular particles

   d) Essentially free of particles showing cloudiness, surface scoring or surface scratching

   e) Water white in color

   f) Applied at a uniform rate

   g) Meet or exceed Specifications shown in AASHTO Standard Specification for Glass Beads Used in Pavement Markings, AASHTO Designation: M 247-09.

b. Thermoplastic, hot applied, extruded

   1) Product shall be especially compounded for traffic markings

   2) When placed on the roadway, the markings shall not be slippery when wet, lift from pavement under normal weather conditions nor exhibit a tacky exposed surface.

   3) Cold ductility of the material shall permit normal road surface expansion and contraction without chipping or cracking.

   4) The markings shall retain their original color, dimensions and placement under normal traffic conditions at road surface temperatures of 158 degrees Fahrenheit and below.

   5) Markings shall have uniform cross-section, clean edges, square ends and no evidence of tracking.
6) The density and quality of the material shall be uniform throughout the 
markings.
7) The thickness shall be uniform throughout the length and width of the 
markings.
8) The markings shall be 95 percent free of holes and voids, and free of 
blisters for a minimum of 60 days after application.
9) The minimum thickness of the marking, as measured above the plane 
formed by the pavement surface, shall not be less than 1/8 inch in the center 
of the marking and 3/32 inch at a distance of 1/2 inch from the edge.
10) Maximum thickness shall be 3/16 inch.
11) The material shall not deteriorate by contact with sodium chloride, calcium 
chloride or other chemicals used to prevent roadway ice or because of the 
oil content of pavement markings or from oil droppings or other effects of 
traffic.
12) The material shall not prohibit adhesion of other thermoplastic markings if, 
at some future time, new markings are placed over existing material. New 
material shall bond itself to the old line in such a manner that no splitting or 
separation takes place.
13) The markings placed on the roadway shall be completely retroreflective 
both internally and externally with traffic beads and shall exhibit uniform 
retro-directive reflectance.
14) Traffic beads
   a) Manufactured from glass
   b) Spherical in shape
   c) Essentially free of sharp angular particles
   d) Essentially free of particles showing cloudiness, surface scoring or 
surface scratching
   e) Water white in color
   f) Applied at a uniform rate
   g) Meet or exceed Specifications shown in AASHTO Standard 
      Specification for Glass Beads Used in Pavement Markings, AASHTO 
      Designation: M 247-09.
   c. Preformed Polymer Tape
      1) Material shall meet or exceed the Specifications for SWARCO Director 35, 
         3M High Performance Tape Series 3801 ES, or approved equal.
   d. Preformed Heat-Activated Thermoplastic Tape
      1) Material shall meet or exceed the Specifications for HOT Tape Brand 0.125 
         mil preformed thermoplastic or approved equal.
   e. Traffic Paint
      1) Materials shall meet or exceed the TxDOT Specification DMS-8200.
2. Raised Markers
   a. Markers shall meet the requirements of the Texas Manual on Uniform Traffic 
      Control Devices.
   b. Non-reflective markers shall be Type Y (yellow body) and Type W (white 
      body) round ceramic markers and shall meet or exceed the TxDOT 
      Specification DMS-4300.
   c. The reflective markers shall be plastic, meet or exceed the TxDOT 
      Specification DMS-4200 for high-volume retroreflective raised markers and be 
      available in the following types:
      1) Type I-C, white body, 1 face reflects white
2) Type II-A-A, yellow body, 2 faces reflect amber
3) Type II-C-R, white body, 1 face reflects white, the other red

3. Work Zone Markings
   a. Tabs
      1) Temporary flexible-reflective roadway marker tabs shall meet requirements of TxDOT DMS-8242, “Temporary Flexible-Reflective Road Marker Tabs.”
      2) Removable markings shall not be used to simulate edge lines.
      3) No segment of roadway open to traffic shall remain without permanent pavement markings for a period greater than 14 calendar days.

   b. Raised Markers
      1) All raised pavement markers shall meet the requirements of DMS-4200.

   c. Striping
      1) Work Zone striping shall meet or exceed the TxDOT Specification DMS-820.

2.3 ACCESSORIES [NOT USED]

2.4 SOURCE QUALITY CONTROL

A. Performance
   1. Minimum maintained retroreflectivity levels for longitudinal markings shall meet the requirements detailed in the table below for a minimum of 30 calendar days.

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<tr>
<td>2-lane roads with centerline markings only (1)</td>
<td>n/a</td>
</tr>
<tr>
<td>All other roads (2)</td>
<td>n/a</td>
</tr>
</tbody>
</table>

(1) Measured at standard 30-m geometry in units of mcd/m²/lux.
(2) Exceptions:
   A. When raised reflective pavement markings (RRPMs) supplement or substitute for a longitudinal line, minimum pavement marking retroreflectivity levels are not applicable as long as the RRPMs are maintained so that at least 3 are visible from any position along that line during nighttime conditions.
   B. When continuous roadway lighting assures that the markings are visible, minimum pavement marking retroreflectivity levels are not applicable.

PART 3 - EXECUTION

3.1 EXAMINATION [NOT USED]

3.2 PREPARATION

A. Pavement Conditions
   1. Roadway surfaces shall be free of dirt, grease, loose and/or flaking existing markings and other forms of contamination.
   2. New Portland cement concrete surfaces shall be cleaned sufficiently to remove the curing membrane.
   3. Pavement to which material is to be applied shall be completely dry.
4. Pavement shall be considered dry, if, on a sunny day after observation for 15
   minutes, no condensation develops on the underside of a 1 square foot piece of
   clear plastic that has been placed on the pavement and weighted on the edges.
5. Equipment and methods used for surface preparation shall not damage the
   pavement or present a hazard to motorists or pedestrians.

3.3 INSTALLATION

A. General
   1. The materials shall be applied according to the manufacturer’s recommendations.
   2. Markings and markers shall be applied within temperature limits recommended by
      the material manufacturer, and shall be applied on clean, dry pavement having a
      surface temperature above 50 degrees Fahrenheit.
   3. Markings that are not properly applied due to faulty application methods or being
      placed in the wrong position or alignment shall be removed and replaced by the
      Contractor at the Contractor’s expense. If the mistake is such that it would be
      confusing or hazardous to motorists, it shall be remedied the same day of
      notification. Notification will be made by phone and confirmed by fax. Other
      mistakes shall be remedied within 5 days of written notification.
   4. When markings are applied on roadways open to traffic, care will be taken to
      ensure that proper safety precautions are followed, including the use of signs,
      cones, barricades, flaggers, etc.
   5. Freshly applied markings shall be protected from traffic damage and disfigurement.
   6. Temperature of the material must be equal to the temperature of the road surface
      before allowing traffic to travel on it.

B. Pavement Markings
   1. Thermoplastic, hot applied, spray
      a. This method shall be used to install and replace long lines – centerlines, lane
         lines, edge lines, turn lanes, and dots.
      b. Markings shall be applied at a 110 mil thickness.
      c. Markings shall be applied at a 90 mil thickness when placed over existing
         markings.
      d. Typical setting time shall be between 4 minutes and 10 minutes depending
         upon the roadway surface temperature and the humidity factor.
      e. Retroreflective raised markers shall be used to supplement the centerlines, lane
         lines, and turn lanes. Refer to City Standard Detail Drawings for placement.
      f. Minimum retroreflectivity of markings shall meet or exceed values shown in
         subparagraph 2.4.A.1 of this Specification.
   2. Thermoplastic, hot applied, extruded
      a. This method shall be used to install and replace crosswalks and stop-lines.
      b. Markings shall be applied at a 125 mil thickness.
      c. Minimum retroreflectivity of markings shall meet or exceed values shown in
         this Specification.
   3. Preformed Polymer Tape
      a. This method shall be used to install and replace crosswalks, stop-lines, and
         legends.
      b. The applied marking shall adhere to the pavement surface with no slippage or
         lifting and have square ends, straight lines and clean edges.
c. Minimum retroreflectivity of markings shall meet or exceed values shown in this Specification.

4. Preformed Heat-Activated Thermoplastic Tape
   a. This method shall be used to install and replace crosswalks, stop-lines, and legends.
   b. The applied marking shall adhere to the pavement surface with no slippage or lifting and have square ends, straight lines and clean edges.
   c. Minimum retroreflectivity of markings shall meet or exceed values shown in this Specification.

5. Traffic Paint
   a. This method shall be used to install Work Zone Markings, Parking Lot Markings and any other temporary marking application.
   b. The applied marking shall adhere to the pavement surface with no slippage or lifting and have square ends, straight lines and clean edges.
   c. Minimum retroreflectivity of markings shall meet or exceed values shown in this Specification.

C. Raised Markers
   1. All permanent raised pavement markers on Portland Cement roadways shall be installed with epoxy adhesive. Bituminous adhesive is not acceptable.
   2. All permanent raised pavement markers on new asphalt roadways may be installed with epoxy or bituminous adhesive.
   3. A chalk line, chain or equivalent shall be used during layout to ensure that individual markers are properly aligned. All markers shall be placed uniformly along the line to achieve a smooth continuous appearance.

D. Work Zone Markings
   1. Work shall be performed with as little disruption to traffic as possible.
   2. Install longitudinal markings on pavement surfaces before opening to traffic.
   3. Maintain lane alignment traffic control devices and operations until markings are installed.
   4. Install markings in proper alignment in accordance with the Texas MUTCD and as shown on the Drawings.
   5. Place standard longitudinal lines no sooner than 3 calendar days after the placement of a surface treatment, unless otherwise shown on the Drawings.
   6. Place markings in proper alignment with the location of the final pavement markings.
   7. Do not use raised pavement markers for words, symbols, shapes, or diagonal or transverse lines.
   8. All markings shall be visible from a distance of 300 feet in daylight conditions and from a distance of at least 160 feet in nighttime conditions, illuminated by low-beam automobile headlight.
   9. The daytime and nighttime reflected color of the markings must be distinctly white or yellow.
   10. The markings must exhibit uniform retroreflective characteristics.
   11. Epoxy adhesives shall not be used to work zone markings.
3.4 REMOVALS

1. Pavement Marking and Marker Removal
   a. The industry’s best practice shall be used to remove existing pavement
      markings and markers.
   b. If the roadway is being damaged during the marker removal, Work shall be
      halted until consultation with the City.
   c. Removals shall be done in such a matter that color and texture contrast of the
      pavement surface will be held to a minimum.
   d. Repair damage to asphaltic surfaces, such as spalling, shelling, etc., greater than
      ½ inch in depth resulting from the removal of pavement markings and markers.
      Driveway patch asphalt emulsion may be broom applied to reseal damage to
      asphaltic surfaces.
   e. Dispose of markers in accordance with federal, state, and local regulations.
   f. Use any of the following methods unless otherwise shown on the Drawings.
      1) Surface Treatment Method
         a) Apply surface treatment at rates shown on the Drawings or as directed.
         b) Place a surface treatment a minimum of 2 feet wide to cover the
            existing marking.
         b) Place a surface treatment, thin overlay, or microsurfacing a minimum
            of 1 lane in width in areas where directional changes of traffic are
            involved or in other areas as directed by the City.
      2) Burn Method
         a) Use an approved burning method.
         b) For thermoplastic pavement markings or prefabricated pavement
            markings, heat may be applied to remove the bulk of the marking
            material prior to blast cleaning.
         c) When using heat, avoid spalling pavement surfaces.
         d) Sweeping or light blast cleaning may be used to remove minor residue.
      3) Blasting Method
         a) Use a blasting method such as water blasting, abrasive blasting, water
            abrasive blasting, shot blasting, slurry blasting, water-injected abrasive
            blasting, or brush blasting as approved.
         b) Remove pavement markings on concrete surfaces by a blasting method
            only.
      4) Mechanical Method
         a) Use any mechanical method except grinding.
         b) Flail milling is acceptable in the removal of markings on asphalt and
            concrete surfaces.

2. If a location is to be paved over, no additional compensation will be allowed for
   marking or marker removal.

3.5 REPAIR / RESTORATION [NOT USED]

3.6 RE-INSTALLATION [NOT USED]

3.7 FIELD QUALITY CONTROL

   A. All lines must have clean edges, square ends, and be uniform cross-section.
   B. The density and quality of markings shall be uniform throughout their thickness.
C. The applied markings shall have no more than 5 percent, by area, of holes or voids and shall be free of blisters.

3.8 SYSTEM STARTUP [NOT USED]

3.9 ADJUSTING [NOT USED]

3.10 CLEANING

A. Contractor shall clean up and remove all loose material resulting from construction operations.

3.11 CLOSEOUT ACTIVITIES [NOT USED]

3.12 PROTECTION [NOT USED]

3.13 MAINTENANCE [NOT USED]

3.14 ATTACHMENTS [NOT USED]

END OF SECTION

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Revision Log
SECTION 32 92 13

HYDROMULCHING, SEEDING AND SODDING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes

1. Furnishing and installing grass sod and permanent seeding as shown on plans, or as directed.

B. Deviations from City of Fort Worth 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.

1.2 PRICE AND PAYMENT PROCEDURES

A. Measurement and Payment

1. Measurement

a. Block Sod Placement: measure by the square yard.

b. Seeding: measure by the square yard by the installation method.

c. Mowing: measure by each.

2. Payment

a. Block Sod Placement: contract unit price and total compensation for furnishing and placing all sod, rolling and tamping, watering (until established), disposal of all surplus materials, and material, labor, equipment, tools and incidentals necessary to complete the work.

b. Seeding: contract unit price and total compensation for furnishing all materials including water for seed-fertilizer, slurry and hydraulic mulching, water and mowing (until established), fertilizer, and material, labor, equipment, tools and incidentals necessary to complete the work.

c. Mowing: contract unit price and total compensation for material, labor, equipment, tools and incidentals necessary to complete the work.

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:


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 twelve 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 one hundred (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]

PART 2 - 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 Zoysiagrass.
      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:

   \[ \text{Percent Pure Live Seed} = \text{Percent Purity} \times \left( \frac{\text{Percent Germination} + \text{Percent Firm or Hard Seed}}{100} \right) \]

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

   a) not exceed ten percent by weight of the total of pure live seed (PLS) and other material in the mixture.

   b) Seed not allowed:

   (1) Johnsongrass

   (2) nutgrass seed

4) Harvest seed within 1-year prior to planting

b. Non-native Grass Seed

1) Plant between April 15 and September 10

<table>
<thead>
<tr>
<th>Lbs. PLS/Acre</th>
<th>Common Name</th>
<th>Botanical Name</th>
<th>Purity (percent)</th>
<th>Germination (percent)</th>
</tr>
</thead>
<tbody>
<tr>
<td>25</td>
<td>Bermuda (unhulled)</td>
<td>cynodon dactylon</td>
<td>85</td>
<td>90</td>
</tr>
<tr>
<td>75</td>
<td>Bermuda (hulled)</td>
<td>cynodon dactylon</td>
<td>95</td>
<td>90</td>
</tr>
</tbody>
</table>

2) Plant between September 10 and April 15

<table>
<thead>
<tr>
<th>Lbs. PLS/Acre</th>
<th>Common Name</th>
<th>Botanical Name</th>
<th>Purity (percent)</th>
<th>Germination (percent)</th>
</tr>
</thead>
<tbody>
<tr>
<td>220</td>
<td>Rye Grass</td>
<td>lolium multiflorum</td>
<td>85</td>
<td>90</td>
</tr>
<tr>
<td>75</td>
<td>Bermuda (unhulled)</td>
<td>cynodon dactylon</td>
<td>95</td>
<td>90</td>
</tr>
</tbody>
</table>

b. Native Grass Seed

1) Plant between February 1 and October 1.

<table>
<thead>
<tr>
<th>Lbs. PLS/Acre</th>
<th>Common Name</th>
<th>Botanical Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.6</td>
<td>Green Sprangletop</td>
<td>Leptochloa dubia</td>
</tr>
<tr>
<td>5.5</td>
<td>Sideoats Grama*</td>
<td>Bouteloua curtipendula</td>
</tr>
<tr>
<td>3.7</td>
<td>Little Bluestem*</td>
<td>Schizachyrium scoparium</td>
</tr>
<tr>
<td>17.0</td>
<td>Buffalograss</td>
<td>Buchloe dactyloides</td>
</tr>
<tr>
<td>1.8</td>
<td>Indian Grass*</td>
<td>Sorghastrum nutans</td>
</tr>
<tr>
<td>0.5</td>
<td>Sand Lovegrass*</td>
<td>Eragrostis trichodes</td>
</tr>
<tr>
<td>6.0</td>
<td>Big Bluestem</td>
<td>Andropogon gerardii</td>
</tr>
<tr>
<td>8.0</td>
<td>Eastern Grama</td>
<td>Tripsacum dactyloides</td>
</tr>
<tr>
<td>1.2</td>
<td>Blue Grama</td>
<td>Bouteloua gracilis</td>
</tr>
<tr>
<td>1.8</td>
<td>Switchgrass</td>
<td>Panicum virgatum</td>
</tr>
<tr>
<td>10.0</td>
<td>Prairie Wildrye*</td>
<td>Elymus canadensis</td>
</tr>
</tbody>
</table>
d. Wildflower Seed
   1) Plant between the following:
      a) March 5 and May 31
      b) September 1 and December 1

<table>
<thead>
<tr>
<th>Lbs. PLS/Acre</th>
<th>Common Name</th>
<th>Botanical Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>3.0</td>
<td>Bush Sunflower</td>
<td><em>Sinsia calva</em></td>
</tr>
<tr>
<td>5.0</td>
<td>Butterfly Weed</td>
<td><em>Asclepias tuberosa</em></td>
</tr>
<tr>
<td>2.0</td>
<td>Clasping Coneflower*</td>
<td><em>Rudbeckia amplexicaulis</em></td>
</tr>
<tr>
<td>3.0</td>
<td>Golden - Wave</td>
<td><em>Coreopsis basalis</em></td>
</tr>
<tr>
<td>13.4</td>
<td>Illinois Bundleflower</td>
<td><em>Desmanthus illinoensis</em></td>
</tr>
<tr>
<td>13.6</td>
<td>Partridge Pea</td>
<td><em>Cassia fasciculata</em></td>
</tr>
<tr>
<td>2.0</td>
<td>Prairie Verbena</td>
<td><em>Verbena bipinnatifida</em></td>
</tr>
<tr>
<td>8.0</td>
<td>Texas Yellow Star</td>
<td><em>Lindheimeri texana</em></td>
</tr>
<tr>
<td>8.0</td>
<td>Winecup</td>
<td><em>Callirhoe involucrata</em></td>
</tr>
<tr>
<td>2.0</td>
<td>Black-eyed Susan</td>
<td><em>Rudbeckia hirta</em></td>
</tr>
<tr>
<td>18.0</td>
<td>Cutleaf Daisy</td>
<td><em>Engelmannia pinnatifida</em></td>
</tr>
<tr>
<td>2.0</td>
<td>Obedient Plant</td>
<td><em>Physostegia intermedia</em></td>
</tr>
<tr>
<td>3.0</td>
<td>Pitcher Sage</td>
<td><em>Salvia azurea</em></td>
</tr>
<tr>
<td>2.0</td>
<td>Plains Coreopsis</td>
<td><em>Coreopsis tinctoria</em></td>
</tr>
<tr>
<td>8.0</td>
<td>Scarlet Sage</td>
<td><em>Salvia coccinea</em></td>
</tr>
</tbody>
</table>

*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.

