

**SECTION 02515
ABANDONMENT OF SANITARY SEWERS**

PART I: GENERAL

1.1 GENERAL REQUIREMENTS

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

1.2 MEASUREMENT AND PAYMENT

- A. Unit Prices:
 - 1. Payment for grout fill and abandonment of existing sanitary sewers, including boxes and elliptical shaped sanitary sewers, is on linear foot basis for each diameter of sanitary sewer being abandoned. Measurement shall be along centerline of sanitary sewer from centerline to centerline of manholes.
 - 2. Payment for grout fill and abandonment of sanitary sewer manholes or junction structure is by each manhole or junction structure abandoned in conformance with this Section.
 - 3. Payment shall be full compensation for all material, equipment and labor required for complete abandonment grouting, including air venting, testing, temporary plugs, PVC pipes and incidentals.
 - 4. No separate payment shall be made for plugging and abandoning sanitary sewer force mains. Include cost of such abandonment in related work.
 - 5. Refer to Section 01270 – Measurement and Payment for unit price procedures.
 - 6. Acceptability of grout material is based on achieving average strength within range of seventy-five pounds per square inch (75 psi) to one hundred fifty pounds per square inch (150 psi) as defined in Paragraph 2.1.A.1. Grout that is out of range after placement may be accepted with price adjustment of one (1.0 %) percent price deduction for each pound per square inch (psi) average compressive strength below seventy-five pounds per square inch (75 psi) and one-half percent (0.5 %) price deduction for each psi average compressive strength above one hundred fifty pounds per square inch (150 psi), as applicable to material volume represented by test series. Shrinkage in grout material placements shall be remedied by the Contractor according to Paragraph 3.4.H without additional compensation.
- B. Stipulated Price (Lump Sum):
 - 1. If Contract is Stipulated Price Contract, payment for Work in this Section is included in Total Stipulated Price.

1.3 DEFINITIONS

- A. Abandonment: Sanitary sewer abandonment consists of demolition and removal of portions of manholes existing within specified depth of surface and abandonment in place of sanitary sewer lines and manholes as specified in this Section.
- B. Flowable Fill: Flowable fill (abandonment grout) shall be controlled low-strength material consisting of fluid mixture of cement, aggregate, water and with admixtures as necessary to provide workable properties. Placement of flowable fill may be by grouting techniques in sanitary sewers or other restricted areas or as mass placement by chutes or tremie methods in unrestricted locations with open access. Long-term hardened strength shall be within specified range.
- C. Ballast: Large aggregate either placed with voids subsequently filled with flowable fill injected by grouting method; or in areas with open access, placed individually and sequentially at same time as flowable fill placement.
- D. Backgrouting: Secondary stage pressure grouting to ensure that voids have been filled within the abandoned sanitary sewer. Backgrouting shall only be required at critical locations indicated on the Drawings or if there is evidence of incomplete flowable fill placements.

1.4 REFERENCES

- A. ASTM – American Society for Testing and Materials.
 - 1. ASTM C150 – Standard Specification for Portland Cement.
 - 2. ASTM C494 – Standard Specification for Chemical Admixture for Concrete.
 - 3. ASTM C937 – Standard Specification for Grout Fluidifier for Pre-placed Aggregate Concrete.
 - 4. ASTM C940 – Standard Test Method for Expansion and Bleeding of Freshly Mixed Grout for Replaced Aggregate Concrete in the Laboratory.
 - 5. ASTM C1017 – Standard Specification for Chemical Admixture for Use in Producing Flowing Concrete.
 - 6. ASTM C1107 – Specification for Packaged Dry, Hydraulic-Cement Grout (Non-shrink).
- B. CFTS – City of Friendswood Technical Standards.

1.5 SUBMITTALS

- A. Conform to requirements of Section 01330 – Submittal Procedures.
- B. Flowable fill mix design report:
 - 1. Flowable fill type and production method. Describe if fill shall be mixed to final proportions and consistency in batch plant or if constituents shall be added in transit mixer at placement location.
 - 2. Use of ballast: Provide percentage of ballast of total placement and size limits for ballast if fill is intended to be used with ballast.

3. Aggregate gradation of fill: Aggregate gradation of mix (excluding ballast) shall be used as pilot curve for quality control during production.
 4. Fill mix constituents and proportions including materials by weight and volume and air content but excluding ballast. Give types and amounts of admixtures including air entrainment or air generating compounds.
 5. Fill densities and viscosities, including wet density at point of placement.
 6. Initial time of set.
 7. Bleeding and shrinkage.
 8. Compressive strength.
- C. Technical information for equipment and operational procedures including projected slurry injection rate, grout pressure, method of controlling grout pressure, bulkhead and vent design and number of stages of grout application.
- D. Experience record for proposed crew, showing minimum of one hundred cubic yards (100 Cy) of flowable fill placed using proposed or similar equipment and methods.
- E. At least sixty days (60 D) prior to commencing abandonment activities, submit plan for abandonment, describing proposed grouting sequence, bypass pumping requirements and plugging, if any and other information pertinent to completion of the Work.

