

SECTION 02051

ABANDONMENT OF SANITARY SEWERS

PART 1 GENERAL

1.01 SECTION INCLUDES

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

1.02 UNIT PRICES

- A. Measurement for grout fill and abandonment of existing gravity sewers is on a linear foot basis for each diameter of sewer being abandoned. Measurement will be along the centerline of the sewer from centerline to centerline of manholes.
- B. Measurement for grout fill and abandonment of sanitary sewer manholes is by each manhole abandoned in conformance with this Section.
- C. Payment will be full compensation for all material, equipment, and labor required for complete abandonment grouting, including air venting, testing, temporary plugs, pipes and all incidentals.
- D. No separate payment will be made for plugging and abandoning sanitary sewer force mains. Include the cost of such abandonment in related work.
- E. Acceptability of grout material is based on achieving an average strength of at least 75 as defined in Paragraph 2.01B.1.

1.03 DEFINITIONS

- A. Abandonment. Sanitary sewer abandonment consists of demolition and removal of any portion of manholes existing within the specified depth of the surface, and the abandonment in place of sewer lines and manholes as specified in this Section.
- B. Flowable Fill. Flowable fill (abandonment grout) shall be a controlled low-strength material consisting of a fluid mixture of cement, fly ash, aggregate, water and with admixtures as necessary to provide workable properties. Placement of flowable fill may be by grouting techniques in sewer pipes or other restricted areas, or as mass placement by chutes or tremie methods in unrestricted locations with open access. The long-term hardened strength shall be within a specified range.
- C. Ballast. Large aggregate either replaced with the voids subsequently filled with flowable fill injected by grouting method; or in areas with open access, placed individually and sequentially at the same time as the flowable fill placement.

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

1.04 SUBMITTALS

- A. Submittals shall conform to requirements of all sections and provisions of these specifications.
- B. Flowable fill mix design report:
1. Flowable fill type and production method.
 2. Use of ballast. Provide percentage of ballast of the total placement and size limits for the ballast if fill is intended to be used with ballast.
 3. Aggregate gradation of fill. The aggregate gradation of the mix (excluding ballast) shall be used as a 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 the 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 the proposed crew, showing a minimum of 5 similar projects using the proposed or similar equipment and methods.
- E. At least 60 days prior to commencing any abandonment activities, submit a plan for abandonment, describing the proposed grouting sequence, bypass pumping requirements and plugging, if any, and other information pertinent to completion of the work.

PART 2 PRODUCTS

2.01 FLOWABLE FILL

- A. Design Mix Criteria. Provide design of one or more mixes to meet the design criteria and conditions for placement. Present the information required by Paragraph 1.05B in the mix design report including the following:
1. Cement: ASTM C150 Type I or II. Volume and weight per cubic yard of fill. Provide minimum cement content of 100 pounds per cubic yard.
 2. Fly ash: ASTM C618 Class C or F. Volume and weight per cubic yard of fill. Provide minimum Fly ash content of 200 pounds per cubic yard.
 3. Potable water: Volume and weight per cubic yard of fill. Amount of water determined by mix design testing.
 4. Aggregate gradation: 100 percent passing the 3/8 inch sieve and not more than 10 percent passing the #200 sieve. The mix design report shall define a pilot gradation based on the following sieve sizes 3/8-inch, Nos. 4, 8, 16, 30, 50, 100 and 200. Do not deviate from the pilot gradation by more than +/-10 percentage points for any sieve for the production material.
 5. Aggregate source material: Screened or crushed aggregate, pit or bank run fine gravels or sand, or crushed concrete. If crushed concrete is used, at least 30 percent of natural aggregate shall be added as necessary to provide workability.
 6. Admixtures: Use admixtures meeting ASTM C494 and ASTM C107 as needed to improve pumpability, to control time of set, and reduce bleeding.
 7. Fluidifier: Use a fluidifier meeting ASTM C397 as necessary to hold the solid constituents in suspension. Add a shrinkage compensator if necessary.
 8. Performance additive: Use a flowable fill performance additive, such as Darafill or approved equal, to control the fill properties.
- B. Flowable Fill Requirements
1. Unconfined compressive strength: minimum 75 psi at 56 days as determined based on an average of three tests for the same placement. Present at least three acceptable strength tests for the proposed mix design in the mix design report.
 2. Placement characteristics: self-leveling.
 3. Shrinkage characteristics: non-shrink.
 4. Water bleeding for fill to be placed by grouting method in sewers: not to exceed 2 percent according to ASTM C940.
 5. Minimum wet density: 90 pounds per cubic foot.

2.02 BALLAST

- A. Ballast material: natural rock or concrete pieces with a minimum size equal to at least 10 times the maximum aggregate size of the flowable fill and a maximum size of 24 inches. The maximum dimension shall not be more than 20 percent of the minimum dimension of the space to be filled.
- B. Ballast composition: free of any regulated waste material.