5. Topsoil: See Section 32 91 19.

6. Water: clean and free of industrial wastes or other substances harmful to the germination of the seed or to the growth of the vegetation.

7. Soil Retention Blanket
   a. "Curlex I" from American Excelsior, 900 Ave. H East, Post Office Box 5624,
      Arlington, Texas 76001, 1-800-777-701 or approved equal.
2.3 ACCESSORIES [NOT USED]

2.4 SOURCE QUALITY CONTROL [NOT USED]

PART 3 - EXECUTION [NOT USED]

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 one 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 one half 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 plans 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 one half 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 plans and areas disturbed by
      construction.
   b. Mark each area to be seeded in the field prior to seeding for the Engineer
      approval.

2. Broadcast Seeding
   a. Broadcast seed in two 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 one inch.
      2) remove grass clippings, so seed can make contact with the soil.

3. Mechanically Seeding (Drilling):
   a. Uniformly distribute seed over the areas shown on the plans 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.

4. 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 thirty (30) minutes after placed in the equipment.
   b. Placing
      1) Uniformly distribute in the quantity specified over the areas shown on the
         plans or as directed.

5. Fertilizing: uniformly apply fertilizer over seeded area.

6. 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 forty eight 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 one half 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 three inches with one mow cycle performed by the CONTRACTOR prior to consideration of acceptance by the City.

C. Rejection
   1. City may reject block sod or seeded area on the basis of weed populations.

3.14 ATTACHMENTS [NOT USED]

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SECTION 33 01 30
SEWER AND MANHOLE TESTING

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 City of Fort Worth 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

   4. Section 33 04 50 – Cleaning of Sewer Mains

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 Engineer 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 04 50.
   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:

\[
T = \left(\frac{0.0850 \times D \times K}{Q}\right)
\]

Where:
\[
T = \text{shortest time, seconds, allowed for air pressure to drop to 1.0 psig}
\]
\[
K = 0.000419 \times D \times L, \text{ but not less than 1.0}
\]
\[
D = \text{nominal pipe diameter, inches}
\]
\[
L = \text{length of pipe being tested (by pipe size), feet}
\]
\[
Q = 0.0015, \text{ cubic feet per minute per square foot of internal surface}
\]

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:

<table>
<thead>
<tr>
<th>Nominal Pipe Size</th>
<th>Percent Deflection Allowed</th>
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<tbody>
<tr>
<td>12 and smaller</td>
<td>5.0</td>
</tr>
<tr>
<td>15 through 30</td>
<td>4.0</td>
</tr>
<tr>
<td>Greater than 30</td>
<td>3.0</td>
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</table>

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:

<table>
<thead>
<tr>
<th>Depth of Manhole, feet</th>
<th>4-foot Dia Seconds</th>
<th>5-foot Dia Seconds</th>
<th>6-foot Dia Seconds</th>
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<tbody>
<tr>
<td>8</td>
<td>20</td>
<td>26</td>
<td>33</td>
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<tr>
<td>18</td>
<td>40</td>
<td>59</td>
<td>73</td>
</tr>
<tr>
<td>**</td>
<td>T=5</td>
<td>T=6.5</td>
<td>T=8</td>
</tr>
</tbody>
</table>

** 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

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SECTION 33 01 31
CLOSED CIRCUIT TELEVISION (CCTV) INSPECTION

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. Deviations from this City of Fort Worth 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 03 10 – Bypass Pumping of Existing Sewer Systems
   4. Section 33 04 50 – Cleaning of Sewer Mains
   5. Section 33 31 20 – Polyvinyl Chloride (PVC) Gravity Sanitary Sewer Pipe
   6. Section 33 31 21 – Polyvinyl Chloride (PVC) Closed Profile Gravity Sanitary
      Sewer Pipe
   7. Section 33 31 22 – Sanitary Sewer Slip Lining

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 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. Digital file

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 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 “Post-CCTV Inspection”.
      1) Contractor will not be paid for unaccepted video.

3. The price bid shall include:
   a. Mobilization
   b. Cleaning
   c. Digital file

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. City of Fort Worth Water Department
   a. City of Fort Worth Water Department CCTV Inspection and Defect Coding
      Program (CCTV Manual). Contact Field Operations to obtain a copy of the
      CCTV Manual.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordination
   1. Meet with City of Fort Worth Water Department staff to confirm that the
      equipment, software, standard templates, defect codes and defect rankings are being
      used, if required.

1.5 SUBMITTALS

A. Submittals shall be in accordance with Section 01 33 00.

B. All submittals shall be approved by the Engineer 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. Listing of CCTV equipment
   5. Listing of backup and standby equipment
   6. Listing of safety precautions and traffic control measures

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. CCTV Equipment

1. Use equipment specifically designed and constructed for such inspection.

2. Use equipment designed to operate in 100 percent humidity conditions.

3. Use equipment with a pan (±270 degrees), tilt, and rotates (360 degrees).

4. Use camera with an accurate footage counter that displays on the monitor the distance of the camera (to the nearest 1/10 foot) from the centerline of the starting manhole.

5. Use camera with height adjustment so camera lens is always centered at 1/2 the inside diameter, or higher, in the televised pipe.

6. Provide sufficient lighting to illuminate the entire periphery of the pipe.

7. Provide color video.

8. Use the Fort Worth Water Department standardized inspection and coding program by I.T. software with pre-configured template.

B. Temporary Bypass Pumping – Conform to Section 33 03 10.

C. Cleaning – Conform to Section 33 04 50.

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 specified in the CCTV Manual.

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.
   3. Provisions for repairing or replacing the impassable location are addressed in Section 33 31 20, Section 33 31 21 and Section 33 31 22.

C. Post-Installation Inspection
   1. Complete manhole installation before inspection begins.
   2. Prior to inserting the camera, flush and clean the main in accordance to Section 33 04 50.

D. Documentation of CCTV Inspection
   1. Follow the CCTV Manual for the inspection video, data logging and reporting.

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. See Section 33 04 50.
3.11 CLOSEOUT ACTIVITIES [NOT USED]

3.12 PROTECTION [NOT USED]

3.13 MAINTENANCE [NOT USED]

3.14 ATTACHMENTS [NOT USED]

END OF SECTION

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Revision Log
SECTION 33 03 10
BYPASS PUMPING OF EXISTING SEWER SYSTEMS

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 City of Fort Worth 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

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 Engineer prior to delivery.

1.6 ACTION SUBMITTALS/INFORMATIONAL SUBMITTALS

A. 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 Engineer 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 on line, 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 Engineer.

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 the Engineer 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

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Revision Log
SECTION 33 04 40
CLEANING AND ACCEPTANCE TESTING OF WATER MAINS

PART 1 - GENERAL

1.0 SUMMARY

A. General
1. Before any newly constructed potable water mains will be permitted to be placed into service in the Fort Worth 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 Fort Worth 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 City of Fort Worth 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

2.0 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.

3.0 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.
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 Engineer 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 Engineer.

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 – ¼-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 that 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) Close isolation valves for air release valves.

5) 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 Engineer.

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 minimum. 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 Engineer 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 The Engineer.
      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 The Engineer 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 The Engineer, 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. 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

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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. Backfill
   g. Compaction

B. Deviations from this City of Fort Worth 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 15 – Paving Removal
5. Section 02 41 14 – Utility Removal/Abandonment
6. Section 03 34 13 – Controlled Low Strength Material (CLSM)
7. Section 31 10 00 – Site Clearing
8. Section 31 25 00 – Erosion and Sediment Control
9. Section 33 05 26 – Utility Markers/Locators
10. 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 pipe line
      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. 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

4. 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/ft3 600 Kn-m/M3)).
   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 Engineer 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:

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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
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 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

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 to10 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
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.

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. 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 equipments specifically designed for tree pruning or trimming.
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 The Engineer will determine if any changes are required in the pipe foundation or bedding.

5. Unless otherwise permitted by the Drawings or by the The Engineer, 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, Sheeting 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 The Engineer, 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 ground water
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 The
Engineer 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 unit price.
   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 16-24 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 greater than 15 feet deep.

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 pipe line shall be within:

1) ±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 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 3.05.26.

3. Water Lines Greater than 24 Inches 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 pipe line shall be within:

1) ±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 pipe line.

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 pipe line shall be within ±0.1 inches of the elevation 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 pipe line.

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 pipe line shall be within ±0.1 inches of the elevation 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 pipe line.
   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 or cement stabilized sand (CSS).
   g. Place pipe on the bedding according to the alignment of the Drawings.
   h. The pipe shall be within ±0.1 inches of the elevation 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 pipe line.
   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 greater than 15 feet and under pavement or future pavement

1) Backfill depth from 0-15 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 greater than 15 feet deep

a) Backfill with:

(1) Select Fill

(2) CSS, or

(3) CLSM when specifically required

c. Final backfill depth greater than 15 feet and not under pavement or future pavement

1) Backfill with:

a) Acceptable backfill material, or

b) Blended backfill material

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 greater than 15 feet and 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 greater than 15 feet and 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. 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.
   c. 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 The Engineer.
      2) The The Engineer 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. Place in loose lifts not to exceed 12 inches.
   c. Compact to specified densities.
   d. Compact only on top of initial backfill, undisturbed trench or previously compacted backfill.
   e. Remove any loose materials due to the movement of any trench box or shoring or due to sloughing of the trench wall.
   f. 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 continent.
      1) The testing lab will provide results as available on the job site.

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 Engineer 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 Test Shall be in conformance with ASTM D2922.
   b. Provide a testing trench protection for trenches deeper than 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 greater than 15 feet deep:
      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]

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Revision Log
SECTION 33 05 13
FRAME, COVER, AND GRADE RINGS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Frame, cover and grade rings used as access ports into water, sanitary sewer and storm drain structures such manholes or vaults

B. Deviations from this City of Fort Worth 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. This Item is considered subsidiary to the structure containing the frame, cover and grade rings.

2. Payment

a. The work performed and the materials furnished in accordance with this Item are subsidiary to the unit price bid per each structure 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. ASTM International (ASTM)


b. ASTM A536 - Standard Specification for Ductile Iron Castings

c. ASTM C478 - Specification for Precast Reinforced Concrete Manhole Sections

3. American Association of State Highways and Transportation Officials (AASHTO)

a. AASHTO M306 – Standard Specification for Drainage, Sewer, Utility and Related Castings

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 Engineer prior to delivery and/or fabrication for specials.

1.6 ACTION SUBMITTALS/INFORMATIONAL SUBMITTALS

A. Product Data
1. All castings shall be cast with:
   a. Approved foundry’s name
   b. Part number
   c. Country of origin
2. Provide manufacturer’s:
   a. Specifications
   b. Load tables
   c. Dimension diagrams
   d. Anchor details
   e. Installation instructions

B. Certificates
1. Manufacturer shall certify that all castings conform to the ASTM and AASHTO designations.

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, 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. Castings
1. Use castings for frames that conform to ASTM A48, Class 35B or better.
2. Use castings for covers that conform to ASTM A536, Grade 65-45-12 or better.
3. Use clean casting capable of withstanding application of AASHTO HS-20 vehicle loading with permanent deformation.
4. Covers
a. Size to set flush with the frame with no larger than a 1/8 inch gap between the frame and cover
b. Provide with 2 inch wide pick slots in lieu of pick holes.
c. Provide gasket in frame and cover.
d. Standard Dimensions
   1) Sanitary Sewer
      a) Provide a clear opening of 30 inches for all sanitary sewer frames and cover assemblies unless otherwise specified in the Contract Documents.
   2) Storm Drain
      a) Provide a clear opening of 19 ¾ inches for all storm drain frames, inlets and cover assemblies unless otherwise specified in the Contract Documents.
      b) Provide a minimum clear opening of 24 inches for all storm sewer manholes and junction structures.
e. Standard Labels
   1) Water
      a) Cast lid with the word “WATER” in 2-inch letters across the lid.
   2) Sanitary Sewer
      a) Cast lid with the word “SANITARY SEWER” in 2-inch letters across the lid.
   3) Storm Drain
      a) Cast lid with the word “STORM DRAIN” in 2-inch letters across the lid.
f. Hinge Covers
   1) Provide water tight gasket on all hinged covers.
   2) Water
      a) Provide hinged covers for all water structures.
   3) Sanitary Sewer
      a) Provide hinged covers for all manholes or structures constructed over 24-inch sewer lines and larger and for manholes where rim elevations are greater than 12 inches above the surface.

C. Grade Rings
   1. Provide grade rings in sizes from 2-inch up to 8-inch.
   2. Use concrete in traffic loading areas.
   3. In non-traffic areas concrete or HDPE can be used.

D. Joint Sealant
   1. Provide a pre-formed or trowelable bitumastic sealant in an extrudable or flat tape form.
   2. Provide sealant that is not dependant on a chemical action for its adhesive properties or cohesive strength.
PART 3 - EXECUTION

3.1 INSTALLERS [NOT USED]

3.2 EXAMINATION [NOT USED]

3.3 PREPARATION [NOT USED]

3.4 INSTALLATION

A. Grade Rings
   1. Place as shown in the water and sanitary sewer City Standard Details.
   2. Clean surfaces of dirt, sand, mud or other foreign matter before placing sealant.
   3. Seal each grade ring with sealant specified in this Specification and as shown on the City Standard Details.

B. Frame and Cover
   1. Water
      a. For water structures install frame, cover and grade rings in accordance with applicable City Standard Detail.
   2. Sanitary Sewer
      a. For sanitary sewer structures install frame, cover and grade rings in accordance with applicable City Standard Detail.
   3. Storm Drain
      a. For storm drain structures install frame, cover and grade rings in accordance with applicable City Standard Detail.
   4. Hinge Cover
      a. Provide hinge cover on elevated manholes, junction boxes, in the flood plain and where specified on the Drawings.

C. Joint Sealing
   1. Seal frame, grade rings and structure with specified sealant.

D. Concrete Collar
   1. Provide concrete collar around all frame and cover assemblies.
1  3.5  REPAIR / RESTORATION [NOT USED]
2  3.6  RE-INSTALLATION [NOT USED]
3  3.7  FIELD [or] SITE QUALITY CONTROL [NOT USED]
4  3.8  SYSTEM STARTUP [NOT USED]
5  3.9  ADJUSTING [NOT USED]
6  3.10 CLEANING [NOT USED]
7  3.11 CLOSEOUT ACTIVITIES [NOT USED]
8  3.12 PROTECTION [NOT USED]
9  3.13 MAINTENANCE [NOT USED]
10  3.14 ATTACHMENTS [NOT USED]

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Revision Log
SECTION 33 05 14
ADJUSTING MANHOLES, INLETS, VALVE BOXES, AND OTHER STRUCTURES TO GRADE

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Vertical adjustments to manholes, drop inlets, valve boxes, cathodic protection test
      stations and other miscellaneous structures to a new grade

B. Deviations from this City of Fort Worth 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 13 – Frame, Cover and Grade Rings
   5. Section 33 39 10 – Cast-in-Place Concrete Manholes
   6. Section 33 39 20 – Precast Concrete Manholes
   7. Section 33 12 20 – Resilient Seated Gate Valve
   8. Section 33 12 21 – AWWA Rubber-Seated Butterfly Valve
   9. Section 33 04 11 – Corrosion Control Test Station
   10. Section 33 04 12 – Magnesium Anode Cathodic Protection

1.2 PRICE AND PAYMENT PROCEDURES

A. Measurement and Payment
   1. Manhole – Minor Adjustment
      a. Measurement
         1) Measurement for this Item shall be per each adjustment using only grade
            rings or other minor adjustment devices to a grade specified on the
            Drawings.
      b. Payment
         1) The work performed and the materials furnished in accordance with this
            Item will be paid for at the unit price bid per each “Manhole Adjustment,
            Minor” completed.
      c. The price bid shall include:
         1) Pavement removal
         2) Excavation
         3) Hauling
         4) Disposal of excess material
         5) Grade rings or other adjustment device
         6) Furnishing, placing and compaction of embedment and backfill
7) Clean-up

2. Manhole - Major Adjustment
   a. Measurement
      1) Measurement for this Item shall be per each adjustment requiring structural
         modifications to manhole to a grade specified on the Drawings.
   b. Payment
      1) The work performed and the materials furnished in accordance with this
         Item will be paid for at the unit price bid per each “Manhole Adjustment,
         Major” completed.
   c. The price bid shall include:
      1) Pavement removal
      2) Excavation
      3) Hauling
      4) Disposal of excess material
      5) Structural modifications, grade rings or other adjustment device
      6) Furnishing, placing and compaction of embedment and backfill
      7) Clean-up

3. Inlet
   a. Measurement
      1) Measurement for this Item shall be per each adjustment requiring structural
         modifications to inlet to a grade specified on the Drawings.
   b. Payment
      1) The work performed and the materials furnished in accordance with this
         Item will be paid for at the unit price bid per each “Inlet Adjustment”
         completed.
   c. The price bid shall include:
      1) Pavement removal
      2) Excavation
      3) Hauling
      4) Disposal of excess material
      5) Structural modifications
      6) Furnishing, placing and compaction of embedment and backfill
      7) Clean-up

4. Valve Box
   a. Measurement
      1) Measurement for this Item shall be per each adjustment to a grade specified
         on the Drawings.
   b. Payment
      1) The work performed and the materials furnished in accordance with this
         Item will be paid for at the unit price bid per each “Valve Box Adjustment”
         completed.
   c. The price bid shall include:
      1) Pavement removal
      2) Excavation
      3) Hauling
      4) Disposal of excess material
      5) Adjustment device
      6) Furnishing, placing and compaction of embedment and backfill
      7) Clean-up
5. Cathodic Protection Test Station
   a. Measurement
      1) Measurement for this Item shall be per each adjustment to a grade specified on the Drawings.
   b. Payment
      1) The work performed and the materials furnished in accordance with this Item will be paid for at the unit price bid per each “Cathodic Protection Test Station Adjustment” completed.
   c. The price bid shall include:
      1) Pavement removal
      2) Excavation
      3) Hauling
      4) Disposal of excess material
      5) Adjustment device
      6) Furnishing, placing and compaction of embedment and backfill
      7) Clean-up

6. Fire Hydrant
   a. Measurement
      1) Measurement for this Item shall be per each adjustment requiring stem extensions to meet a grade specified by the Drawings.
   b. Payment
      1) The work performed and the materials furnished in accordance with this Item will be paid for at the unit price bid per each “Fire Hydrant Stem Extension” completed.
   c. The price bid shall include:
      1) Pavement removal
      2) Excavation
      3) Hauling
      4) Disposal of excess material
      5) Adjustment materials
      6) Furnishing, placing and compaction of embedment and backfill
      7) Clean-up

7. Miscellaneous Structure
   a. Measurement
      1) Measurement for this Item shall be per each adjustment requiring structural modifications to said structure to a grade specified on the Drawings.
   b. Payment
      1) The work performed and the materials furnished in accordance with this Item will be paid for at the unit price bid per each “Miscellaneous Structure Adjustment” completed.
   c. The price bid shall include:
      1) Pavement removal
      2) Excavation
      3) Hauling
      4) Disposal of excess material
      5) Structural modifications
      6) Furnishing, placing and compaction of embedment and backfill
   d. 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. Texas Commission on Environmental Quality (TCEQ):

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 [or] OWNER-SUPPLIED PRODUCTS [NOT USED]

2.2 MATERIALS

A. Cast-in-Place Concrete
   1. See Section 03 30 00.

B. Modifications to Existing Concrete Structures
   1. See Section 03 80 00.

C. Grade Rings
   1. See Section 33 05 13.

D. Frame and Cover
   1. See Section 33 05 13.

E. Backfill material
   1. See Section 33 05 10.

F. Water valve box extension
   1. See Section 33 12 20.

G. Corrosion Protection Test Station
   1. See Section 33 04 11.
H. Cast-in-Place Concrete Manholes
   1. See Section 33 39 10.