PART II: PRODUCTS

2.1 FLOWABLE FILL

- A. Design Mix Criteria: Provide design of one (1) or more mixes to meet design criteria and conditions for placement. Present information required by Paragraph 1.5.B in mix design report including following:
1. Cement: ASTM C150 Type I or II. Volume and weight per cubic yard of fill. Provide minimum cement content of one hundred pounds per cubic yard (100 Lbs/Cy).
 2. Potable water: Volume and weight per cubic yard of fill. Amount of water determined by mix design testing.
 3. Aggregate gradation: One hundred percent (100%) passing three-eighths inch (3/8 In) sieve and not more than ten percent (10%) passing No. 200 sieve. Mix design report shall define pilot gradation based on following sieve sizes three-eighths inch (3/8 In), Nos. 4, 8, 16, 30, 50, 100 and 200. Do not deviate from pilot gradation by more than plus or minus ten percentage ($\pm 10\%$) points for any sieve for production material.
 4. Aggregate source material: Screened or crushed aggregate, pit or bank run fine gravels or sand or crushed concrete. If crushed concrete is used, add at least thirty percent (30%) of natural

- aggregate to provide workability.
- 5. Admixtures: Use admixtures meeting ASTM C494 and ASTM C1017 as needed to improve pumpability, to control time of set and reduce bleeding.
- 6. Fluidifier: Use fluidifier meeting ASTM C937 as necessary to hold solid constituents in suspension. Add shrinkage compensator if necessary.
- 7. Performance additive: Use flowable fill performance additive, such as Darafill or approved equal, to control fill properties.
- B. Flowable Fill Requirements:
 - 1. Unconfined compressive strength: minimum seventy-five pounds per square inch (75 psi) and maximum one hundred fifty pounds per square inch (150 psi) at fifty-six days (56 D) as determined based on an average of three (3) tests for same placement. Present at least three (3) acceptable strength tests for proposed mix design in mix design report.
 - 2. Placement characteristics: self-leveling.
 - 3. Shrinkage characteristics: non-shrink.
 - 4. Water bleeding for fill to be placed by grouting method in sanitary sewers: not to exceed two percent (2%) according to ASTM C940.
 - 5. Minimum wet density: ninety pounds per cubic foot (90 Lbs/Cf).

2.2 BALLAST

- A. Ballast Material: Natural rock or concrete pieces within the following limits:
 - 1. Minimum size equal to at least ten (10) times maximum aggregate size of flowable fill and;
 - 2. not more than twenty percent (20%) of minimum dimension of space to be filled and;
 - 3. maximum size of twenty-four inches (24 In).
- B. Ballast Composition: Free of regulated waste material.

2.3 PLUGS FOR SANITARY SEWER FORCE MAINS

- A. Grout Plugs: Cement-based dry-pack grout conforming to ASTM C1107, Grade B or C.
- B. Manufactured Plug: Commercially available plug or cap specifically designed and manufactured to be used with pipe being abandoned.

PART III: EXECUTION

3.1 PREPARATION

- A. Have fill mix design reports and other submittals required by Paragraph 1.5 accepted by the Project Manager prior to start of placement. Notify the Project Manager at least twenty-four hours (24 Hrs) in advance of

grouting with flowable fill.

- B. Select fill placement equipment and follow procedures with sufficient safety and care to avoid damage to existing underground utilities and structures. Operate equipment at pressure that shall not distort or imperil portion of the Work, new or existing.
- C. Clean sanitary sewer lines and video with closed circuit television to identify connections, locate obstructions and assess condition of pipe. Locate previously unidentified connections, which have not been redirected and reconnected as part of this project and report them to the Project Manager. During placement of fill, compensate for irregularities in sanitary sewer lines, such as obstructions, open joints or broken pipe to ensure no voids remain unfilled.
- D. Perform demolition work prior to starting placement of fill. Clean placement areas of sanitary sewers and manholes of debris that may hinder fill placement. Remove excessive amounts of sludge and other substances that may degrade performance of fill. Do not leave sludge or other debris in place if filling more than two percent (2%) of placement volume. Dispose of waste material in compliance with Section 01580 – Waste Material Disposal.
- E. Remove free water prior to starting fill placement.

3.2 EQUIPMENT

- A. Mix flowable fill in automated batch plant and deliver it to site in ready-mix trucks. Performance additives may be added at placement site if required by mix design.
- B. Use concrete or grout pumps capable of continuous delivery at planned placement rate.

