Section 02081

CAST-IN-PLACE CONCRETE MANHOLES

PART 1 GENERAL

1.01 SUMMARY

This Section includes:

A. Cast-in-place concrete manholes for sanitary sewers and storm sewers, including box sewers.

B. Pile-supported concrete foundation used for unstable subgrade treatment for manhole base.

1.02 MEASUREMENT AND PAYMENT

A. Unit Prices.

1. Payment for manholes is on a unit price basis for each manhole installed.

2. Payment for Type C manhole with inlet top is on a unit price basis for each.

3. Payment for pile-supported concrete foundation used for unstable subgrade treatment for manhole base is on a unit price basis for each foundation installed.

4. Refer to Section 01270 – “Measurement and Payment” for unit price procedures.

B. Stipulated Price (Lump Sum). If Contract is Stipulated Price Contract, payment for Work in this Section is included in total Stipulated Price.

1.03 REFERENCES

A. ASME B16.1 - Gray Iron Pipe Flanges and Flanged Fittings Classes 25, 125, and 250

B. ASTM A307 - Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60 000 PSI Tensile Strength ASTM C270 REV A - Standard Specification for Mortar for Unit Masonry.

C. ASTM C923 - Standard Specifications for Resilient Connectors Between Reinforced Concrete Manhole Structures, Pipes, and Laterals.

D. ASTM C1107/C1107M REV A - Standard Specification for Packaged Dry, Hydraulic - Cement Grout (Nonshrink).

E. ASTM D698 - Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lb/ft^3).

F. ASTM D2665 - Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Drain, Waste and Vent Pipe, and Fittings.

G. ASTM D2996 - Standard Specification for Filament-Wound Fiberglass (Glass-Fiber-Reinforced Thermosetting-Resin) Pipe.

H. ASTM D 2997 - Standard Specification for Centrifugally Cast Fiberglass (Glass-Fiber-Reinforced Thermosetting-Resin) Pipe.

I. AWWA C 213 - Fusion-Bonded Epoxy Coatings and Linings for Steel Water Pipe and Fittings

1.04 SUBMITTALS

A. Conform to requirements of Section 01330 – "Submittal Procedures".

B. Submit proposed design mix and test data for each type and strength of concrete.

C. Submit manufacturer's data and details of following items for approval:

1. Frames, grates, rings, and covers.

2. Materials to be used in fabricating drop connections.

3. Materials to be used for pipe connections at manhole walls.

4. Materials to be used for stubs and stub plugs.

5. Plugs to be used for sanitary sewer hydrostatic testing.

6. Installation instruments for forms.

D. If detailed design for cast-in-place manholes is not included in the construction documents, contractor shall submit detailed drawings for the cast-in-place manholes meeting the design requirements of Section 02082 – "Precast Concrete Manholes". Seal submittal drawings by a Professional Engineer registered in the State of Texas. Include design details on the pipe to manhole connections.

1.05 RELATED REQUIREMENTS

A. Section 01270 – "Measurement and Payment"

B. Section 01330 – "Submittal Procedures"

C. Section 02082 – "Precast Concrete Manholes"

D. Section 02084 – "Frames, Grates, Rings, and Covers"

E. Section 02317 – "Excavation and Backfill for Utilities"

F. Section 02911 – "Topsoil"

G. Section 02921 – "Hydro-Mulch Seeding"

H. Section 02922 – "Sodding"

I. Section 03315 – "Concrete for Utility Construction"

1.06 – 1.13 NOT USED

PART 2 P R O D U C T S

2.01 MANUFACTURER(S) (NOT USED)

2.02 MATERIALS AND/OR EQUIPMENT

A. Concrete

1. Conform to requirements of Section 03315 – "Concrete for Utility Construction".

2. Provide Class A concrete with minimum compressive strength of 4,000 psi unless otherwise indicated on Plans.

B. Reinforcing Steel

Conform to requirements of Section 03315 - "Concrete for Utility Construction".

C. Mortar

Conform to requirements of ASTM C270 REV A, Type S using Portland cement.

D. Miscellaneous Metals

Provide cast-iron frames, grates, rings, and covers conforming to requirements of Section 02084 - "Frames, Grates, Rings, and Covers".

E. Drop Connections and Stubs

Provide drop connections and stubs conforming to same pipe material requirements used in main pipe, unless otherwise indicated on Plans.

F. Pipe Connections

1. Sanitary Sewers:

a. Provide resilient connectors conforming to requirements of ASTM C923. Use the following materials for metallic mechanical devices as defined in ASTM C923:

1) External clamps: Type 304 stainless steel

2) Internal, expandable clamps on Standard manholes: Type 304 stainless steel, 11 gauge minimum

3) Internal, expandable clamps on corrosion-resistant manholes:

a) Type 316 stainless steel, 11 gauge minimum

b) Type 304 stainless steel, 11 gauge minimum, coated with minimum 16 mil fusion-bonded epoxy conforming to AWWA C 213

b. Where rigid joints between pipe and cast-in-place manhole base are specified or shown on Plans, provide polyethylene-isoprene waterstop meeting physical property requirements of ASTM C923, such as Pres-Seal WS Series, or approved equal.