I. Precast Concrete Manholes
   1. See Section 33 39 20.

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. Examine existing structure to be adjusted, for damage or defects that may affect
      grade adjustment.
      a. Report issue to City for consideration before beginning adjustment.

3.3 PREPARATION

A. Grade Verification
   1. On major adjustments confirm any grade change noted on Drawings is consistent
      with field measurements.
      a. If not, coordinate with City to verify final grade before beginning adjustment.

3.4 ADJUSTMENT

A. Manholes, Inlets, and Miscellaneous Structures
   1. On any sanitary sewer adjustment replace 24-inch frame and cover assembly with
      30-inch frame and cover assembly per TCEQ requirement.
   2. On manhole major adjustments, inlets and miscellaneous structures protect the
      bottom using wood forms shaped to fit so that no debris blocks the invert or the
      inlet or outlet piping in during adjustments.
      a. Do not use any more than a 2-piece bottom.
   3. Do not extend chimney portion of the manhole beyond 24 inches.
   4. Use the least number of grade rings necessary to meet required grade.
      a. For example, if a 1-foot adjustment is required, use 2 6-inch rings, not 6 2-inch
      rings.

B. Valve Boxes
   1. Utilize typical 3 piece adjustable valve box for adjusting to final grade as shown on
      the Drawings.

C. Backfill and Grading
   1. Backfill area of excavation surrounding each adjustment in accordance to Section
      33 05 10.
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]

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13
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 City of Fort Worth 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 Meter Vault or Butterfly Valve 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 “Meter Vault or Butterfly Valve 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.
   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.
      c. C858, Standard Specification for Underground Precast Concrete Utility Structures
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 Engineer or 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 to provide seals around pipe
         penetrations.
   3. Vault Access
      a. Cover / Door
         1) Where a standard manhole cover is not used, use an AASHTO HS-20
            loaded fabricated aluminum door.
         2) With aluminum door, provide an automatic hold-open arm with release
            handle and locking device.
         3) Provide Bilco type fall protection grating under aluminum door that meets
            OSHA 29 CFR 1910.23 requirements or approved equal.
         4) Incorporate a drain gutter with an outlet routed to the exterior of the vault
            lid.
      b. Ladder
         1) Provide aluminum or stainless steel ladder to dimensions shown on
            Drawings.
         2) Provide Bilco 48-inch extendable handrail (ladder up) or approved equal.
         3) Provide ladder up with telescoping tubular section that locks automatically
            when fully extended and a release lever to allow it to be returned to its
            lowered position.

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. Interior Coating or Liner – Conform to Section 33 39 60.
7. Exterior Coating
   a. Coal Tar Bitumastic for below grade dam 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 ± 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.
1  3.5 REPAIR / RESTORATION [NOT USED]
2  3.6 RE-INSTALLATION [NOT USED]
3  3.7 FIELD QUALITY CONTROL [NOT USED]
4  3.8 SYSTEM STARTUP [NOT USED]
5  3.9 ADJUSTING [NOT USED]
6  3.10 CLEANING [NOT USED]
7  3.11 CLOSEOUT ACTIVITIES [NOT USED]
8  3.12 PROTECTION [NOT USED]
9  3.13 MAINTENANCE [NOT USED]
10  3.14 ATTACHMENTS [NOT USED]

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13
SECTION 33 05 17
CONCRETE COLLARS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Concrete Collars for Manholes
B. Deviations from this City of Fort Worth 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
   5. Section 33 05 13 – Frame, Cover, and Grade Rings

1.2 PRICE AND PAYMENT PROCEDURES

A. Measurement and Payment
   1. Manhole
      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 “Concrete Collar”
            installed.
      c. The price bid will include:
         1) Concrete Collar
         2) Excavation
         3) Forms
         4) Reinforcing steel (if required)
         5) Concrete
         6) Backfill
         7) Pavement removal
         8) Hauling
         9) Disposal of excess material
         10) Placement and compaction of backfill
         11) Clean-up
         12) Additional pavement around perimeter of concrete collar as required for
             rim adjustment on existing manhole.
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. D4258, Standard Practice for Surface Cleaning Concrete for Coating.
      b. D4259, Standard Practice for Abrading Concrete.

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 [or] OWNER-SUPPLIED PRODUCTS [NOT USED]

2.2 EQUIPMENT, PRODUCT TYPES, MATERIALS

A. Materials
   1. Concrete – Conform to Section 03 30 00.
   2. Reinforcing Steel – Conform to Section 03 30 00.
   3. Frame and Cover – Conform to Section 33 05 13.
   4. Grade Ring – Conform to Section 33 05 13.

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. 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.

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]

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SECTION 33 05 20
AUGER BORING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Minimum requirements for auger boring using 48-inch and smaller casing pipe with lengths less than 350 feet at the locations shown on the Drawings.

B. Deviations from this City of Fort Worth 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 22 – Steel Casing Pipe

1.2 PRICE AND PAYMENT PROCEDURES

A. Measurement and Payment
1. Measurement
   a. This Item is considered subsidiary to steel casing pipe construction.
2. Payment
   a. The work performed and materials furnished in accordance with this Item are subsidiary to the unit price bid per linear foot of By Other Than Open Cut to be 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. Occupational Safety and Health Administration (OSHA)

1.4 ADMINISTRATIVE REQUIREMENTS

A. Pre-installation
1. Provide written notice to the City at least 3 workings days in advance of the planned launch of auger boring operations.

1.5 SUBMITTALS

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

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. Qualifications

1. Contractor

   a. All boring work shall be performed by an experienced subcontractor or Contractor who has at least 5 years of experience in performing tunneling work and has completed at least 5 boring projects of similar diameter and ground conditions.

   1) At least 1 of the projects shall have an individual boring length equal to or greater in length than the longest tunnel on this project.

   2) Submit details of referenced projects including owner’s name and contact information, project superintendent and machine operators.

   b. The project superintendent shall have at least 5 years of experience supervising boring construction.

   1) The Contractor may be required to submit details of referenced project including owner’s name, contact information and project superintendent.

   c. The site safety representative and personnel responsible for air quality monitoring shall be experienced in tunnel construction and shall have current certification by OSHA.

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. Description

1. Steel Casing Pipe shall be in accordance with Section 33 05 22.

2. Tunnel Liner Plate is not permitted for use with Auger Boring.

B. Design Criteria

1. Design excavation methods and spoil conveyance system for the full range of ground conditions described in the Geotechnical Reports anticipated.

2. Tolerance

   a. Pressurized Carrier pipe
1) Lateral or vertical variation in the final position of the pipe casing from the line and grade established by the Drawings shall be permitted only to the extent of 1 inch in 10 feet provided that such variation shall be regular and only in the direction that will not detrimentally affect the function of the carrier pipe and clearances from other underground utilities or structures.

b. Gravity Carrier Pipe
1) Lateral variation in the final position of the pipe casing from the line and grade established by the Drawings shall be permitted only to the extent of 1 inch in 10 feet provided that such variation shall be regular and only in the direction that will not detrimentally affect the function of the carrier pipe and clearances from other underground utilities or structures.

2) Grades shown on Drawings must be maintained vertically.

3. Use methods and equipment that control surface settlement and heave above the pipeline to prevent damage to existing utilities, facilities and improvements.

a. Limit any ground movements (settlement/heave) to values that shall not cause damage to adjacent utilities or surface features (i.e. pavement, structures, railroad tracks, etc.)

b. Repair any damage caused by ground movements at no cost to the City.

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. Boring shall not begin until the following have been completed:

1. Review of available utility drawings and location of conduits and underground utilities in all areas where excavation is to be performed.

a. Notify the applicable one-call system prior to any excavation to avoid interference with the existing conduits and utilities in accordance with Division 1.

b. Follow notification requirements of permit provider where applicable.

2. Complete pit excavations and support systems for each drive in accordance with the requirements of the Specifications.

3.4 INSTALLATION

A. General

1. Immediately notify the City if any problems are encountered with equipment or materials or if the Contractor believes the conditions encountered are materially and significantly different than those represented within the Contract Documents.
2. Where pipe is required to be installed under railroad embankments or under highways, streets or other facilities, construction shall be performed in such a manner so as to not interfere with the operation of the railroad, street, highway or other facility, and so as not to weaken or damage any embankment or structure.

3. During construction operations, furnish and maintain barricades and lights to safeguard traffic and pedestrians until such time as the backfill has been completed and then remove from the site.

4. Properly manage and dispose of groundwater inflows to the shafts in accordance with requirements of specifications and all permit conditions.
   a. Discharge of groundwater inflow into sanitary sewers is not allowed without proper approval and permits.

5. Furnish all necessary equipment, power, water and utilities for tunneling, spoil removal and disposal, grouting and other associated work required for the methods of construction.

6. Promptly clean up, remove and dispose of any spoil or slurry spillage.

7. Do not disturb roadways, railroads, canal channels, adjacent structures, landscaped areas or existing utilities.
   a. Any damage shall be immediately repaired to original or better condition and to the satisfaction of the Engineer or permit grantor at no additional cost to the City.

8. Whenever there is a condition that is likely to endanger the stability of the excavation or adjacent structures, operate with a full crew 24 hours a day, including weekends and holidays, without interruption, until those conditions no longer jeopardize the stability of the Work.

9. Notify the Texas One Call system (800-245-4545) to request marking of utilities by utility owners/operators that subscribe to One Call, and shall individually notify all other known or suspected utilities to request marking of these utilities.
   a. Confirm that all requested locates are made prior to commencing boring operations.
   b. Visually confirm and stake necessary existing lines, cables, or other underground facilities including exposing necessary crossing utilities and utilities within 10 feet laterally of the designed tunnel.
   c. Control drilling and grouting practices to prevent damage to existing utilities.

B. Boring Methods

1. Tunnel liner plate shall not be used for auger boring.

2. The Contractor shall be fully responsible for insuring the methods used are adequate for the protection of workers, pipe, property and the public and to provide a finished product as required.

3. Blasting is not allowed.

C. Pits and Trenches

1. If the grade of the pipe at the end is below the ground surface, suitable pits or trenches shall be excavated for the purpose of conducting the jacking operations and for placing end joints of the pipe.

2. Wherever end trenches are cut in the sides of the embankment or beyond it, such work shall be sheeted securely and braced in a manner to prevent earth from caving in.
3. The location of the pit shall meet the approval of the City.

4. The pits of trenches excavated to facilitate these operations shall be backfilled in accordance with Section 33.05.10 immediately after the casing and carrier pipe installation has been completed.

D. Boring

1. Install steel casing pipe by boring hole with the earth auger and simultaneously jacking pipe into place.

2. The boring shall proceed from a pit provided for the boring equipment and workmen.

3. Pilot Hole, required for 24-inch and larger casings
   a. By this method an approximate 2-inch hole shall be bored the entire length of the crossing and shall be checked for line and grade on the opposite end of the bore from the work pit.
   b. This pilot hole shall serve as the centerline of the larger diameter hole to be bored.
   c. Other methods of maintaining line and grade on the casing may be approved if acceptable to the Engineer.
   d. Placed excavated material near the top of the working pit and disposed of as required.
      1) If no room is available, immediate haul off is required.

4. The use of water or other fluids in connection with the boring operation will be permitted only to the extent required to lubricate cuttings.
   a. Jetting or sluicing will not be permitted.

5. In unconsolidated soil formations, a gel-forming colloidal drilling fluid consisting of at least 10 percent of high grade carefully processed bentonite may be used to:
   a. Consolidate cuttings of the bit
   b. Seal the walls of the hole
   c. Furnish lubrication for subsequent removal of cuttings and installation of the pipe immediately thereafter

6. Allowable variation from the line and grade shall be as specified in this Specification.

7. All voids in excess of 2 inches between bore and outside of casing shall be pressure grouted.

E. Contact Grouting

1. Contact grout any voids caused by or encountered during the boring.
   a. Modify equipment and procedures as required to avoid recurrence of excessive settlements or damage.

F. Control of Line and Grade

1. Monitor line and grade continuously during boring operations.
   a. Record deviation with respect to design line and grade once at each casing joint.

2. If the pipe installation does not meet the specified tolerances, correct the installation, including any necessary redesign of the pipeline or structures and acquisition of necessary easements.
3.5 CLEANUP AND RESTORATION

A. After completion of the boring, all construction debris, spoils, oil, grease and other materials shall be removed from the pipe, pits and all work areas.

B. Restoration shall follow construction as the Work progresses and shall be completed as soon as reasonably possible.
   1. Restore and repair any damage resulting from surface settlement caused by shaft excavation or boring.
   2. Any property damaged or destroyed shall be restored to a condition equal to or better than existing prior to construction.
   3. Restoration shall be completed no later than 30 days after boring is complete, or earlier if required as part of a permit or easement agreement.
   4. This provision for restoration shall include all property affected by the construction operations.

3.6 RE-INSTALLATION [NOT USED]

3.7 SITE QUALITY CONTROL

A. Field Tests and Inspections
   1. Allow access to the City and furnish necessary assistance and cooperation to aid in the observations, measurements, data and sample collection, including, but not limited to the following:
      a. The City shall have access to the boring system prior to, during and following all boring operations.
      b. The City shall have access to the tunneling shafts prior to, during and following all boring operations.
         1) This shall include, but not be limited to, visual inspection of installed pipe and verification of line and grade.
         2) The Contractor shall provide safe access in accordance with all safety regulations.
      c. The City shall have access to spoils removed from the boring excavation prior to, during and following all boring operations.
         1) The City shall be allowed to collect soil samples from the muck buckets or spoil piles a minimum of once every 10 feet and at any time when changes in soil conditions or obstructions are apparent or suspected.

B. 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 receiving shafts/pits.
      a. Diesel, electrical, hydraulic, and air powered equipment are acceptable, subject to applicable local, State and Federal regulations.
   3. 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.

4. Perform all work in accordance with all current applicable regulations and safety requirements of the Federal, State and Local agencies.

   a. 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

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SECTION 33 05 21
TUNNEL LINER PLATE

PART 1 - GENERAL

1.0 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 City of Fort Worth 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. HB-17, Standard Specifications for Highway Bridges, Section 16.

b. M190, Bituminous-Coated Corrugated Metal Culvert Pipe and Pipe Arches.

3. ASTM International (ASTM):


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 Engineer or 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 25 00.

B. Design Criteria

1. Manufacturer to design Tunnel Liner Plate in accordance with the methods and criteria as specified in AASHTO HB-17.
   a. Soil parameters shall be determined by the Tunnel Liner Plate Manufacturer.
   b. Allow a maximum deflection of 3 percent.
   c. 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.

3) Tunnel Liner Plates and fasteners shall comply with the requirements of AASHTO HB-17.

4) 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.

5) Bolts and nuts shall be galvanized to conform to ASTM A153.

6) Where groundwater is encountered gasketed liner plates shall be used.

7) Plates shall be of uniform fabrication and those intended for 1 size tunnel shall be interchangeable.

8) Field welding of Tunnel Liner Plate, including grout couplings shall not be allowed.

9) The material used for the construction of these plates shall be new, unused and suitable for the purpose intended.

10) Minimum thickness of Tunnel Liner Plate shall be as follows*:

<table>
<thead>
<tr>
<th>Tunnel Diameter (inches)</th>
<th>2-Flanged Liner Plate Thickness (gauge)</th>
<th>4-Flanged Liner Plate Thickness (gauge)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Bury Depth: 8 feet – 16 feet</td>
<td></td>
</tr>
<tr>
<td>48</td>
<td>14</td>
<td>12</td>
</tr>
<tr>
<td>54</td>
<td>14</td>
<td>12</td>
</tr>
<tr>
<td>60</td>
<td>14</td>
<td>11</td>
</tr>
<tr>
<td>66</td>
<td>12</td>
<td>10</td>
</tr>
<tr>
<td>72</td>
<td>12</td>
<td>8</td>
</tr>
<tr>
<td>Greater than 72</td>
<td>Project Specific Design</td>
<td>Project Specific Design</td>
</tr>
</tbody>
</table>

*The information in the above table is based on the following assumptions: AASHTO Section 16: “Steel Tunnel Liner Plates”, H20 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

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<th>SUMMARY OF CHANGE</th>
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</tbody>
</table>
SECTION 33 05 22
STEEL CASING PIPE

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 City of Fort Worth 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):

3. American Water Works Association (AWWA):

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 Engineer or 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.

d. Steel Casing Pipe shall have a minimum wall thickness as follows:

<table>
<thead>
<tr>
<th>Casing Pipe Diameter (inches)</th>
<th>Minimum Wall Thickness (inches)</th>
</tr>
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<tbody>
<tr>
<td>14 – 18</td>
<td>.3125 (5/16)</td>
</tr>
<tr>
<td>20 – 24</td>
<td>.375 (3/8)</td>
</tr>
<tr>
<td>26 – 32</td>
<td>.5 (1/2)</td>
</tr>
<tr>
<td>34 – 42</td>
<td>.625 (5/8)</td>
</tr>
<tr>
<td>44 – 48</td>
<td>.6875 (11/16)</td>
</tr>
<tr>
<td>Greater than 48</td>
<td>Project specific design</td>
</tr>
</tbody>
</table>

3. 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 05 24. Allowable casing diameters are shown on the Drawings for each crossing.