2.03 PLUGS FOR 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 the pipe being abandoned.

PART 3 EXECUTION

3.01 PREPARATION

- A. Have fill mix design reports and other submittals required by Paragraph 1.05 accepted by the Owner's Representative prior to start of placement. Notify the Owner's Representative at least 24 hours in advance of grouting with flowable fill.
- B. Select fill placement equipment and follow procedures with sufficient safety and care to avoid damage to existing underground utilities and structures. Operate equipment at a pressure that will not distort or imperil any portion of the work, new or existing.
- C. Clean sewer lines and video with closed circuit television to identify connections, locate obstructions, and assess the condition of the pipe. Locate previously unidentified connections, which have not been redirected and reconnected as a part of this project, and report them to the Owner's Representative. During placement of the fill, compensate for any irregularities in the sewer pipe, such as obstructions, open joints, or broken pipe to ensure no voids remain unfilled.
- D. Perform demolition work prior to starting fill placement. Clean placement areas of sewers and manholes of debris that may hinder fill placement. Remove excessive amounts of sludge and any other substances that may degrade performance of the fill. Do not leave sludge or other debris in place if filling more than 2 percent of the placement volume. Dispose of waste material in compliance with Section 01500 - Temporary Facilities and Controls.
- E. Remove free water prior to starting fill placement.

3.02 EQUIPMENT

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

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

- A. Remove manhole frames and covers and any castings from other existing pipeline structures. Deliver these castings to the Owner's storage yard. Alternatively, salvaged castings may be used upon approval by the Owner's Representative for construction of new manholes on this project.
- B. Demolish and remove precast concrete adjustment rings and corner section, or brick and mortar corbel and chimney, or other pipeline structure, to a minimum depth of 4 feet below finished grade. The structure may be removed to a greater depth, but not deeper than 18 inches above the crown of the abandoned sewer.
- C. If the adjacent sewer lines are not to be filled, place temporary plugs in each line connecting to the manhole in preparation for filling the manhole.
- D. Excavate overburden from force mains to be abandoned at the locations indicated on the Drawings. Cut the existing force main, if necessary, to provide an end surface perpendicular to the axis of the pipe and suitable for the plug to be installed. Remove any force main piping material remaining outside of the segment to be abandoned.

3.04 INSTALLATION

- A. Abandon sewer lines by completely filling the sewer line with flowable fill. Abandon manholes and other structures by filling with flowable fill, together with ballast as applicable, within the depth of structures left in place.
- B. Place flowable fill to fill the volume between the manholes as completely as practicable. Continuously place flowable fill from manhole to manhole with no intermediate pour points, but not exceeding 500 feet in length.
- C. Have the filling operation performed by experienced crews with equipment to monitor density of the flowable fill and to control pressure.
- D. Temporarily plug sewer lines which are to remain in operation during pouring/pumping to keep the lines free of flowable fill.
- E. Pump flowable fill through bulkheads constructed for placement of two 2-inch PVC pipes or use other suitable construction methods to contain the flowable fill in the

lines to be abandoned. These pipes will act as injection points or vents for placement of flowable fill.

- F. Place flowable fill under pressure flow conditions into a properly vented open system until flowable fill emerges from the vent pipes. Pump flowable fill with sufficient pressure to overcome friction and to fill the sewer from the downstream end, to discharge at the upstream end.
- G. Inject flowable fill through replaced ballast using grouting equipment and a series of grout pipes discharging at the bottom of the placement, allowing the fill to rise through the ballast effectively filling all voids. Alternatively, sequentially place individual pieces of ballast at the same time as flowable fill is placed. Do not fill with ballast more than 50 percent of the volume at any level to prevent nesting and void formation.
- H. Remediate placement of flowable fill which does not fill voids in a sewer, in manhole or other structures, or where voids develop due to excessive shrinkage or bleeding of the fill by using pressure grouting either from inside the sewer or from the surface.
- I. Plug each end of force mains being abandoned.
- J. Force main abandonment
 1. Clean the inside surface of force mains at least 12 inches from the ends, as necessary, to achieve a firm bond and seal the grout plug or manufactured plug to the pipe surface. Similarly, clean and prepare the exterior pipe surface if a manufactured cap is to be used.
 2. When using a grout plug, place a temporary plug or bulkhead approximately 12 inches inside the pipe. Fill the pipe end completely with dry-pack grout mixture.
 3. When using a manufactured plug or cap, install the fitting, as recommended by the manufacturer's instructions, to form a watertight seal.
- K. Backfill to the surface, above the pipe or structures left in place, with flowable fill in restricted areas, compacted bank run sand in unrestricted areas to be paved or select fill in unrestricted areas outside of pavement. Place and compact backfill, other than flowable fill, in compliance with these specifications.
- L. Collect and dispose of excess flowable fill material and other debris in accordance with all sections of these specifications.

3.05 FIELD QUALITY CONTROL

- A. Provide batch plant tickets for each truck delivery of flowable fill. Note on the tickets addition of admixtures at the site.
- B. Check flow characteristics and workability of the fill as the placement proceeds.
- C. Obtain at least three test cylinders for each placement area for determination of 56 day compressive strength and bleeding. The acceptance of the placement will be based on the average strength of the three tests.
- D. Record the volume of ballast together with the flowable fill placement for the same space to demonstrate that voids have been filled.

3.06 PROTECTION OF PERSONS AND PROPERTY

- A. Provide safe working conditions for employees throughout demolition and removal operations. Observe safety requirements for work below grade.
- B. Maintain safe access to adjacent property and buildings. Do not obstruct roadways, sidewalks or passageways adjacent to the work.

END OF SECTION