2. Storm Sewers: Use non-shrink grout for storm sewer pipe connections to concrete manholes, unless otherwise shown on Plans. Grout pipe penetration in place on both inside and outside of manhole.

G. Sealant Materials

1. Provide sealing materials between precast concrete adjustment ring and manhole cover frame, such as Adeka Ultraseal P 201, or approved equal.

2. Provide external sealing material from Canusa Wrapid Seal manhole encapsulation system, or approved equal.

3. Butyl Sealant: Provide Press-Seal EZ Stick, or equal, for HDPE rings.

H. Corrosion-Resistant Manhole Materials

Where corrosion-resistant manholes or PVC-lined manholes are indicated on the Plans, provide one of the following:

1. PVC liner for precast cylindrical manhole section, base sections, and cone sections

2. Precast base sections lined with PVC and fiberglass manhole sections and cone sections.

I. Backfill Materials

Conform to the requirements of Section 02317 - "Excavation and Backfill for Utilities".

J. Non-Shrink Grout

1. Provide prepackaged, inorganic, flowable, non-gas-liberating, non-metallic, cement-based non-shrink grout requiring only addition of water.

2. Provide grout meeting requirements of ASTM C1107/C1107 M REV A and having minimum 28-day compressive strength of 7,000 psi.

K. Vent Pipes for Sanitary Manholes

1. Provide external vent pipes for manholes where indicated on Plans.

2. Buried Vent Pipes: Provide 3 inch or 4 inch PVC DWV pipe conforming to ASTM D2665. Alternatively, provide FRP pipe as specified for vent outlet assembly.

3. Vent Outlet Assembly: Provide vent outlet assembly as shown on Plans, constructed of following specified materials.

a. FRP Pipe: Provide filament-wound FRP conforming to ASTM D2996 or centrifugally cast FRP conforming to ASTM D2997. Seal cut ends in accordance with manufacturer's recommendations.

b. Joints and Fittings: Provide epoxy- bodied fittings and join pipe to fittings with epoxy adhesive, according to pipe manufacturer's instructions.

c. Flanges: Provide socket-flange fittings for epoxy adhesive bonding to pipe ends where shown on Plans. Meet bolt pattern and dimensions for ASME B16.1, 125-pound flanges. Use Type 304 stainless steel or hot-dip zinc coated, conforming to ASTM A307, Class A or B flange bolts.

d. Coating: Provide 2-component, aliphatic polyurethane coating, using primer or tie coat recommended by manufacturer. Provide two or more coats to yield dry film thickness of at least 3 mils. Provide Amershield, Tnemec 74, or approved equal. Project Manager selects color from manufacturer's standard colors.

L. Prohibited Materials

Do not use brick masonry for construction of sanitary sewer manhole, including adjustment of manholes to grade. Use only specified materials listed above.

2.03 – 2.04 NOT USED

PART 3 EXECUTION

3.01 GENERAL / MANUFACTURER(S) (NOT USED)

3.02 PREPARATION

A. Verify lines and grades are correct.

B. Determine if subgrade, when scarified and recompacted, can be compacted to 95 percent of maximum Standard Proctor Density according to ASTM D698 prior to placement of foundation material and base section. When proper density cannot be reached, moisture condition subgrade until that density is reached or treat as an unstable subgrade.

C. Do not build manholes in ditches, swales, or drainage paths unless approved by Project Manager.

3.03 ERECTION/INSTALLATION APPLICATION AND/OR CONSTRUCTION

A. Manholes

1. Construct manholes to dimensions shown on Plans. Commence construction as soon as possible after pipes are laid. On monolithic sewers, construct manholes at same time sewer is being constructed.

2. Unstable Subgrade Treatment: When unstable subgrade is encountered, notify Project Manager for examination of subgrade to determine if subgrade has heaved upwards after being excavated. When heaving has not occurred, over-excavate subgrade to allow for 24-inch-thick layer of crushed stone wrapped in filter fabric as foundation material under manhole base. When there is evidence of heaving, provide pile-supported concrete foundation, as detailed on Plans, under manhole base.

3. Cast manhole foundations and walls monolithically. Use cold joint with approved waterstop when manhole flow line depth exceeds 12 feet. No other joints shall be allowed unless shown on Plans. Wrap cold joints with external sealing material, minimum 6-inch width.

4. For concrete containing micro silica admixtures, place, finish, and cure concrete for manholes following procedures in Section 03315 - “Concrete for Utility Construction”.