4. Furnish in lengths that are compatible with Contractor’s shaft sizes and allowable work areas.

5. Random segments of pipe will not be permitted for straight runs of casing.
   a. Closing piece segments, however, shall be acceptable.

6. 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 ± 2½ degrees and with a width of root face 1/16 inch ± 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

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3.15 END OF SECTION
SECTION 33 05 23
HAND TUNNELING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Minimum requirements for Hand Tunneling using tunnel liner plate or casing pipe
      at the locations shown on the Drawings

B. Deviations from this City of Fort Worth 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 21 – Tunnel Liner Plate
   4. Section 33 05 22 – Steel Casing Pipe

1.2 PRICE AND PAYMENT PROCEDURES

A. Measurement and Payment
   1. Measurement
      a. This Item is considered subsidiary to Tunnel Liner Plate or Steel Casing Pipe
      installation.
   2. Payment
      a. The work performed and materials furnished in accordance with this Item are
         considered subsidiary the unit price bid per linear foot of By Other than Open
         Cut installation of Tunnel Liner plate or Steel Casing to be completed 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):
      a. HB-17, Standard Specifications for Highway Bridges.
   3. 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

A. Pre-installation
1. The Contractor shall provide written notice to the City at least 72 hours in advance of the planned launch of tunneling operations.

1.5 SUBMITTALS

A. Submittals shall be in accordance with Section 01 33 00.

B. All submittals shall be approved by the Engineer or the City prior to delivery.

1.6 ACTION SUBMITTALS/INFORMATIONAL SUBMITTALS

A. Shop Drawings

1. Submit the following, when required by the Contract Documents:
   a. Detailed description of the methods and equipment to be used in completing each reach of tunnel
   b. Description of the survey methods that will be used to ensure that the tunnel is advanced as shown on the Drawings and within the line and grade tolerances specified
   c. Shaft layout drawings
      1) Detailing dimensions and locations of all equipment, including overall work area boundaries, crane, front-end loader, forklift, spoil stockpiles, spoil hauling equipment, pumps, generator, pipe storage area, tool trailer or containers, fences, and staging area
      2) Shaft layout drawings will be required for all shaft locations and shall be to scale, or show correct dimensions.
      3) Layout such that all equipment and operations shall be completely contained within the allowable construction areas shown on the Drawings
   d. Schedule in accordance with Division 1 to include the following activities as independent items:
      1) Mobilization
      2) Shaft excavation and support
      3) Water control at shafts
      4) Working slab construction
      5) Thrust wall construction
      6) Tunneling
      7) Shaft backfill
      8) Site restoration
      9) Cleanup
     10) Demobilization

2. For all projects, provide the following for Contact Grouting:
   a. Contact Grouting (outside of casing) Work Plan and Methods including:
      1) Grouting methods
      2) Details of equipment
      3) Grouting procedures and sequences including:
         a) Injection methods
         b) Injection pressures
         c) Monitoring and recording equipment
         d) Pressure gauge calibration data
         e) Materials
      4) Grout mix details including:
         a) Proportions
         b) 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.
   (b) Submit a minimum of 3 other similar projects where the proposed grout mix design was used.
   (c) Submit anticipated volumes of grout to be pumped for each application and reach grouted.

B. Daily Records
   1. Submit samples of the tunneling logs or records to be used at least 7 days prior to beginning Hand Tunneling.
   2. Submit daily records to the City’s Inspector by noon on the day following the shift for which the data or records were taken.
   3. Daily records shall include:
      a. Date
      b. Time
      c. Name of operator
      d. Tunnel drive identification
      e. Installed liner ring and corresponding tunnel length
      f. Time required to tunnel each ring
      g. Time required to set subsequent ring
      h. Spoil volumes (muck carts per liner ring and estimated volume of spoil in each muck cart)
      i. Grout volumes and pressures
      j. Soil conditions, including occurrences of unstable soils and estimated groundwater inflow rates, if any
      k. Line and grade offsets
      l. Any movement of the guidance system
      m. Problems encountered during tunneling
      n. Durations and reasons for delays
      o. Manually recorded observations made:
         1) At intervals of not less than 2 every 5 feet
         2) As conditions change
         3) As directed by the City and/or Engineer

1.7 CLOSEOUT SUBMITTALS [NOT USED]

1.8 MAINTENANCE MATERIAL SUBMITTALS [NOT USED]

1.9 QUALITY ASSURANCE

A. Qualifications
   1. Failure to meet the qualification requirements is failure to fulfill the Contract and the Contractor will be required to obtain a subcontractor that meets the qualification requirements.
   2. Contractor
a. All tunneling work shall be performed by an experienced subcontractor or Contractor who has at least 5 years of experience in performing tunneling work and has completed at least 5 projects of similar diameter in similar ground conditions.

3. All Work by the Contractor shall be done in the presence of the City unless the City grants prior written approval to perform such work in City’s absence.

4. The Contractor shall allow access to the City and/or Engineer and shall furnish necessary assistance and cooperation to aid in the observations, measurements, data and sample collection including, but not limited to, the following:
   a. The City and/or Engineer shall have access to the tunneling system prior to, during and following all tunneling operations.
   b. The City and/or Engineer shall have access to the tunneling shafts prior to, during and following all tunneling operations.
      1) This shall include, but not be limited to, visual inspection of installed pipe and verification of line and grade.
      2) The Contractor shall provide safe access in accordance with all safety regulations.
   c. The City and/or Engineer shall have access to spoils removed from the tunnel excavation prior to, during and following all tunneling operations.
      1) The City shall be allowed to collect soil samples from the muck buckets or spoil piles a minimum of once every 10 feet and at any time when changes in soil conditions or obstructions are apparent or suspected.

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. Description

1. Tunnel Liner Plate shall be in accordance with Section 33 05 21.

2. Casing Pipe shall be in accordance with Section 33 05 22.

B. Design Criteria

1. Design excavation methods and spoil conveyance system for the full range of ground conditions described in the Geotechnical Reports

2. Tolerance
   a. Accurately maintain the face of the excavation inside the tunnel so as to allow the absolute minimum of void space outside the casing/liner plate.
   b. Maintain a maximum of ½ inch tolerance between the outside of the casing/liner plate and the excavation wherever possible.
   c. The tunnel diameter shall not be greater than 2 inches larger than the casing/liner outer diameter (O.D.).
3. Use methods and equipment that control surface settlement and heave above the pipeline to prevent damage to existing utilities, facilities and improvements.
   a. Limit any ground movements (settlement/heave) to values that shall not cause damage to adjacent utilities and facilities.
   b. Repair any damage caused by ground movements at no cost to the City.

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. Tunneling shall not begin until the following have been completed:
   1. All required submittals have been made and the City and/or Engineer has reviewed and accepted all submittals.
   2. Review of available utility drawings and location of conduits and underground utilities in all areas where excavation is to be performed.
      a. Notify the applicable one-call system prior to any excavation to avoid interference with the existing conduits and utilities.
      1) Repair damage to existing utilities resulting from excavation at no additional cost to the City.
   3. Shaft excavations and support systems for each drive completed in accordance with the requirements of the Specifications.
   4. Site safety representative has prepared a code of safe practices in accordance with OSHA requirements.
      a. Provide the Engineer and Owner with a copy of each prior to starting shaft construction or tunneling.
      b. Hold safety meetings and provide safety instruction for new employees as required by OSHA.
   5. All specified settlement monitoring points have been installed, approved and baselined in accordance with the Contract Documents.

B. Verification of Stability

1. Confirm that the ground will remain stable without movement of soil or water while the entry/exit location shoring is removed and while the tunnel is launched or received into a shaft.
2. Demonstrate that all soils have been stabilized at all tunnel portal locations to:
   a. Prevent the inflow of weak, running or flowing soils.
   b. Prevent the inflow of loose rock.
   c. Prevent and control groundwater inflows.

3.4 INSTALLATION

A. Tunnel Methods
1. Tunnel liner plate shall not be used where bore or jack methods are used, or where
   not allowed on the Drawings or permits.

2. The Contractor shall be fully responsible to:
   a. Ensure the methods used are adequate for the protection of workers, pipe,
      property and the public
   b. Provide a finished product as required.

B. General

1. The Contractor shall immediately notify the City, in writing, if and when any
   problems are encountered with equipment or materials, or if the Contractor believes
   the conditions encountered are materially and significantly different than those
   represented within the Contract Documents.

2. Properly manage and dispose of groundwater inflows to the shafts in accordance
   with requirements of Specifications and all permit conditions.
   a. Discharge of groundwater inflow into sanitary sewers is not allowed without
      proper approval and permits.

3. Furnish all necessary equipment, power, water and utilities for tunneling, spoil
   removal and disposal, grouting and other associated work required for the methods
   of construction.

4. Promptly clean up. Remove and dispose of any spoil or slurry spillage.

5. Whenever there is a condition that is likely to endanger the stability of the
   excavation or adjacent structures, operate with a full crew 24 hours a day, including
   weekends and holidays, without interruption, until those conditions no longer
   jeopardize the stability of the Work.

C. Installation with Steel Casing Pipe

1. Jack the pipe from the low or downstream end, unless specified otherwise.
   a. Provide heavy duty jacks suitable for forcing the pipe through the embankment.
      1) When operating jacks, apply pressure evenly.
   b. Provide a suitable jacking head and bracing between jacks so that pressure will
      be applied to the pipe uniformly around the ring of the pipe.
   c. Provide a suitable jacking frame or back stop.
   d. Set the pipe to be jacked on guides, properly braced together, to support the
      section of the pipe and to direct it in the proper line and grade.
   e. Place the whole jacking assembly so as to line up with the direction and grade
      of the pipe.
   f. In general, excavate embankment material just ahead of the pipe and remove
      material through the pipe.
   g. Force the pipe through the embankment with jacks into the space excavated.

2. The excavation for the underside of the pipe, for at least 1/3 of the circumference of
   the pipe, shall conform to the contour and grade of the pipe.
   a. Provide a clearance of not more than 2 inches for the upper half of the pipe.
      1) This clearance shall be tapered off to 0 at the point where the excavation
         conforms to the contour of the pipe.
   b. Extend the distance of the excavation beyond the end of the pipe depending on
      the character of the material, but do not exceed 2 feet in any case.
      1) Decrease the distance if the character of the material being excavated
         makes it desirable to keep the advance excavation closer to the end of the
         pipe.
3. If desired, use a cutting edge of steel plate around the head end of the pipe
   extending a short distance beyond the end of the pipe with inside angles or lugs to
   keep the cutting edge from slipping back onto pipe.

4. When jacking of pipe has begun, carry on the operation without interruption to
   prevent the pipe from becoming firmly set in the embankment.
   a. Remove and replace any pipe damaged in the jacking operations.
   b. The Contractor shall absorb the entire expense.

D. Installation with Tunnel Liner Plate

1. Install the tunnel liner plates to the limits indicated on the Drawings and as
   specified in AASHTO HB-17, Section II-26, Construction of Tunnels Using Steel
   Tunnel Liner Plates.
   a. Assemble liner plates into circumferential rings.
   b. Liner plates shall be of the type to permit segments to be installed completely
       from inside the tunnel.

2. Accurately maintain the face of the excavation inside the tunnel so as to allow the
   absolute minimum of void space outside the casing/liner plate.
   a. Maintain a maximum of ½ inch tolerance between the outside of the
      casing/liner plate and the excavation wherever possible.
   b. The tunnel diameter shall not be greater than 2 inches larger than the liner O.D.

3. Liner plate installation shall proceed as closely as possible behind the excavation.
   a. Excavation shall at no time be more than 6 inches ahead of the required space
      to install an individual tunnel liner plate.
   b. Use breast plates, poling boards or other suitable devices to maintain accurate
      excavation with the minimum of unsupported excavation at any time.
   c. Casing/Tunnel liner plate shall not be allowed to deflect vertically during
      installation.

4. Tunneling operations shall control surface settlement and heave above the pipeline
   to prevent damage to existing utilities, facilities and improvements.
   a. In no case shall ground movements cause damage to adjacent structures,
      roadways, or utilities.
   b. The Contractor shall repair any damage resulting from construction activities,
      at no additional cost to the City and without extensions of schedule for
      completion.

E. Contact Grouting

1. Pressure grout any voids caused by or encountered during the tunneling.
   a. Modify equipment and procedures as required to avoid recurrence of excessive
      settlements or damage.

2. Install contact grout in the void space between the outside of the casing/tunnel liner
   and the excavation.
   a. For tunnel liner plate, install pressure grout mix at the end of each work day or
      more often, as conditions warrant.

3. Install pressure grouting through grout fittings for the casing/tunnel liner plate 48-
   inches in diameter or larger.
   a. Grout fittings shall be fabricated into tunnel liner plate at a maximum spacing
      of 6 feet.
   b. Remove and plug grout fittings after pressure grouting.
4. Install pressure grout from the low end for all crossings where grout fittings are not used.
   a. Seal the low end and pressure grout until grout is extruded from the opposite end.

F. Control of Line and Grade
1. Confirm that all established benchmarks and control points provided for the Contractor’s use are accurate.
   a. Use these benchmarks to furnish and maintain all reference lines and grades for tunneling.
   b. Use lines and grades to establish the location of the pipe using a laser or theodolite guidance system.
   c. Submit to the City copies of field notes used to establish all lines and grades
      and allow the Engineer to check guidance system setup prior to beginning each
      tunneling drive.
   d. Provide access for the City to perform survey checks of the guidance system
      and the line and grade of the carrier pipe on a daily basis during tunneling
      operations.
   e. The Contractor remains fully responsible for the accuracy of the work and the
      correction of it, as required.

2. The casing/tunnel liner shall be installed in accordance with the following tolerances:
   a. Variations from design line or grade: ± 2 inches maximum
      1) If the installation is off line or grade, make the necessary corrections and
         return to the design alignment and grade at a rate of not more than 1 inch
         per 25 feet.

3. Monitor line and grade continuously during tunneling operations.
   a. Record deviation with respect to design line and grade once at each pipe joint
      and submit records to Engineer daily.

4. If the pipe installation does not meet the specified tolerances, correct the installation, including any necessary redesign of the pipeline or structures and
   acquisition of necessary easements.

G. Obstructions
1. If the tunneling operations should encounter an object or condition that impedes the
   forward progress of the shield, notify the City immediately.

2. Correct the condition and remove, clear or otherwise make it possible for the shield
   to advance past any objects or obstructions that impede forward progress.

3. Proceed with removal of the object or obstruction by methods submitted by the
   Contractor and accepted by the City and/or Engineer.

4. Compensation
   a. The Contractor will receive compensation by change order for removal of
      obstructions, as defined as metallic debris, reinforced concrete, rocks, whole
      trees and other hard objects with a maximum dimension larger than 50 percent
      of the outer diameter of the shield which:
         1) Cannot be broken up by the cutting tools with diligent effort, and
         2) Are located partially or wholly within the cross-sectional area of the bore
         3) Contain utilities or ditch lines located longitudinally within the tunnel
            horizon
b. Payment will be negotiated with the Contractor on a case-by-case basis.

c. The City and/or Engineer shall be provided an opportunity to view obstruction
prior to removal.

1) Any removal process that does not allow direct inspection of the nature
and position of the obstruction will not be considered for payment.

d. No additional compensation will be allowed for removing, clearing or
otherwise making it possible for the shield to advance past objects consisting of
coffles, boulders, wood, reinforced concrete, and other objects or debris with
maximum lateral dimensions less than 50 percent of the outer diameter of the
shield.

3.5 CLEANUP AND RESTORATION

A. After completion of the tunneling, all construction debris, spoils, oil, grease and other
materials shall be removed from the tunneling pipe, shafts and all work areas.

1. Cleaning shall be incidental to the construction.

B. Restoration shall follow construction as the Work progresses and shall be completed as
soon as reasonably possible.

1. Restore and repair any damage resulting from surface settlement caused by shaft
evacuation or tunneling.

2. Any property damaged or destroyed, shall be restored to a condition equal to or
better than that to which it existed prior to construction.

3. Restoration shall be completed no later than 30 days after tunneling is complete, or
earlier if required as part of a permit or easement agreement.

4. This provision for restoration shall include all property affected by the construction
operations.

3.6 RE-INSTALLATION [NOT USED]

3.7 SITE QUALITY CONTROL

A. Safety

1. No gasoline powered equipment shall be permitted in receiving shafts/pits.

a. Diesel, electrical, hydraulic and air powered equipment are acceptable, subject
to applicable local, State, and Federal regulations.

2. 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 gases in all underground work areas.

3. Perform all Work in accordance with all current applicable regulations and safety
requirements of the Federal, State, and Local agencies. Comply with all applicable
provisions of OSHA 29 CFR Part 1926, Subpart S, Underground Construction and
Subpart P, Excavations.

a. In the event of conflict, comply with the more stringent requirements.

4. If personnel will enter the pipe during construction, the Contractor shall develop an
emergency response plan for rescuing personnel trapped underground in a shaft
evacuation or pipe.
1 a. Keep on-site all equipment required for emergency response in accordance with
2 the agency having jurisdiction.
3
4 3.8 SYSTEM STARTUP [NOT USED]
5 3.9 ADJUSTING [NOT USED]
6 3.10 CLEANING [NOT USED]
7 3.11 CLOSEOUT ACTIVITIES [NOT USED]
8 3.12 PROTECTION [NOT USED]
9 3.13 MAINTENANCE [NOT USED]
10 3.14 ATTACHMENTS [NOT USED]

11 END OF SECTION

12

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SECTION 33 05 24

INSTALLATION OF CARRIER PIPE IN CASING OR TUNNEL LINER PLATE

PART 1 - GENERAL

1.0 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 City of Fort Worth 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. 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
   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.
     a. C39, Standard Test Method for Compressive Strength of Cylindrical Concrete
        Specimens.
        Mortars (Using 2-in or [50 mm] Cube Specimens).
  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 Engineer or 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


1.10 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.