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

- A. Remove manhole frames and covers and castings from other existing sanitary sewer structures. Deliver castings to the City of Friendswood Public Works Facility for future use. Alternatively, salvaged castings may be used upon approval by the Project Manager for use in construction of new manholes on the project.
- B. Demolish and remove precast concrete adjustment rings and corner section or brick and mortar corbel and chimney or other sanitary sewer structures, to minimum depth of four feet (4 Ft) below finished grade. Structures may be removed to greater depth, but not deeper than eighteen inches (18 In) above crown of abandoned sanitary sewer.
- C. When adjacent sanitary sewer lines are not to be filled, place temporary plugs in each line connecting to manhole, in preparation for filling manhole.
- D. Excavate overburden from sanitary sewer force mains to be abandoned at locations indicated on the Drawings, conforming to Section 02125 –

Excavation and Backfill for Utilities. Cut existing sanitary sewer force main, when necessary, to provide an end surface perpendicular to axis of pipe and suitable for plug to be installed. Remove sanitary sewer force main piping material remaining outside of segment to be abandoned.

3.4 INSTALLATION

- A. Abandon sanitary sewer lines by completely filling sanitary sewer line with flowable fill. Abandon manholes and other structures by filling with flowable fill, together with ballast as applicable, within depth of structures left in place.
- B. Place flowable fill to fill volume between manholes. Continuously place flowable fill from manhole to manhole with no intermediate pour points but in no case exceeding five hundred feet (500 Ft) in length unless approved by the Project Manager.
- C. Have filling operation performed by experienced crews with equipment to monitor density of flowable fill and to control pressure.
- D. Temporarily plug sanitary sewer lines which are to remain in operation during pouring/pumping to keep lines free of flowable fill.
- E. Pump flowable fill through bulkheads constructed for placement of two (2) – two inch (2 In) PVC pipes or use other suitable construction methods to contain flowable fill in lines to be abandoned. These pipes shall act as injection points or vents for placement of flowable fill.
- F. Place flowable fill under pressure flow conditions into properly vented open system until flowable fill emerges from vent pipes. Pump flowable fill with sufficient pressure to overcome friction and to fill sanitary sewer from downstream end, to discharge at upstream end.
- G. Inject flowable fill through replaced ballast using grouting equipment and series of grout pipes discharging at bottom of placement, allowing fill to rise through ballast effectively filling all voids. Alternatively, sequentially place individual pieces of ballast at same time as flowable fill is placed. Do not fill with ballast more than fifty percent (50%) of volume at any level, to prevent nesting and void formation.
- H. Remediate placement of flowable fill which does not fill voids in sanitary sewer, in manholes or in other structures, or where voids develop due to excessive shrinkage or bleeding of fill, by using pressure grouting either from inside sanitary sewer or from surface. Pressure grout shall conform to Section 03105 – Grout.
- I. Plug each end of sanitary sewer force main being abandoned.
- J. Sanitary sewer force main abandonment:
 1. Clean inside surface of sanitary sewer force main at least twelve inches (12 In) from ends to achieve firm bond and seal grout plug or manufactured plug to pipe surface. Similarly, clean and prepare exterior pipe surface if manufactured cap is to be used.
 2. When using grout plug, place temporary plug or bulkhead approximately twelve inches (12 In) inside pipe. Fill pipe end completely with dry-pack grout mixture.

3. When using manufactured plug or cap, install fitting as recommended by manufacture's instructions, to form water tight seal.
 - K. Backfill to surface, above pipe or structures left in place, with:
 1. flowable fill in restricted areas or;
 2. compacted bank run sand in unrestricted areas to be paved or;
 3. select fill in unrestricted areas outside of pavement.
 - L. Place and compact backfill, other than flowable fill, in compliance with Section 02125 – Excavation and Backfill for Utilities.
 - M. Collect and dispose of excess flowable fill material and other debris in accordance with Section 01580 – Waste Material Disposal.
- 3.5 FIELD QUALITY CONTROL
- A. Provide batch plant tickets for each truck delivery of flowable fill. Note on tickets addition of admixtures at site.
 - B. Check flow characteristics and workability of fill as placement proceeds.
 - C. Obtain at least three (3) test cylinders for each placement area for determination of fifty-six day (56 D) compressive strength and bleeding. Acceptance of placement shall be based on average strength of three (3) tests.
 - D. Record volume of ballast together with flowable fill placement for same space to demonstrate that voids have been filled.
- 3.6 PROTECTION OF PERSONS AND PROPERTY
- A. Provide safe working conditions for employees throughout demolition and removal operations. Observe safety requirements for work below grade.
 - B. Maintain safe access to adjacent property and buildings. Do not obstruct roadways, sidewalks or passageways adjacent to the Work.

END OF SECTION