5. Top of manhole elevations shown on Plans are approximate, based on current pavement and natural ground conditions as determined from elevations measured on 50-foot spacings. No additional payment shall be made if final elevation of manhole ring and cover is higher or lower due to requirements of finished grade or replaced pavement surface.

B. Pipe Connections

1. Install approved resilient connectors at each pipe entering and exiting sanitary sewer manholes in accordance with manufacturer's instructions.

2. Grout storm sewer connections to manhole unless otherwise shown on Plans. Grout pipe penetrations both inside and outside of manhole.

3. Ensure no concrete, cement stabilized sand, fill, or other solid material is allowed to enter space between pipe and edge of wall opening at and around resilient connector on interior or exterior of manhole. When necessary, fill space with compressible material to ensure resilient connector will maintain full flexibility where evidence of reduced flexibility is encountered.

4. Where new manhole is to be constructed on existing sewer, a rigid joint pipe may be used. Install waterstop gasket around existing pipe at center of cast-in-place wall. Join ends of split waterstop material at pipe spring line using adhesive recommended and supplied by waterstop manufacturer.

5. Do not construct joints on sanitary sewer pipe within wall sections of manholes. Use approved connection material.

6. Construct pipe stubs with resilient connectors for future connections at locations and with material indicated on Plans. Install approved stub plugs at interior of manhole.

7. Test connection for watertight seal before backfilling.

C. Inverts for Sanitary Sewers

1. Construct invert channels to provide smooth flow transition waterway with no disruption of flow at pipe-manhole connections. Conform to following criteria:

   a. Slope of invert bench: 1 inch per foot minimum; 1½ inch per foot maximum.

   b. Depth of bench to invert:

      1) Pipes smaller than 15 inches: one-half of largest pipe diameter

      2) Pipes 15 to 24 inches: three-fourths of largest pipe diameter

      3) Pipes larger than 24 inches: equal to largest pipe diameter

   c. Invert slope through manhole: 0.10 foot drop across manhole with smooth transition of invert through manhole and at pipe-manhole connections, unless otherwise indicated on Plans.

2. Form invert channels with Class A concrete if not integral with manhole base. For direction changes of mains, construct channels tangent to mains with maximum possible radius of curvature. Provide curves for side inlets and smooth invert fillets for flow transition between pipe inverts.

D. Drop Connections for Sanitary Sewers

1. Backfill drop assembly with crushed stone wrapped in filter fabric, cement-stabilized sand, or Class A concrete to form solid mass. Extend cement stabilized sand or concrete encasement minimum of 4 inches outside bells.

2. Install connection when sewer line enters manhole higher than 24 inches above invert of manhole.

E. Stubs for Future Connections

In manholes where future connections are indicated on Plans, install resilient connectors and pipe stubs with approved watertight plugs.

F. Adjustment Rings and Frame

1. Combine precast concrete or HDPE adjustment rings so elevation of installed casting cover matches pavement surface. Seal between concrete adjustment ring and precast top section with non-shrink grout; do not use mortar between adjustment rings. Apply latex-based bonding agent to precast concrete surfaces to be joined with non-shrink grout. Set cast iron frame on adjustment ring in a bed of approved sealant material. Install a sealant bed consisting of two beads of sealant, each bead having minimum dimensions of ½-inch high and ½-inch wide.

2. Wrap manhole frame and adjustment rings with external sealing material, minimum 3 inches beyond joint between ring and frame, and ring and precast section.

3. For manholes in unpaved areas, set top of frame a minimum of 6 inches above existing ground line unless otherwise indicated on Plans. Encase manhole frame in mortar or non-shrink grout placed flush with face of manhole ring and top edge of frame. Provide rounded corner around perimeter.

G. Backfill

1. After concrete obtains adequate strength, place, and compact backfill materials in area of excavation surrounding manholes in accordance with requirements of Section 02317 - “Excavation and Backfill for Utilities”. Use embedment zone backfill material for adjacent utilities, as shown in details over each pipe connected to manhole. Provide trench zone backfill, as specified for adjacent utilities, above embedment zone backfill.

2. Where rigid joints are used for connecting existing sewers to manhole, backfill under existing sewer up to spring line of pipe with Class B concrete or flowable fill.

3. In unpaved areas, grade surface at uniform slope of 5 to 1 from manhole frame to natural grade. Provide minimum of 4 inches of topsoil conforming to requirements of Section 02911 – "Topsoil". Seed in accordance with Section 02921 - "Hydro-Mulch Seeding", or sod disturbed areas in accordance with Section 02922 - "Sodding".

3.04 – 3.08 NOT USED

3.09 PROTECTION

Protect manholes from damage until subsequent work has been accepted. Repair or replace damaged elements of manholes at no additional cost.

3.10 SCHEDULES (NOT USED)

END OF SECTION