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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).
   b. Casing Spacers/Insulators 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) File 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) ± 2 inches from design line
   b. Vertical
      1) ±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 ductile-iron pipe, flanged pipe or bell and spigot pipe, install spacers within
      1 foot on each side of the bell or flange and 1 in the center of the joint where 18
      foot or 20 foot long joints are used.
   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
ground 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 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.
   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

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SECTION 33 05 26
UTILITY MARKERS/LOCATORS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Buried and surface utility markers for utility construction

B. Deviations from this City of Fort Worth 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 Engineer or 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
      a. Detectable warning tape shall be 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 Color Code)
(2) Legend – Caution Sewer Line Below (repeated every 24 inches)

b. Electronic utility marker balls shall be as follows:

1) Sealed shell containing a passive antenna – low-frequency resonance circuit tuned to specific frequency
2) Size – 4.5-inch diameter
3) Range – 5 feet minimum
4) Field Type/Shape – Spherical
5) Material – high-density polyethylene
6) Color and Frequency

   a) Water Lines

       (1) Color – Blue (in accordance with APWA Uniform Color Code)
       (2) Frequency – 145.7 kHz

   b) Sewer Line Markers

       (1) Color – Green (in accordance with APWA Uniform Color Code)
       (2) Frequency – 121.6 kHz

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 Color Code)
               (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 Color Code)
               (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

1. Detectable Warning Tape
   a. Install in accordance with manufacturer’s recommendations below natural
      ground surface and directly above the utility for which it is marking.
      1) Allow 18 inches minimum between utility and marker.
      2) Bury to a depth of 3 feet or as close to the grade as is practical for optimum
         protection and detectability.

2. Electronic Marker Balls
   a. Install in accordance with manufacturer’s recommendations below natural
      ground surface and directly above the utility for which it is marking.
      1) Allow 4 inches minimum between utility and marker.
      2) Bury to a depth of 5 feet maximum, or as close to the grade as is practical
         for optimum protection and detectability.
      3) Allow at least 6 feet between each marker.
   b. Use tie-downs for placement of markers if deemed necessary by the City, or
      Engineer.
   c. Upon completion of installation, the City will inspect that electronic marker
      balls are installed in place, prior to paving over any of the required locations.
   d. See table below for other details related to marker ball installation.
<table>
<thead>
<tr>
<th>Marker Ball Clearance, Spacing, Bury and Placement</th>
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<tr>
<td><strong>Clearance between Utility and Marker</strong></td>
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<td><strong>Maximum Bury Depth</strong></td>
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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

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Revision Log
SECTION 33 05 30
EXPLORATORY EXCAVATION FOR 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

B. Deviations from this City of Fort Worth 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. Measurement
      a. Measurement for this Item shall be per each excavation performed as identified in the Drawings, or as directed.
   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 “Exploratory Excavation of Existing Utilities” of the type specified.
   3. The price bid shall include:
      a. Grade survey
      b. Pavement removal
      c. Excavation
      d. Hauling
      e. Disposal of excess material
      f. Furnishing, placing and compaction of embedment
      g. Furnishing, placing and compaction of backfill
      h. Clean-up
      i. Surface restoration

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.
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 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. Verify location of existing utility at location denoted on the Drawings, or as directed by
   the City or Engineer.
   1. Expose utility to spring line, as necessary.
   2. Excavate and Backfill Trench for the Exploratory Excavation in accordance with
      Section 33 05 10.

B. Upon completion of the utility exploration, submit a report of the findings.

C. If location of utility is in conflict with the Drawings, notify the City Project Manager
   for appropriate design modifications.

D. Place embedment and backfill in accordance with Section 33 05 10.

E. 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
## Revision Log

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**CITY OF FORT WORTH**  
**STANDARD CONSTRUCTION SPECIFICATION DOCUMENTS**  
Revised July 1, 2011
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 City of Fort Worth Standard Specification
   1. Subparagraph 1.2.A.1.b.1

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
   7. 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” or “Water Pipe” installed for:
            a) Various sizes
            b) Various types of backfill
            c) Various linings
            d) Various gaskets
            e) Various Depths, for miscellaneous projects only
            f) Various restraints
            g) 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 Stop  
12) Thrust restraint, if required in Contract Documents  
13) Bolts and nuts  
14) Gaskets  
15) Clean-up  
16) Cleaning  
17) Disinfection  
18) Testing  

2. 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 “Hydrocarbon Resistant  
         Gaskets”.

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.  
3. American Society of Mechanical Engineers (ASME):  
4. ASTM International (ASTM):  
   b. A307, Standard Specification for Carbon Steel Bolts and Studs, 60,000 psi  
      Tensile Strength.  
   c. A674, Standard Practice for Polyethylene Encasement for Ductile Iron Pipe for  
      Water or Other Liquids.  
   e. 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.  
   c. M41, Ductile-Iron Pipe and Fittings.  
6. American Water Works Association/American National Standards Institute  
   (AWWA/ANSI):
7. C600, Installation of Ductile-Iron Water Mains and their Appurtenances
8. NSF International (NSF):
   a. 61, Drinking Water System Components - Health Effects.
9. 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 Engineer or 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
1. Fittings
2. Stationing
3. Transitions
4. 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.
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:

<table>
<thead>
<tr>
<th>Diameter (inches)</th>
<th>Min Pressure Class (psi)</th>
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<tbody>
<tr>
<td>3 through 12</td>
<td>350</td>
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<td>14 through 20</td>
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<td>24</td>
<td>200</td>
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<tr>
<td>30 through 64</td>
<td>150</td>
</tr>
</tbody>
</table>

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 \((P_w) = 150 \text{ psi}\)
6) Surge Allowance \((P_s) = 100 \text{ psi}\)
7) Design Internal Pressure \((P_d) = P_w + P_s \text{ or } 2:1 \text{ safety factor of the actual working pressure plus the actual surge pressure, whichever is greater.}\)
   a) Test Pressure =
       (1) No less than 1.25 minimum times the stated working pressure \((187 \text{ psi minimum})\) of the pipeline measured at the highest elevation along the test section.
       (2) No less than 1.5 times the stated working pressure \((225 \text{ psi minimum})\) at the lowest elevation of the test section.
8) Maximum Calculated Deflection \((D_r) = 3 \text{ percent}\)
9) Restraint Joint Safety Factor \((S_r) = 15 \text{ percent}\)
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 \((P_d)\) 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. All rubber joint gaskets utilized on Ductile Iron Pipe shall be in conformance
      with AWWA/ANSI C111/A21.11.

   b. Flanged Gaskets
      1) Full face
      2) Manufactured true to shape from minimum 80 durometer SBR rubber stock
         of a thickness not less than 1/8 inch
      3) Virgin stock
      4) Conforming to the physical and test requirements specified in
         AWWA/ANSI C111/A21.11.
      5) Finished gaskets shall have holes punched by the manufacturer and shall
         match the flange pattern in every respect.
      6) Frayed cut edges resulting from job site gasket fabrication are not
         acceptable.
      7) Furnish Viton® Rubber gaskets hydrocarbon restraint gaskets, when
         required.

   c. Isolation Flanges
      1) Flanges required by the drawings to be Isolation Flanges shall conform to
         Section 3 04 10.

10. Bolts and Nuts
    a. Mechanical Joints
       1) High strength corrosion restraint low-carbon weathering steel in
          accordance with AWWA/ANSI C111/A21.11 and ASTM A242.
       2) Cor-Blue coated with FluoroKote #1, or equal
          a) Coating shall conform to the performance requirements of ASTM B117
             for up to 4000 hours and shall include, if required, a certificate of
             conformance.

    b. Flanged Ends
       1) Meet requirements of AWWA C115.
          a) For buried and non-buried applications, provide ASTM A193 Grade B7
             Bolts and ASTM 194 Grade 2H Nuts.
11. Flange Coatings
   a. Connections to Steel Flanges
      1) Coatings for buried flanges shall be Densyl Tape system manufactured by
         Carboline, consisting of Densyl Mastic, Densyl Paste, and Densyl Tape, or
         approved equal.

12. 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.

13. 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

<table>
<thead>
<tr>
<th>Nominal Pipe Diameter (inches)</th>
<th>Min. Width – Flat Tube (inches)</th>
<th>Min. Width – Sheet (inches)</th>
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<tbody>
<tr>
<td>3</td>
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<td>216</td>
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<tr>
<td>64</td>
<td>121</td>
<td>242</td>
</tr>
</tbody>
</table>

14. 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.

c. 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 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
### Revision Log

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<th>NAME</th>
<th>SUMMARY OF CHANGE</th>
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SECTION 33 11 11

DUCTILE IRON FITTINGS

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

B. Deviations from this City of Fort Worth 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. 03 34 16 – Concrete Base Material for Trench Repair
   4. 33 04 40 – Cleaning and Acceptance Testing of Water Mains
   5. 33 05 10 – Utility Trench Excavation, Embedment and Backfill

1.2 PRICE AND PAYMENT PROCEDURES

A. Measurement and Payment
   1. Ductile Iron Water 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 Water Fittings”.
      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
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 restraint (if required)
      10) Furnishing, placement and compaction of embedment
      11) Furnishing, placement and compaction of backfill
      12) Clean-up
      13) Cleaning
      14) Disinfection
      15) Testing

3. 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 “Hydrocarbon Resistant
Gaskets”.

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):

3. ASTM International (ASTM):
   b. A674, Standard Practice for Polyethylene Encasement for Ductile Iron Pipe for
      Water or Other Liquids.

4. American Water Works Association (AWWA):
   a. C203, Coal-Tar Protective Coatings and Linings for Steel Water Pipelines -
      Enamel and Tape - Hot Applied.
   c. M41, Ductile-Iron Pipe and Fittings.

5. American Water Works Association/American National Standards Institute
   (AWWA/ANSI):
   e. C115/A21.15, 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. 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 Engineer or 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. Bolts and nuts for mechanical and or flange joints

6. Gaskets

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


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. Push-On Joints
      1) Comply with AWWA/ANSI C111/A21.11.
   b. Mechanical Joints
      1) Comply with AWWA/ANSI C111/A21.11.
   c. Mechanical Joints with mechanical restraint
      1) Restraint devices shall consist of multiple gripping wedges incorporated into a follower gland meeting the applicable requirements of ANSI/AWWA C110/A21.10.
      2) The devices 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, 305 psi
   (2) 14-inch – 16-inch, 235 psi
   (3) 18-inch – 20-inch, 200 psi
   (4) 24-inch – 30-inch 165 psi
c) Ratings are for water pressure and must include a minimum safety factor of 2 to 1 in all sizes

3) Restraint devices shall have specific designs for Ductile Iron and PVC and should be easily differentiate between the two.

4) Gland body, wedges and wedge acting 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.

d. 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

e. 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. All rubber joint gaskets utilized on Ductile Iron Fittings shall be in conformance with AWWA/ANSI C111/A21.11.
   b. Flanged Gaskets
      1) Full face
      2) Manufactured true to shape from minimum 80 durometer SBR rubber stock of a thickness not less than 1/8 inch
      3) Virgin stock
      4) Conforming to the physical and test requirements specified in AWWA/ANSI C111/A21.11
      5) Finished gaskets shall have holes punched by the manufacturer and shall match the flange pattern in every respect.
6) Frayed cut edges resulting from job site gasket fabrication are not acceptable.
7) Furnish Viton® Rubber gaskets hydrocarbon restraint gaskets, when required.
   c. Isolation Flanges
   1) Flanges required by the drawings to be Isolation Flanges shall conform to Section 3 04 10.
7. Bolts and Nuts
   a. Mechanical Joints
      1) High strength corrosion restraint low-carbon weathering steel in accordance with AWWA/ANSI C111/A21.11, and ASTM A242.
      2) Cor-Blue coated with FluoroKote #1, or equal
         a) Coating shall conform to the performance requirements of ASTM B117 for up to 4000 hours and shall include, if required, a certificate of conformance.
   b. Flanged Ends
      1) Meet requirements of AWWA C115.
         a) For buried and non-buried applications, provide ASTM A193 Grade B7 bolts and ASTM 194 Grade 2H Nuts.
8. Flange Coatings
   a. Connections to Steel Flanges
      1) Coatings for buried flanges shall be Densyl Tape system manufactured by Carbone, consisting of Densyl Mastic, Densyl Paste, and Densyl Tape, or approved equal.
9. 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.
10. 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

<table>
<thead>
<tr>
<th>Nominal Fittings Diameter (inches)</th>
<th>Min. Width – Flat Tube (inches)</th>
<th>Min. Width – Sheet (inches)</th>
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<td>64</td>
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<td>242</td>
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</table>

11. 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

   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, refinished 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 proceeding 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 34 16 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.
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SECTION 33 11 12
POLYVINYL CHLORIDE (PVC) PRESSURE PIPE

PART 1 - GENERAL

1.0 SUMMARY

A. Section Includes:
1. Polyvinyl Chloride (PVC) Pressure Pipe 4-inch through 24-inch for potable water,
wastewater and reuse applications

B. Deviations from this City of Fort Worth 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

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
      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
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.


3. ASTM International (ASTM):
      Compounds and Chlorinated Poly(Vinyl Chloride) (CPVC) Compounds.
      Flexible Elastomeric Seals.

4. American Water Works Association (AWWA):
   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.

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 Engineer or 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
1. Manufacturer
2. Dimension Ratio
3. 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 AWWA C900
      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-B. Outside diameters must be equal to those of cast iron and ductile iron pipes.
   6. As a minimum the following Dimension Ratio’s apply:

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<th>Diameter (inch)</th>
<th>Min Pressure Class (psi)</th>
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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 pipe 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 (Pw) = 150 psi
   g. Surge Allowance (Ps) = 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

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), 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.
   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) 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. Bolt the follower ring into compression against the gasket, with the bolts
tightened down evenly then cross torque 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 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. 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. 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

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SECTION 33 11 13
CONCRETE PRESSURE PIPE, BAR-WRAPPED, STEEL CYLINDER TYPE

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Concrete Pressure Pipe, Bar-Wrapped, Steel Cylinder Type (Concrete Pressure Pipe) 24-inch through 72-inch for potable water applications in conformance with AWWA C303

B. Deviations from this City of Fort Worth Standard Specification

1. Subparagraph 1.2.A.1.b.1

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

1.2 PRICE AND PAYMENT PROCEDURES

A. Measurement and Payment

1. Concrete Pressure Pipe

a. Measurement

1) Measured horizontally along the surface from center line to centerline of the fitting or appurtenance

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 “Concrete AWWA C303 Pipe” or “Water Pipe” installed for:

a) Various sizes

b) Various types of backfill

c. The price bid shall include:

1) Furnishing and installing Concrete Pressure Pipe with joints as specified by the Drawings

2) Mobilization

3) Coating

4) Lining

5) Pavement removal

6) Excavation

7) Hauling

8) Disposal of excess material
9) Furnishing, placement, and compaction of embedment
10) Trench Water Stop
11) Joint restraint
12) Bolts and nuts
13) Welding
14) Gaskets, if allowed
15) Furnishing, placement, and compaction of backfill
16) Clean-up
17) Cleaning
18) Disinfection
19) Testing

2. Concrete Pressure Pipe Fittings
   a. Measurement
      1) Measurement for this Item shall be by lump sum.
   b. Payment
      1) The work performed and materials furnished in accordance with this Item
         shall be paid for at the lump sum price bid for “C303 Fittings” installed for:
         a) Various sizes
         b) Various types of backfill
   c. The price bid shall include:
      1) Furnishing and installing Concrete Pressure Pipe Fittings as specified by
         the Drawings
      2) Mobilization
      3) Coating
      4) Lining
      5) Pavement removal
      6) Excavation
      7) Hauling
      8) Disposal of excess material
      9) Furnishing, placement, and compaction of embedment
      10) Clay Dams
      11) Joint restraint
      12) Bolts and nuts
      13) Welding
      14) Gaskets, if allowed
      15) Furnishing, placement, and compaction of backfill
      16) Clean-up
      17) Cleaning
      18) Disinfection
      19) 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):

b. A307, Standard Specification for Carbon Steel Bolts and Studs, 60,000 PSI
   Tensile Strength.
d. B633, Standard Specification for Electrodeposited Coatings of Zinc on Iron and
   Steel.
e. C33, Standard Specification for Concrete Aggregates.
g. C150, Specification for Portland Cement.
h. C293, Standard Test Method for Flexural Strength of Concrete (Using Simple
   Beam with Center-Point Loading).
i. C497, Methods of Testing Concrete Pipe.
j. C882, Standard Test Method for Bond Strength of Epoxy-Resin Systems Used
   With Concrete By Slant Shear.
k. C1090, Standard Test Method for Measuring Changes in Height of Cylindrical
   Specimens of Hydraulic-Cement Grout.

   a. D1.1, Structural Welding Code - Steel.

5. American Water Works Association (AWWA):
   a. C206, Field Welding of Steel Water Pipe.
   b. C207, Steel Pipe Flanges for Waterworks Service - Sizes 4 IN through 144 IN.
   c. C303, Concrete Pressure Pipe, Bar-Wrapped, Steel-Cylinder Type.
   d. M9, Concrete Pressure Pipe.

6. American Water Works Association/American National Standards Institute
   (AWWA/ANSI):
   a. C111/A21.11, Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and
      Fittings.


8. National Sanitation Foundation (NSF):
   a. NSF 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 Engineer or the City prior to delivery and/or
   fabrication for specials.

1.6 ACTION SUBMITTALS/INFORMATIONAL SUBMITTALS

A. Product Data
   1. Exterior Coating
      a. Material data
      b. Application recommendations
      c. Field touch-up procedures
   2. Joint Wrappers
      a. Material data
      b. Installation recommendations
3. Flexible Joint Couplings
   a. Manufacturer
   b. Model
4. Mixes
   a. Mortar for interior joints and patches
   b. Bonding agents for patches
5. Gaskets (if applicable)

B. Shop Drawings – Furnish for Concrete Pressure Pipe used in the potable water systems
   including:
   1. Wall thickness design calculations sealed by a Licensed Professional Engineer in
      Texas including:
      a. Internal pressure
         1) Working Pressure
         2) Test Pressure
         3) Surge pressure
      b. External pressure
         1) Deflection
         2) Buckling
      c. Special physical loading such as supports or joint design
      d. Thermal expansion and/or contraction, if applicable for the proposed
         installation
   2. Thrust restraint calculations for all fittings and valves including the restraint length
      sealed by a Licensed Professional Engineer in Texas.
   3. Fabrication and lay drawings showing a schematic location with profile and a
      tabulated layout schedule that is sealed by a Licensed Professional Engineer in
      Texas and includes:
      a. Pipe class
      b. Joint types
      c. Fittings
      d. Thrust Restraint
      e. Stationing (in accordance with the Drawings)
      f. Transitions
      g. Joint deflection
      h. Outlet locations for welding, ventilation, and access
      i. Welding requirements
   4. Pipe within Casing
      a. Provide drawings detailing how pipe is restrained to prevent floating within the
         casing.

C. Certificates and Test Reports
   a. Submittals for certificates and testing reports shall be as outlined in Article 1.9
      of this Section.

1.7 CLOSEOUT SUBMITTALS [NOT USED]

1.8 MAINTENANCE MATERIAL SUBMITTALS [NOT USED]

1.9 QUALITY ASSURANCE

A. Qualifications
1. Manufacturers
   a. Shall be American Concrete Pressure Pipe Association (ACPPA) Quality
      Program certified, I.S.O. Quality Certification Program certified, or equal, for
      Concrete Pressure Pipe and accessory manufacturing.
   b. Pipe manufacturing operations (pipe, lining, and coatings) shall be performed
      under the control of the manufacturer.
   c. Pipe shall be the product of 1 manufacturer which has had not less than 5 years
      successful experience manufacturing AWWA C303 pipe of the particular type
      and size indicated.
      1) This experience record will be thoroughly investigated by the Engineer, and
      acceptance will be at the sole discretion of the Engineer and City.
      2) Pipe manufacturing operations (pipe, fittings, lining, and coating) shall be
      performed at 1 location, unless otherwise approved by the Engineer.
   d. Pipe shall be manufactured in accordance with the latest revisions of
      AWWA C303.

B. Certifications
   1. Prior to shipment of the pipe, the Pipe Manufacturer shall submit the following:
      a. A Certificate of Adequacy of Design stating that the pipe to be furnished
         complies with AWWA C303 and these Specifications
      b. Copies of results of factory hydrostatic tests shall be provided to the Engineer
      c. Mill certificates, including chemical and physical test results for each heat of
         steel
         1) The manufacturer shall perform the tests described in AWWA C303, for all
         pipe, fittings, and specials, except that the absorption test detailed in this
         Specification shall supersede the requirements of the applicable portion of
         AWWA C303.
      d. Certified test reports for welder certification for factory and field welds in
         accordance with AWWA C303, Section 5
      e. Certified test reports for cement mortar tests
      f. Certified test reports for steel cylinder tests

C. Hydrostatic Pressure Testing
   1. Hydrostatic pressure testing shall meet or exceed the requirements of AWWA C303
      Section 4.6 – Fabrication.
      a. Each pipe cylinder, with rings welded to its ends, shall be hydrostatically tested
         prior to application of lining or coating.
      b. The internal test pressure shall be that which results in a fiber stress equal to 75
         percent of the minimum yield strength of the steel used.
      c. Each pipe cylinder tested shall be completely watertight under maximum test
         pressure.
      d. Test pressure shall be held for sufficient time to observe the weld seams.
      e. Pipe manufacturer shall maintain a recording of the pressure gauge report and
         provide to the Engineer.
   2. Fittings shall be fabricated from hydrostatically tested pipe or fabricated of welded
      steel sheets or plates.
      a. Fittings shall be tested in accordance with AWWA C303.
   3. Factory Testing
      a. Cement Mortar Coating - Absorption Test
1) A water absorption test shall be performed on samples of cured mortar coating taken from each working shift.
   a) The mortar coating samples shall have been cured in the same manner as the pipe.
   b) A test value shall consist of the average of a minimum of 3 samples taken from the same working shift.
   c) The test method shall be in accordance with ASTM C497, Method A.
   d) The average absorption value for any test shall not exceed 9 percent and no individual sample shall have an absorption exceeding 11 percent.
   e) Tests for each working shift shall be performed on a daily basis until conformance to the absorption requirements has been established by 10 consecutive passing test results, at which time testing may be performed on a weekly basis for each working shift. (1) Daily testing shall be resumed for each working shift with failing absorption test results and shall be maintained until conformance to the absorption requirements is re-established by 10 consecutive passing test results.

D. Cement Mortar Lining
   1. Shop-applied cement mortar linings shall be tested in accordance with AWWA C303.

E. City Testing and Inspection
   1. The City reserves the option to have an independent testing laboratory, at the City's expense, inspect pipe and fittings at the pipe manufacturer's plant.
      a. The City's testing laboratory and Engineer shall have free access to the manufacturer's plant.
      b. The pipe manufacturer shall notify the City, in writing, at least 2 weeks prior to pipe fabrication as to start of fabrication and fabricating schedule. The City will then advise the manufacturer as to City's decision regarding tests to be performed by an independent testing laboratory.
      c. In the event the City elects to retain an independent testing laboratory to make material tests and weld tests, it is the intent that the tests be limited to 1 spot testing of each category unless the tests do not show compliance with the standard.
         1) If these tests do not show compliance, the City reserves the right to have the laboratory make additional tests and observations.
   2. The inspection and testing by the independent testing laboratory anticipates that production of pipe shall be done over a normal period of time and without "slow downs" or other abnormal delays.
      a. In the event that an abnormal production time is required, and the City is required to pay excessive costs for inspection, then the Contractor shall be required to reimburse the City for such costs over and above those which would have been incurred under a normal schedule of production as determined by the Engineer.

F. Manufacturer’s Technician for Pipe Installation
   1. Pipe Manufacturer’s Representative
a. During the construction period, the pipe manufacturer shall furnish the services
of a factory trained, qualified, job experienced technician to advise and instruct,
as necessary, in pipe laying and pipe jointing.
   1) The technician shall assist and advise the Contractor in his pipe laying
operations and shall instruct construction personnel in proper joint
assembly and joint inspection procedures.
   2) The technician is not required to be on-site full time; however, the
technician shall be regularly on-site during the first 2 weeks of pipe laying
and thereafter as requested by the Engineer, City or Contractor.

1.10 DELIVERY, STORAGE, AND HANDLING

A. Packing
   1. Prepare pipe for shipment to:
      a. Afford maximum protection from normal hazards of transportation
      b. Allow pipe to reach project site in an undamaged condition
   2. Pipe damaged in shipment shall not be delivered to the project site unless such
damaged pipe is properly repaired.
   3. After the completed pipe and fittings have been removed from the final cure at
the manufacturing plant:
      a. Protect pipe lining from drying by means of plastic end covers banded to the
pipe ends.
      b. Maintain covers over the pipe ends at all times until ready to be installed.
      c. Moisture shall be maintained inside the pipe by periodic addition of water as
necessary.
   4. Pipes shall be carefully supported during shipment and storage.
      a. Pipe, fittings and specials shall be separated so that they do not bear against
each other and the whole load shall be securely fastened to prevent
movement in transit.
      b. Ship pipe on padded bunks with tie-down straps approximately over stulling.
      c. Store pipe on padded skids, sand or dirt berms, tires or other suitable means
to protect the pipe from damage.
      d. Each end and each length of pipe, fitting or special (36-inches and larger)
and the middle of each pipe joint shall be internally supported and braced
with stulls to maintain a true circular shape.
         i. Internal stulls shall consist of timber or steel firmly wedged and secured
so that stulls remain in place during storage, shipment and installation.
         ii. Pipe shall be rotated so that one stall remains vertical during storage,
shipment and installation.
         iii. At a minimum, stulls shall be placed at each end, each quarter point and
center.
B. Delivery, Handling, and Storage
   1. Once the first shipment of pipe has been delivered to the site, the Engineer and
the Contractor shall inspect the pipe’s interior coating for excessive cracking.
      a. If excessive cracking is found, exceeding the allowance in AWWA C303,
modify shipping procedures to reduce or eliminate cracking.
   2. Deliver, handle and store pipe in accordance with the manufacturer's
recommendations to protect coating systems.
C. Marking for Identification
   1. For each joint of pipe and each fitting, plainly mark on 1 end:
      a. Class for which it is designated
b. Date of manufacturer
c. Identification number
d. Top centerlines shall be marked on all specials.

D. Point of Delivery
1. The Contractor is responsible for securing and maintaining a location to store the material in accordance with Section 01 66 00.

1.11 WARRANTY [NOT USED]

PART 2 - PRODUCTS

2.1 OWNER-FURNISHED [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. Materials
1. General
   a. Pipe shall be manufactured in accordance with the latest revisions of AWWA C303, AWWA M9, as well as the special requirements of this Specification.
   b. All pipe shall meet the requirements of NSF 61.
2. Cement
   a. Cement for use in concrete and mortar shall be Type I or II Portland Cement.
3. Aggregates
   a. Aggregates for concrete lining and coating shall conform to ASTM C33.
4. Sand
   a. Sand used for inside and outside joints shall be of silica base, conforming to ASTM C144.
5. Special Coating (Mortar Rings)
   a. Pipe to be installed in casing shall have 2 built-up mortar rings, each approximately 2 feet long and slightly higher than the pipe bell, to prevent the pipe from being supported by the pipe bell.
   b. Built-up mortar rings are to be applied at the quarter points of the pipe section.
6. Bushings, Couplings and Plugs
   a. Where outlets or taps are threaded, furnish and install brass reducing bushings in larger steel half couplings for the outlet size indicated.
   b. Threaded plugs shall be brass.
7. Mixes
   a. Cement Mortar
      1) Cement mortar used for pouring joints shall consist of:
          a) 1 part Portland Cement
b) 2 parts clean, fine, sharp silica sand

c) Mixed with water

d) No manufactured sand shall be permitted.

e) Exterior joint mortar shall be mixed to the consistency of thick cream.

f) Interior joint mortar shall be mixed with as little water as possible so
that the mortar is very stiff, but workable.

g) Cement shall be ASTM C150, Type I or Type II.

h) Sand shall conform to ASTM C144.

2) Cement mortar used for patching shall be mixed as per cement mortar for
inside joints.

8. Joint Wrappers

a. Joint wrappers shall be manufactured by Mar-Mac Manufacturing Company, or
approved equal.

b. For pipe within casing, Flex Protex joint filler, or approved equal, may be used
for pipes that can be welded from the interior.

9. Flexible Joint Couplings

a. Flexible Joint Couplings shall be Dresser Style 38, Smith-Blair Style 411 or
approved equal.

10. Pipe Ends

a. The standard pipe end shall include steel joint ring and a continuous solid
rubber ring gasket as per AWWA M9.

11. Flanges

a. Flanges shall conform to AWWA C207 with laying dimensions and drilling in
accordance with ASME B16.1, Class 125.

b. Flanges shall be Flange Class E with a minimum working pressure of 275 psi
for areas designated with 225 psi test pressure.

c. In no case shall the working or test pressure of the pipe exceed the working
pressure of the flange.

d. Drilling shall match class of valves or appurtenances which are attached.

e. When Isolation Flanges are required by the Drawings, Drillings shall
accommodate the required spacing for mylar sleeves according to Section 33 04
10.

12. Flange Coatings

a. Coatings for buried flanges shall be Densyl Tape system manufactured by
Carboline, consisting of Densyl Mastic, Densyl Paste, and Densyl Tape, or
approved equal.

13. Gaskets

a. Isolation Flanges

1) Flanges which are required by the drawings to be Isolation Flanges shall
conform to Section 33 04 10.

b. Class D Flanges

1) Full face

2) Manufactured true to shape from minimum 80 durometer SBR rubber stock
of a thickness not less than 1/8 inch

3) Virgin stock

4) Conforming to the physical and test requirements specified in
AWWA/ANSI C111/A21.11
5) Finished gaskets shall have holes punched by the manufacturer and shall match the flange pattern in every respect.
6) Frayed cut edges resulting from job site gasket fabrication are not acceptable.
7) Furnish Viton® Rubber gaskets hydrocarbon restraint gaskets, when required.
c. Class E Flanges
   1) Full Face
   2) Provide a 1/8-inch Nonasbestos gasket in accordance with AWWA C207.

14. Bolts and Nuts
   a. Flanged Ends
      1) Meet requirements of AWWA C207.
      2) Class D and E Flanges
         a) For buried and non-buried applications, provide ASTM A193 Grade B7 Bolts and ASTM 194 grade 2H Nuts.

15. Threaded Outlets
   a. Where outlets or taps are threaded, Threaded with CC Threads and furnish and install brass bushings for the outlet size indicated.

16. Weld Lead Outlets (if applicable)
   a. Use of threaded outlets for access for weld leads is permitted.
   b. Additional outlet configurations shall be approved by the Engineer.
   c. Outlets shall be welded after use.

17. Snap Rings
   a. Snap rings shall be manufactured by Hanson, or approved equal.

C. Performance / Design Criteria

1. Pipe Design
   a. Pipe shall be designed, manufactured and tested in accordance with the latest revisions of AWWA C303, AWWA M9, as well as the special requirements of this Specification.
   b. Sizes and pressure classes (working pressure) shall be as specified in the Drawings.
   c. For the purposes of pipe design, working pressure plus transient pressure shall be as indicated below.
   d. Pipe design shall be based on trench conditions and design pressure class specified in the Drawings.
   e. Pipe shall be designed according to the methods indicated in AWWA C303 and AWWA M9 for trench construction, using the following parameters:
      1) Unit Weight of Fill \((w) = 130 \text{ pounds per cubic foot}\)
      2) Live Load = AASHTO H-20 truck for unpaved conditions
      3) Live Load = Cooper E-80 loading for railroad crossings
      4) Trench Depth = As indicated on Drawings
      5) Coefficient \(K_a = 0.150\)
      6) Trench Width \(B_0\) as indicated on Drawings
      7) Bedding Conditions = as indicated on Drawings
      8) Pressure Class = 150 psi min. working pressure
      9) Surge Allowance = 100 psi minimum
         a) where: Total Pressure (including surge) = 150 psi + 100 psi = 250 psi.
      10) Deflection Lag Factor = 1.0
11) Soil Reaction Modulus (E’) < 1,000

f. Trench depths indicated on Drawings 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.

2. Provisions for Thrust
a. Thrust at bends, tees or other fittings shall be resisted by restrained joints or
snap rings.

1) Thrust at bends adjacent to casing shall be restrained by welding joints
through the casing and a sufficient distance each side of the casing.

2) No thrust restraint contribution shall be allowed for pipe in casing unless
the annular space in the casing is filled with grout.

3) The distance for thrust restraint shown on the Drawings is the minimum
restraint and does not relieve the manufacturer from calculating the restraint
needs as specified herein.

a) In no case shall the restrained distance be less than indicated on the
Drawings.

b. Restrained joints shall be used a sufficient distance from each side of the bend,
tee, plug or other fitting to resist thrust which develops at the design pressure of
the pipe.

1) The distance for thrust restraint shown on the Drawings is the minimum
restraint and does not relieve the manufacturer from calculating the restraint
needs as specified herein.

a) In no case shall the restrained distance be less than indicated on the
Drawings.

2) Restrained joints shall consist of welded joints or snap rings.

3) In areas where restrained joints are used for thrust restraint, the pipe shall
have adequate cylinder thickness to transmit the thrust forces.

c. Thrust restraint design

1) The length of pipe with restrained joints to resist thrust forces shall be
verified by the pipe manufacturer in accordance with AWWA M9 and the
following:

a) The Weight of Earth (We) shall be calculated as the weight of the
projected soil prism above the pipe.

(1) Soil Density = 130 pounds per cubic foot (maximum value to be
used for unsaturated soil).

d. Thrust collars will only be permitted for temporary plugs.

1) Thrust collars may not be used for any other application, unless approved in
writing by the Engineer.

3. Inside Diameter

a. The inside diameter of the cement mortar lining shall be the nominal diameter
specified, unless otherwise indicated on the Drawings.

4. Joint Bonds, Insulated Connections and Flange Gaskets

a. Joint Bonds, Insulated Connection and Flange Gaskets shall be in accordance
with Section 33 04 10.

5. Bend Fittings

a. All bend fittings shall be long radius to permit passage of pipeline pigs.
6. Fittings with Flanges
   1) Flanged joints shall be provided at connections to valves and where
      indicated on the Drawings.
   2) Ends to be fitted with slip-on flanges shall have the longitudinal or spiral
      welds ground flush to accommodate the type of flanges provided.
   3) Pipe flanges and welding of flanges to Concrete Pressure Pipe shall
      conform to the requirements of AWWA C207 and AWWA C206.
   4) Pipe flanges shall be of rated pressure equal to or greater than the adjacent
      pipe class.
   5) Flanges shall match the fittings or appurtenances which are to be attached.
   6) Flanges shall be Class E with 275 psi working pressure in accordance with
      AWWA C207 and in accordance with ASME B16.1 Class 125 for areas
      designated with a 225 psi test pressure.

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 Concrete Pressure Pipe, fittings, specials and appurtenances as required for
      the proper functioning of the completed pipe line.
   2. Install pipe, fittings, specials and appurtenances as specified herein, as specified in
      AWWA M9, and in accordance with the pipe manufacturer's recommendations.
   3. Lay pipe to the lines and grades show on the Drawings.
   4. Excavate, embed and backfill trenches in accordance with Section 33 05 10.
   5. 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.
   6. If pipe is placed in casing, restrain pipe from floating as required in Article 1.6.B.4.

B. Pipe Handling
   1. Haul and distribute pipe fittings at the project site and handle piping with care to
      avoid damage.
   2. Before lowering into the trench and inspect each joint of pipe and reject or repair
      any damaged pipe.
   3. Pipe shall be handled at all times with a minimum of 1 wide non-abrasive sling,
      belts or other equipment designed to prevent damage to the coating or lining.
4. The equipment shall be kept in such repair that its continued use is not injurious to the coating.

5. The spacing of pipe supports required to handle the pipe shall be adequate to prevent cracking or damage to the lining or coating.

C. Pipe Jointing

1. General
   a. Thoroughly clean the bell and spigot rings before laying each joint of pipe by brushing and wiping.
   b. If any damage to the protective coating on the metal has occurred, repair the damage before laying the pipe.
   c. Lubricate the gasket and the inside surface of the bell with an approved lubricant (flax soap) which will facilitate the telescoping of the joint.
   d. Tightly fit together sections of pipe and exercise care to secure true alignment and grade.
   e. When a joint of pipe is being laid, place the gasket on the spigot ring and enter the spigot end of the pipe into the bell of the adjoining pipe and force into position.
      1) The inside joint space between ends of the pipe sections shall have an opening within the tolerances as recommended by the pipe manufacturer.
   f. No "blocking up" of pipe or joints will be permitted, and if the pipe is not uniformly supported or the joint not made up properly, remove the joint and properly prepare the trench.
   g. After joining, check the position of the gasket with a feeler gauge.
      1) If the gasket is out of position, disassemble the joint and repeat the joint laying procedure.
   h. For interior welded joints, complete backfilling before welding.
   i. For exterior field-welded joints, provide adequate working room under and beside the pipe.

2. Exterior Joints
   a. Make the exterior joint by placing a joint wrapper around the pipe and secure in place with 2 metal straps.
      1) The wrapper shall be 9 inches wide for pipe 36-inches and larger, and 7 inches wide for smaller pipe, hemmed on each side.
      2) The wrapper shall be fiberglass reinforced or burlap cloth, with lengths encircling the pipe, leaving enough opening between ends to allow the mortar to be poured inside the wrapper into the joint.
      3) Fill the joint with mortar from 1 side in 1 continuous operation until it has flowed entirely around the pipe.
      4) During the filling of the joint, pat or manipulate the sides of the wrapper to settle the mortar and expel any entrapped air.
      5) Leave wrappers in place undisturbed until the mortar has set-up.

3. Interior Joints
   a. Upon completion of backfilling of the pipe trench, fill the inside joint recess with a stiff cement mortar/high-strength grout.
   b. Prior to placing of mortar/grout, clean out dirt or trash which has collected in the joint and moisten the concrete surfaces of the joint space by spraying or brushing with a wet brush.
c. Ram or pack the stiff mortar/grout into the joint space and take extreme care to
   insure that no voids remain in the joint space.

d. After the joint has been filled, level the surfaces of the joint mortar/grout with
   the interior surfaces of the pipe with a steel trowel so that the surface is smooth.

e. Interior joints of pipe smaller than 21-inches shall have the bottom of the bell
   buttered with grout, prior to inserting the spigot, such that when the spigot is
   pushed into position it will extrude surplus grout from the joint.
      1) The surplus grout shall be struck off flush with the inside of the pipe by
         pulling a filled burlap bag or an inflated ball through the pipe with a rope.

4. Welded Joints
   a. Weld joints in accordance with the AWWA M9.
      1) Contractor shall provide adequate ventilation for welders and for the City to
         observe welds.
      2) Unless otherwise specified on the Drawings, welds shall be full circle fillet
         welds.
   b. Adequate provisions for reducing temperature stresses shall be the
      responsibility of the Contractor.
   c. Before welding:
      1) Thoroughly clean pipe ends.
      2) Weld pipe by machine or by the manual shielded electric arc process.
   d. Welding shall be performed so as not to damage lining or coating.
   e. Furnish labor, equipment, tools and supplies, including shielded type welding
      rod.
      1) Protect welding rod from any deterioration prior to its use.
      2) If any portion of a box or carton is damaged, reject the entire box or carton.
   f. In all hand welding:
      1) The metal shall be deposited in successive layers.
      2) Not more than 1/8 inch of metal shall be deposited in each pass.
      3) Each pass except the final 1, whether in butt or fillet welds, shall be
         thoroughly bobbed or peened to relieve shrinkage stresses and to remove
         dirt, slag or flux before the succeeding bead is applied.
      4) Each pass shall be thoroughly fused into the plates at each side of the
         welding groove or fillet and shall not be permitted to pile up in the center of
         the weld.
      5) Undercutting along the side shall not be permitted.
   g. Welds shall be free from pin holes, non-metallic inclusions, air pockets,
      undercutting and/or any other defects.
   h. If the ends of the pipe are laminated, split or damaged to the extent that
      satisfactory welding contact cannot be obtained, remove the pipe from the line.
   i. Furnish each welder employed with a steel stencil for marking the welds so that
      the work of each welder may be identified.
      1) Have each welder stencil the pipe adjacent to the weld with the stencil
         assigned to him.
         a) In the event any welder leaves the job, his stencil shall be voided and
            not duplicated if another welder is employed.
   j. Welders
      1) Each welder employed by the Contractor shall be required to satisfactorily
         pass a welding test in accordance with AWWA C206 before being allowed
         to weld on the line.
2) After each welder has qualified in the preliminary tests referred to above, inspections shall be made of joints in the line.
   a) The inspection will be done by a Certified Welding Inspector retained by the City.
3) Any welder making defective welds shall not be allowed to continue to weld.
   k) Weld Testing
      1) Dye penetrant tests in accordance with ASTM E165, or magnetic particle test in accordance with AWWA C206 and set forth in AWS D.1.1. shall be performed by the Contractor under the supervision and inspection of the City’s Representative or an independent testing laboratory, on all full welded joints.
         a) Welds that are defective will be replaced or repaired, whichever is deemed necessary by the Engineer, at the Contractor's expense.
         b) If the Contractor disagrees with the Engineer's interpretation of welding tests, test sections may be cut from the joint for physical testing. The Contractor shall bear the expense of repairing the joint, regardless of the results of physical testing.
            (1) The procedure for repairing the joint shall be approved by the Engineer before proceeding.
5. Protection of Exposed Metal
   a. Protect exposed ferrous metal by a minimum of 1 inch coating of cement mortar as previously specified for inside joints, unless otherwise specified in the Drawings.
   b. Exposed large flat surfaces such as flanges, bolts, caulked joints, threaded outlets, closures, etc., shall have coating reinforced with galvanized wire mesh.
   c. Thoroughly clean and wet the surface receiving a cement mortar coating with water just prior to placing the cement mortar coating.
   d. After placing, take care to prevent cement mortar from drying out too rapidly by covering with damp earth or burlap.
   e. Cement mortar coating shall not be applied during freezing weather.
6. Patching
   a. Excessive field-patching of lining or coating shall not be permitted.
   b. 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.
   c. In general, there shall not be more than 1 patch on either the lining or the coating of any 1 joint of pipe.
   d. Wherever necessary to patch the pipe, make patch with cement mortar as previously specified for interior joints.
   e. Do not install patched pipe until the patch has been properly and adequately cured and approved for laying by the City.
   f. Promptly remove rejected pipe from the site.

3.5 REPAIR / RESTORATION [NOT USED]

3.6 RE-INSTALLATION [NOT USED]

3.7 FIELD QUALITY CONTROL

   A. Field [or] Site Tests and Inspections
      1. Cleaning and Testing
a. Cleaning, disinfection, hydrostatic testing and bacteriological testing of water mains
   1) 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

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Revision Log

CITY OF FORT WORTH
STANDARD CONSTRUCTION SPECIFICATION DOCUMENTS
Revised July 1, 2011

XXXX
Draft 6/4/2012 2:44 PM
SECTION 33 12 10
WATER SERVICES 1-INCH TO 2-INCH

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. 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 City of Fort Worth 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 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 will be paid for at the unit price bid per each “New 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) Connection to existing service
10) Pavement removal
11) Excavation
12) Hauling
13) Disposal of excess material
14) Clean-up
15) Disinfection
16) Testing

2. New Water Service, Bored
   a. Measurement
      1) Measurement for this Item shall be per each New 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
         will be paid for at the unit price bid per each “New Water Service, Bored”
         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) Connection to existing service
      9) Pavement removal
      10) Excavation
      11) Hauling
      12) Disposal of excess material
      13) Clean-up
      14) Disinfection
      15) Testing

3. Water Meter Service Relocate
   a. Measurement
      1) Measurement for this Item shall be per each Water Meter Service Relocate
         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
         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 Relocate” installed for:
            a) Various size of services
   c. The price bid shall include:
1) Service line
2) Fittings
3) Connection to service line
4) Pavement removal
5) Excavation
6) Hauling
7) Disposal of excess material
8) Clean-up
9) Cleaning

4. Private Service
   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 Service” installed for:
            a) Various sizes of service
   c. The price bid shall include:
      1) Submitting product data
      2) Private Service line
      3) Fittings
      4) Connection to existing private service line
      5) Pavement removal
      6) Excavation
      7) Hauling
      8) Disposal of excess material
      9) Clean-up
     10) Cleaning
     11) Disinfection
     12) 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 Relocate
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
   a. Relocation and reconnection of private service line on private property 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.

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):
      d. B98, Standard Specification for Copper-Silicon Alloy Rod, Bar and Shapes.
   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.

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 Engineer or 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
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 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. Water Services shall meet or exceed the latest revisions of AWWA C800 and
         shall meet or exceed the requirements of this Specification.
b. 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.

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 ¾ inch per foot or 0.1458 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 7/8-inch for 1-inch corporation stops
         b) Four 15/16-inch for 1 ½ -inch and 2-inch corporation stops

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.

5. Straight Adapters
5a. Brass castings and threads per AWWA C800

6. Three Part Copper Unions
5a. Brass castings and threads per AWWA C800

7. Straight Meter Couplings
5a. Brass castings per AWWA C800
5b. Threads per AWWA C700
5c. Tailpiece with outside iron pipe thread
5d. Chamfer corners on threaded end of meter nut
5e. Machine inside and outside of tailpiece

8. Branch Connections
5a. Brass castings per AWWA C800
5b. Inlet and outlet connections per AWWA C800

9. Service Saddles
5a. Castings
   1) Brass or Nylon coated ductile iron castings per AWWA C800
   2) Free of porosity with sharp edges removed
3) Fit contour of pipe as follows:

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4) Saddle
   a) Form to fit firmly against side of maximum diameter of water main with approximately 180 degrees wrap around.

5) 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) Rod diameter not less than 5/8 inch flattened to 1 inch on one side.
   4) 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.
   5) Chamfer strap ends to protect the starting threads.
   6) The threads shall be full and free from shear.
   7) 4-inch and larger pipe shall be in accordance with Section 33 12 25.
   8) Single straps are allowed for Saddles for pipe 2-inches in diameter and smaller.

c. Nuts
   1) Bronze material
   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 1½ -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.

11. Meter Boxes shall:
   a. Be constructed of:
      1) Linear Medium Density Polyethylene (LMDPE) as defined in ASTM D883, as follows:
         a) Not allowed to be located within driveways
         b) Minimum wall thickness of 0.500 inches
         c) Black exterior to provide UV protection
         d) Exterior free from seams or parting lines
         e) Smooth edges and corners and be free from sharp edges so the unit can be handled safely without gloves.
      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. Class A Standard Meter Box
      1) For use with services utilizing 5/8-inch x ¾-inch, ¾-inch or 1-inch meter
      2) Size
         a) 11-inch x 18-inch Box, 12 inches high
   e. Class B Standard Meter Box
      1) For use with services utilizing 1-1/2-inch or 2-inch meter
2) Size
   a) 15.25-inch x 27-inch Box, 12 inches high
f. Class C Standard Meter Box
   1) For use with services utilizing two 5/8-inch x 3/4-inch or 3/4-inch meters
   2) Size
      a) 18-inch x 16-inch Box, 12 inches high

12. Meter Box Lid
   a. Cast Iron or Ductile Iron
      1) Per ASTM A48, Class 30B or ductile iron per ASTM A536
      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 ±1/16 inch per foot.
      5) All castings will bear the Manufacturer’s IS (name or logo) and Country of
         Origin.
      6) Casting weights may vary ±5 percent from drawing weight per industry
         standards.
   b. Plastic
      1) Plastic meter lids not allowed to be installed within driveways.
      2) The lid shall:
         a) Be modified polyethylene material with ultraviolet protection
         b) Seat securely and evenly inside the Meter Box and shall not overlap the
            top edge of the Meter Box
         c) Have a grid pattern for skid resistance
         d) Be solid through and rated for traffic loads
         e) Include 1/2-inch rebar segments which can be utilized for location
            purposes

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.

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 3/4-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 nylon sleeved inserts 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 ½ inch to ¾
      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]

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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

B. Deviations from this City of Fort Worth 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 11 10 – Ductile Iron Pipe

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 the materials furnished in accordance with this Item shall be paid for at the unit price bid per each “Gate Valve” installed for:
         1) Various sizes
   3. The price bid shall include:
      a. Furnishing and installing Gate Valves with connections as specified in the Drawings
      b. Valve box
      c. Extension
      d. Valve vault and appurtenances (for 16-inch and larger gate valves)
      e. Polyethylene encasement
      f. Pavement removal
      g. Excavation
      h. Hauling
      i. Disposal of excess material
      j. Furnishing, placement and compaction of embedment
      k. Furnishing, placement and compaction of backfill
      l. Clean-up
      m. Cleaning
      n. Disinfection
      o. 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.


3. American Society of Mechanical Engineers (ASME):

4. ASTM International (ASTM):

5. American Water Works Association (AWWA):
   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. 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 Engineer or 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. Bolts and nuts for mechanical and flange joints
5. Instructions for field repair of fusion bonded epoxy coating
6. 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.

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. Resilient Seated Gate Valves shall be new and the product of a manufacturer regularly engaged in the manufacturing of Resilient Seated Gate Valves having similar service and size.

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. 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)
   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)

4. Bolts and Nuts
   a. Mechanical Joints
      1) High strength corrosion restraint low-carbon weathering steel in
         accordance with AWWA/ANSI C111/A21.11, and ASTM A242.
      2) Cor-Blue coated with FluoroKote #1, or equal
         a) Coating shall conform to the performance requirements of ASTM B117
            for up to 4000 hours and shall include, if required, a certificate of
            conformance.
   b. Flanged Ends
      1) Meet requirements of AWWA C509 and C515.
      2) For buried and non-buried applications, provide AISI 304 Stainless Steel
         bolts and AISI 316 Stainless Steel nuts.
      3) Spray bolts and nuts with anti-seize compound.

5. 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 cylinder pipe
         a) Use flange-joints unless otherwise specified in the Contract
            Documents.
      3) Ductile Iron or PVC pressure pipe
         a) Use mechanical joints unless otherwise specified in the Contract
            Documents.

6. 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.
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.

7. 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.

8. Gaskets
a. All rubber joint gaskets utilized on valves shall be in conformance with
AWWA/ANSI C111/A21.11.
b. Flanged Gaskets
   1) Full face
   2) Manufactured true to shape from approved synthetic rubber stock of a
      thickness not less than 1/16 inch
   3) Virgin stock and conforming to the physical and test requirements specified
      in AWWA/ANSI C111/A21.11
   4) Finished gaskets shall have holes punched by the manufacturer and shall
      match the flange pattern in every respect.
   5) Frayed cut edges resulting from job site gasket fabrication are not
      acceptable.
   6) Furnish Viton® Rubber gaskets hydrocarbon restraint gaskets, where
      required.

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 ⅜-inch
      shafts, screw type, consisting of a top section and a bottom section.
   b. Valve boxes shall be as listed in the City of Fort Worth 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” in raised letters on the upper surface.

f. Cast iron valve boxes and covers shall conform to ASTM A48, Class 40.

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 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.
3. 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 does not meet the City’s criteria, remedy the situation until the valve meets the City’s criteria.
1 | 3.8  SYSTEM STARTUP [NOT USED]  
2 | 3.9  ADJUSTING [NOT USED]  
3 | 3.10  CLEANING [NOT USED]  
4 | 3.11  CLOSEOUT ACTIVITIES [NOT USED]  
5 | 3.12  PROTECTION [NOT USED]  
6 | 3.13  MAINTENANCE [NOT USED]  
7 | 3.14  ATTACHMENTS [NOT USED]  

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SECTION 33 12 25
CONNECTION TO EXISTING WATER MAINS

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. Performing in-line connections
   d. Installing a tapping sleeve and valve

B. Deviations from this City of Fort Worth 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 04 40 – Cleaning and Acceptance Testing of Water Mains
   4. 33 05 10 – Utility Trench Excavation, Embedment and Backfill
   5. 33 11 10 – Ductile Iron Pipe

1.2 PRICE AND PAYMENT PROCEDURES

A. Measurement and Payment
1. Connection to an existing unpressurized Fort Worth 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 Fort Worth 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 Fort Worth 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):
   f. 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.
   d. C223, Fabricated Steel and Stainless Steel Tapping Sleeves.


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 Engineer or 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 C207.
      2) Provide AISI 304 Stainless Steel bolts and AISI 316 Stainless Steel nuts.
         a) Spray bolts and nuts with anti-seize compound.

4. Gaskets
   a. Nitrile Butadiene Rubber (NBR, Buna-N) per ASTM D2000
   b. Bonded into cavity for internal and external retention
   c. Temperature range: -20 degrees F to +180 degrees F
   d. Suitable for water, oil, mild acids, bases, and most (aliphatic) hydrocarbon fluids

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 a fish kill occurs associated with the construction activities:
   a. Immediately alter activities to prevent further fish kills.
   b. Immediately notify Water Department.
   c. Collect and classify fish in accordance with TCEQ requirements.
   d. Coordinate with City to properly notify TCEQ.
   e. Be responsible for fines assessed.
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 form 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

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SECTION 33 12 40
FIRE HYDRANTS

PART 1 - GENERAL

1.1 SUMMARY
A. Section Includes:
   1. Dry-barrel fire hydrants with 5\(\frac{1}{4}\)-inch main valve for use with potable water mains
B. Deviations from this City of Fort Worth 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. Specification 33 05 10 – Utility Trench Excavation, Embedment and Backfill
   4. Specification 33 04 40 – Cleaning and Acceptance Testing of Water Mains
   5. Specification 33 11 10 – Ductile Iron Pipe
   7. Specification 33 11 14 – Buried Steel Pipe and Fittings
   8. Specification 33 12 20 – Resilient Seated Gate Valves

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. Pavement Removal
      e. Excavation
      f. Freight, loading, unloading and handling
      g. Disposal of excess material
      h. Furnish, placement and compaction of embedment
      i. Furnish, placement and compaction of backfill
      j. Blocking, Braces and Rest
      k. Clean up
      l. Disinfection
m. 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

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 Engineer or 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) 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 1/4-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) 2 x 2 1/2-inch hose nozzles
            (1) 180 degrees apart
         b) 4 1/2-inch pump nozzle
   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) Silver coating in accordance with City of Fort Worth requirements
         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.
1 3.8 SYSTEM STARTUP [NOT USED]
2 3.9 ADJUSTING [NOT USED]
3 3.10 CLEANING [NOT USED]
4 3.11 CLOSEOUT ACTIVITIES [NOT USED]
5 3.12 PROTECTION [NOT USED]
6 3.13 MAINTENANCE
7 3.14 ATTACHMENTS

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Revision Log
SECTION 33 12 50
WATER SAMPLING STATIONS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Water sampling stations for potable water mains

B. Deviations from this City of Fort Worth Standard Specification
   1. None.

C. Products Installed But Not Furnished Under This Section
   1. 1-inch water service line
      a. From water main to curb stop (including tap)

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 03 30 00 – Cast-In-Place Concrete
   4. Section 33 04 40 – Cleaning and Acceptance Testing of Water Mains
   5. Section 33 05 10 – Utility Trench Excavation, Embedment and Backfill
   6. Section 33 12 10 – Water Services 1-inch to 2-inch
   7. Section 33 12 25 – Connections to Existing Water Mains

1.2 PRICE AND PAYMENT PROCEDURES

A. Measurement and Payment
   1. Water Sampling Station
      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 “Water Sampling
            Station” completed in place.
      c. The price bid includes:
         1) Furnishing and installing Sampling Station with appurtenances as specified
            in the Drawings
         2) Concrete support block
         3) Curb stop
         4) Fittings
         5) Incidental 5 feet of service line
         6) Pavement Removal
         7) Excavation
         8) Hauling
         9) Disposal of excess material
10) Clean up
11) Disinfection
12) Testing

2. Water Sampling Station installed per City Standard Details.
   a. Measurement
   1) This Item is considered subsidiary to Water Meter Vault.
   b. Payment
      1) The work performed and the materials furnished in accordance with this
         Item are subsidiary to the unit price per each Water Meter Vault (with
         Sampling Station) 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. NSF International
      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 Engineer or the City prior to construction.

1.6 ACTION SUBMITTALS/INFORMATIONAL SUBMITTALS

A. Product Data
   1. Product Data submitted in accordance with Section 33 12 10.
   2. Sampling Station

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 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 sampling station
   1. Eclipse™ Number 88 Sampling Station, or approved equal, with 12-inch depth of
   2. Lockable, aluminum weather shield enclosure
   3. Brass internal piping and appurtenances
   4. Galvanized riser pipe
   5. Brass isolation valve with ¾-inch female iron pipe inlet
   6. Removable parts that require no excavation

2.2 EQUIPMENT, PRODUCT TYPE, 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 Water Sampling Station components in contact with potable water shall
         conform to the requirements of NSF 61.

C. Materials / Design Criteria
   1. Water Service
      a. In accordance with Section 33 12 10 include:
         1) 1-inch Water Service
         2) ¾-inch Water Service
         3) 1-inch Corporation Stop
         4) 1-inch Curb Stop
         5) Fittings
   2. Concrete Pad
      a. In accordance with Section 03 30 00
      b. Dimensions
         1) 2 feet x 2 feet
         2) 6 inches thick
      c. Design
         1) Class ‘B’ Concrete (2500 psi)
2) Reinforced with #4 Rebar

2.3 ACCESSORIES [NOT USED]

2.4 SOURCE QUALITY CONTROL

A. Tests, Inspections and Markings
   1. Conform to Section 33 12 10.

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 Sampling Station in accordance with City Standard Details and Section 33
      12 10 Water to include:
      a. 1-inch Corporation Stop
      b. 1-inch Water Service
      c. 1-inch Curb Stop
      d. 1-inch 90 Degree Elbow
      e. 1 inch x ¾ inch Reducer
      f. ¾-inch Water Service
      g. Sampling Station
      h. Concrete Pad
   2. Where appropriate, place sampling station adjacent to power pole, elevated tank,
      street sign, tree or fire hydrant
      a. Typical installation on short side of street
      b. When placing adjacent to fire hydrant:
         1) Maintain 4-foot offset from fire hydrant and lead.
         2) Do not tap fire hydrant lead line.
      c. For installations adjacent to valves along large water mains, connect to existing
         large valve copper riser.
         1) Do not tap main, unless approved by City.
   3. Excavate, embed and backfill trenches in accordance with 33 05 10.

3.5 REPAIR / RESTORATION [NOT USED]

3.6 RE-INSTALLATION [NOT USED]

3.7 FIELD QUALITY CONTROL

A. Field Tests and Inspections
   1. See Section 33 12 10.
### Revision Log

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**END OF SECTION**
SECTION 33 31 13
FIBERGLASS REINFORCED PIPE FOR GRAVITY SANITARY SEWERS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Fiberglass Reinforced pipe 18-inch and larger for gravity sanitary sewer applications

B. Deviations from this City of Fort Worth 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 for “Fiberglass Sewer Pipe” installed for:
         1) Various sizes
         2) Various backfills
   3. The price bid shall include:
      a. Furnishing and installing Fiberglass gravity pipe with joints as specified by the Drawings
      b. Mobilization
      c. Pavement removal
      d. Excavation
      e. Hauling
      f. Disposal of excess material
      g. Gaskets
      h. Furnishing, placement and compaction of embedment
      i. Furnishing, placement and compaction of backfill
1. Trench Water Stops
2. Clean-up
3. Cleaning
4. 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):
   e. F477, Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe.

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 Engineer or the City prior to delivery.

1.6 ACTION SUBMITTALS/INFORMATIONAL SUBMITTALS

A. Product Data
   1. Manufacturer
   2. Manufacturer Number (identifies factory, location, and date manufactured.)
   3. Nominal Diameter
   4. Beam load
   5. Laying lengths
   6. ASTM designation

B. Shop Drawings
   1. Pipe details
   2. Joint details
   3. Miscellaneous items to be furnished and fabricated for the pipe
   4. Dimensions
   5. Tolerances
   6. Wall thickness
   7. Properties and strengths
   8. Pipe calculations
a. Calculations confirming the pipe will handle anticipated loading signed and
sealed by a Licensed Professional Engineer in Texas

C. Certificates
   1. Furnish an affidavit certifying that all Fiberglass Reinforced Pipe meets the
provisions of this Section and has been tested and meets the requirements of ASTM
D3262.

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.
         b. Pipe manufacturing operations shall be performed under the control of the
manufacturer.
         c. All pipe furnished shall be in conformance with this specification and ASTM
D3262.

1.10 DELIVERY, STORAGE, AND HANDLING
   A. Delivery
      1. Provide adequate strutting during transport to prevent damage to the pipe, fittings
and appurtenances.
   B. 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-SUPPLIEDPRODUCTS [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. Design in accordance with ASTM D3262
b. Design pipe for service loads that include:
   1) External groundwater and earth loads
   2) Jacking/pushing loads
      a) The allowable jacking/pushing capacity shall not exceed 40 percent of
      the ultimate compressive strength or the maximum allowable
      compressive strength recommended by the manufacturer, whichever is
      less.
   3) Traffic loads
   4) Practical considerations for handling, shipping and other construction
      operations
c. Design is to be conducted under the supervision of a Professional Engineer
   licensed in the State of Texas, who shall seal and sign the design.
d. Standard lay length of 20 feet, except for special fittings or closure pieces
   necessary to comply with the Drawings.
e. Stiffness class that satisfies design requirement on the Drawings, but not less
   than 46 psi when used in direct bury operations.
f. Accommodate vertical alignment changes required because of existing utility or
   other conflicts by an appropriate change in pipe design depth.
g. In no case shall pipe be installed deeper than its design allows.

2. Dimensional Tolerances
   a. Inside diameter
      1) Pipe shall not vary more than 1/8 inch from the nominal inside diameter.
b. Roundness
      1) The difference between the major and minor outside diameters shall not
      exceed 0.1 percent of the nominal outside or ¼ inch, whichever is less.
c. Wall thickness
      1) Provide minimum single point thickness no less than 98 percent of stated
      design thickness.
d. End Squareness
      1) Provide pipe ends square to pipe axis with maximum tolerance of 1/8 inch.
e. Fittings
      1) Provide tolerance of angle of elbow and angle between main and leg of wye
      or tee to ±2 degrees.
      2) Provide tolerance of laying length of fitting to ±2 inches.

C. Materials
   1. Resin Systems
      a. Only use polyester resin system with proven history of performance in this
      particular application.
   2. Glass Reinforcements
      a. Use reinforcing glass fibers of highest quality commercial grade E-glass
      filaments with binder and sizing compatible with impregnated resins to
      manufacture components.
   3. Fillers
      a. Silica sand or other suitable materials may be used.
      b. Use 98 percent silica with maximum moisture contest of 0.2 percent.
   4. Additives
a. Resin additives, such as curing agents, pigments, dyes, fillers, thixotropic agents, etc., when used, shall not detrimentally affect the performance of the product.

5. Internal liner resin
   a. Suitable for service as sewer pipe
   b. Highly resistant to exposure to sulfuric acid
   c. Produced by biological activity from hydrogen sulfide gases
   d. Meet or exceed requirements of ASTM D3681

6. Gaskets
   a. Supply from approved gasket manufacturer in accordance with ASTM F477 and suitable for service intended.
   b. Affix gaskets to pipe by means of suitable adhesive or install in a manner so as to prevent gasket from rolling out of pre-cut groove in pipe or sleeve coupling.
   c. Provide the following gaskets in potentially contaminated areas.
      1) Petroleum (diesel, gasoline) – Viton
      2) Other contaminants – Manufacturer recommendation

7. Couplings
   a. Field connect pipe with fiberglass sleeve couplings that utilize elastomeric sealing gaskets as sole means to maintain joint water tightness.

8. Joints
   a. Joints must meet requirements of ASTM D4161.

9. Pipe markings shall meet the minimum requirements of ASTM D3236. Minimum pipe markings shall be as follows:
   a. Manufacturer
   b. Manufacturer Number (identifies factory, location, date manufactured, shift and sequence)
   c. Nominal diameter
   d. Beam load
   e. Laying length
   f. ASTM designation

10. Connections
    a. Use only manufactured fittings.
    b. See Section 33 31 50.

11. 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, fittings, 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 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 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. Closed Circuit Television (CCTV) Inspection
      a. Provide a CCTV inspection in accordance with Section 33 01 31.
   2. Air Test and Deflection (Mandrel) Test
      a. Perform 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

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SECTION 33 31 20

POLYVINYL CHLORIDE (PVC) GRAVITY SANITARY SEWER PIPE

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 City of Fort Worth 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 embeddings
         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
1. Trench Water Stops
2. Clean-up
3. Cleaning
4. 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):
4. Texas Commission on Environmental Quality (TCEQ):
   b. Title 30, Part I, Chapter 217, Subchapter C, Rule 217.54 – Criteria for Laying Pipe.
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 Engineer or 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 35/26 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^4/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]

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SECTION 33 31 50
SANITARY SEWER SERVICE CONNECTIONS AND SERVICE LINE

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 City of Fort Worth 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 31 20 – Polyvinyl Chloride (PVC) Gravity Sanitary Sewer Pipe

1.2 PRICE AND PAYMENT PROCEDURES

A. Measurement and Payment

1. New 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
         9) Furnishing, placing and compaction of embedment
         10) Furnishing, placing and compaction of backfill
         11) Clean-up
2. New Ductile Iron Service
   a. Measurement
      1) Measurement for this Item shall be per each “DIP 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
      9) Furnishing, placing and compaction of embedment
     10) Furnishing, placing and compaction of backfill
     11) Clean-up

3. 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
     10) Furnishing, placing and compaction of embedment and backfill
     11) Clean-up

4. Deep Sewer Service
   a. Measurement
      1) Measurement for this Item shall be per each “Deep 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 new “Deep Sewer Service” installed for:
      a) Various sizes
      b) Various materials

c. The price shall include:
   1) Furnishing and installing Deep 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
  10) Furnishing, placing and compaction of embedment and backfill
  11) Clean-up

5. 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 “Sewer Service, Private Relocation”
         installed for:
         a) Various sizes
         b) Various materials
   c. The price shall include:
      1) Performing relocation as specified in the Drawings
      2) Excavation
      3) Hauling
      4) Disposal of excess material
      5) Service Line - private side by plumber
      6) Fittings
      7) Furnishing, placing and compaction of embedment
      8) Furnishing, placing and compaction of backfill
      9) 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 as specified in the Drawings
2) Pavement removal
3) Hauling
4) Disposal of excess material
5) Furnishing, placing and compaction of backfill
6) 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 reinstatement of service 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

1.3 REFERENCES

A. 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. Deep Service (See Detail SAN-012)
   a. Deep service applies to the installation of a service to a new or existing sewer
      main where a difference of at least 15 feet exists between the finished grade and
      the top of the sewer main.
   b. The service materials would include service line, fittings and cleanout.

4. 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.
5. 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.

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. 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

1.4 ADMINISTRATIVE REQUIREMENTS

A. Scheduling
   1. Provide advance notice for service interruption to property owner and meet
      requirements of Division 0.

1.5 SUBMITTALS

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

1.6 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.
1.7 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. 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.

1.11 FIELD [SITE] CONDITIONS [NOT USED]

1.12 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.
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. No inserta tees service connections may be used.
3. Cleanout
   a. Cleanout stack should be the same material as the service line, except when DI pipe is being used.
   b. Use cast iron cap for cleanout cover.
4. Coupling
   a. For connections between new PVC pipe stub out and existing service line, use flexible adapter coupling consisting of neoprene gasket and stainless steel shear rings with 2-inch stainless steel band clamps.

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 details SAN-011 and SAN-011A 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 Detail SAN-011.
   3. Install 2-way cleanout in paved areas in accordance with Detail SAN-011A.

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 [or] SITE QUALITY CONTROL
   A. Inspections
      1. Private property service line requires approval by the City plumbing inspector before final acceptance.
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CITY OF FORT WORTH
STANDARD CONSTRUCTION SPECIFICATION DOCUMENTS
Revised July 1, 2011
SECTION 33 39 10
CAST-IN-PLACE CONCRETE MANHOLE

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Sanitary Sewer Cast-in-Place Concrete Manholes

B. Deviations from this City of Fort Worth 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
   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.
      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
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 the 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:
   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

3. Sanitary Sewer Junction Structure
   a. Measurement
      1) Measurement for this Item will be per each Sewer Junction Structure being
         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
         lump sum bid per each “Sewer Junction Structure” location.
   c. Price bid will include:
      1) Junction 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 4 feet 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
   c. 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. D4258, Standard Practice for Surface Cleaning Concrete for Coating.
   b. D4259, Standard Practice for Abrading 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 Engineer or the City prior to delivery.

1.6 ACTION SUBMITTALS/INFORMATIONAL SUBMITTALS

A. Product Data

1. Drop connection materials
2. Pipe connections at manhole walls
3. Stubs and stub plugs
4. Admixtures
5. 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 [NOT USED]

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. Materials
1. Concrete – Conform to Section 03 30 00.
2. Reinforcing Steel – Conform to Section 03 21 00.
3. Frame and Cover – Conform to Section 33 05 13.
4. Grade Ring – Conform to Section 33 05 13.
5. Pipe Connections
   a. Pipe connections can be premolded pipe adapter, flexible locked-in boot adapter, or integrally cast gasket channel and gasket.
6. Interior Coating or Liner – Conform to Section 33 39 60, if required.
7. Exterior Coating
   a. Use Coal Tar Bitumastic for below grade damp proofing.
   b. Dry film thickness shall be no less than 12 mils and no greater than 30 mils.
   c. Solids content is 68 percent by volume ± 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

A. Foundation Preparation
   1. Excavate 8 inches below manhole foundation.
   2. Replace excavated soil with course aggregate, creating a stable base for the
      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. Cast manhole foundation and wall monolithically.
      a. A cold joint with water stop is allowed when the manhole depth exceeds 12
         feet.
      b. No other joints are allowed unless shown on Drawings.
   3. Place, finish and cure concrete according to Section 03 30 00.
      a. Manholes must cure 3 days before backfilling around structure.

B. Pipe connection at Manhole
   1. Do not construct joints of sewer pipe within wall sections of manhole.

C. 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. Sewer pipe may be laid through the manhole and the top ½ of the pipe removed to
      facilitate manhole construction.
   4. For all standard manholes provide full depth invert.
   5. For example, if 8-inch pipe is connected to manhole, construct the invert to full 8
      inches in depth.

D. Drop Manhole Connection
1. Install drop connection when sewer line enters manhole higher than 24 inches above the invert.

E. 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.

F. Internal coating

1. Internal coating application will conform to Section 33 39 60, if required by Drawings.

G. External coating

1. Remove dirt, dust, oil and other contaminants that could interfere with adhesion of the coating.
2. Cure for 3 days before backfilling around structure.
3. Coat the same date the forms are removed.
4. Prepare surface in accordance with ASTM D4258 and ASTM D4259.
5. Application will follow manufacturer’s recommendation.

H. Modifications and Pipe Penetrations

1. Conform to Section 03 80 00.

I. Junction Structures

1. All structures shall be installed as specified in Drawings.

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]

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PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Sanitary Sewer Precast Concrete Manholes
   
B. Deviations from this City of Fort Worth Standard Specification
   1. Subparagraph 1.3.A.1.d
   2. Paragraph 2.2.B.11
   
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
   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
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. Fiberglass Type “A” Manhole (See City Standard Detail for Tee Base
      Manhole)
      1) Manhole set on a reinforced concrete block placed around 39-inch and
         larger sewer pipe.
2) Fiberglass sewer pipe tee-base fitting.
3) Standard precast manhole riser per City Standard Details.
   e. 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. C478, Standard Specification for Precast Reinforced Concrete Manhole
      Sections.
   b. C923, Standard Specification for Resilient Connectors Between Reinforced
      Concrete Manholes Structures, Pipes, and Laterals.

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 Engineer or 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. Concrete – Conform to Section 03 30 00.


3. Precast Sections
   a. Provide bell-and-spigot design incorporating a premolded joint sealing compound for wastewater use.

   b. Clean bell spigot and gaskets, lubricate and join.

   c. Minimize number of segments.

   d. Use long joints at the bottom and shorter joints toward the top.

   e. Include manufactures stamp on each section.

4. 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.

5. Frame and Cover – Conform to Section 33 05 13.

6. Grade Ring – Conform to Section 33 05 13 and ASTM C478.

7. 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.

8. Steps
   a. No steps are allowed.

9. Interior Coating or Liner – Conform to Section 33 39 60.

10. Exterior Coating
    a. Use Coal Tar Bitumastic for below grade damp proofing.

    b. Dry film thickness shall be no less than 12 mils and no greater than 30 mils.

    c. Solids content is 68 percent by volume ± 2 percent.

11. Fiberglass Tee Base – Conform to Section 33 31 13.
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

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 premolded 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 in 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]

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Revision Log
SECTION 33 39 60
EPOXY LINERS FOR SANITARY SEWER STRUCTURES

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 City of Fort Worth 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
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):
      Reagents.
   d. D790, Standard Test Methods for Flexural Properties of Unreinforced and
      Reinforced Plastics and Electrical Insulating Materials.
      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).


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 Engineer or 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 topcoated
   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. 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
topcoating compatibility
b. Factory blended, rapid setting, high early strength, fiber reinforced, non-shrink
repair mortar that can be towed or pneumatically spray applied and
specifically formulated to be suitable for topcoating 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 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]

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Revision Log
SECTION 3471 13
TRAFFIC CONTROL

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 City of Fort Worth 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

   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
1 a. Measurement
   1) Measurement for this Item be per each Traffic Control Detail prepared.
2 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.
3 c. The price bid shall include:
   1) Preparing the Traffic Control Plan Details
   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.
   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 (817-392-7738) 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, 311 W. 10th 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. Contractor responsible for having a licensed Texas Professional Engineer sign and seal
      changes to the Traffic Control Plan(s) developed by the Design Engineer.
F. 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. 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.
L. 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]
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