SECTION 33 05 14
UTILITY MANHOLES AND STRUCTURES

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
1. Precast reinforced concrete manholes and structures with tongue-and-groove joints with masonry transition to frames, lids, grates, anchorage, and accessories.
2. Masonry manhole and structure sections with masonry transition to frames, lids, grates, anchorage, and accessories.
3. Cast-in-place concrete manholes and structures with masonry transition to frames, lids, grates, covers, anchorage, and accessories.
4. Structure connections to existing public utility lines.
5. Bedding and backfill materials.

B. Related Sections:
1. Section 31 23 17 - Trenching: Excavating and backfilling for manholes, structures, and foundation slabs.
2. Section 33 01 32 - Sewer and Manhole Testing.
3. Section 33 11 13 - Water Utility Distribution Piping: Connections to valve and meter vaults.
4. Section 33 31 13 - Sanitary Utility Sewerage Piping: Connections to manholes.
5. Section 33 41 13 - Storm Utility Drainage Piping: Connections to inlets, catch basins, manholes, and structures.

1.2 REFERENCES

A. American Concrete Institute:
1. ACI 530/530.1 - Building Code Requirements for Masonry Structures and Specifications for Masonry Structures.

B. ASTM International:
1. ASTM A48 - Standard Specification for Gray Iron Castings.
2. ASTM C32 - Standard Specification for Sewer and Manhole Brick (Solid Masonry Units Made From Clay or Shale).
3. ASTM C39 - Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens.
4. ASTM C55 - Standard Specification for Concrete Brick.
5. ASTM C443 – Standard Specification for Joints for Circular Concrete Sewer and Culvert Pipe, Using Rubber gaskets.
6. ASTM C478 - Standard Specification for Precast Reinforced Concrete Manhole Sections.
7. ASTM C497 - Standard Test Methods for Concrete Pipe, Manhole Sections, or Tile.
8. ASTM C857 - Standard Practice for Minimum Structural Design Loading for Underground Precast Concrete Utility Structures.
9. ASTM C890 - Standard Practice for Minimum Structural Design Loading for Monolithic or Section Precast Concrete Water and Wastewater Structures.
10. ASTM C891 - Standard Practice for Installation of Underground Precast Concrete Utility Structures.
11. ASTM C913 - Standard Specification for Precast Concrete Water and Wastewater Structures.

12. ASTM C923 - Standard Specification for Resilient Connectors Between Reinforced Concrete Manhole Structures, Pipes, and Laterals.
13. ASTM C990 - Standard Specification for Joints for Concrete Pipe, Manholes, and Precast Box Sections Using Preformed Flexible Joint Sealants.

C. National Precast Concrete Association:
1. NPCA Quality Control Manual for Precast Plants.
2. NPCA Plant Certification Program.

D. SCDOT Standard Specifications:
1. Standard Specifications for Highway Construction, 2007, published by the South Carolina Department of Transportation.

1.3 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.

B. Shop Drawings:
1. Standard Fabrication: Indicate structure locations, elevations, sections, equipment support, piping sizes, and elevations of penetrations.
2. Custom Fabrication: Indicate design, construction and installation details, typical reinforcement and additional reinforcement at openings for each custom type, size and configuration.

C. Product Data: Submit manhole frames and lids, accessories, component construction, features, configuration, dimensions, and joint data.

D. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

E. Project Record Documents: Record actual locations of manholes and structures with rim and invert elevations.

F. Identify and describe unexpected variations to subsoil conditions or discovery of uncharted utilities.

1.4 QUALITY ASSURANCE

A. Obtain precast concrete utility structures from single source.

B. Perform Work in accordance with Section 719 of SCDOT Standard Specifications.

C. Maintain one copy of document on site.

1.5 QUALIFICATIONS

A. Manufacturer: Certified by NPCA Plant Certification Program prior to and during Work of this section.

B. Installer: Company specializing in performing work of this Section with minimum five years experience.

C. Design custom utility structures under direct supervision of Professional Engineer experienced in design of this Work and licensed in State of Project location.

1.6 DELIVERY, STORAGE AND HANDLING

A. Section 01 60 00 - Product Requirements: Product storage and handling requirements.

B. Comply with precast concrete manufacturer's instructions and ASTM C913 for unloading, storing and moving precast manholes and drainage structures.

C. Store precast concrete manholes and drainage structures to prevent damage to Owner's property or other public or private property. Repair property damaged from materials storage.

D. Mark each precast structure by indentation or waterproof paint showing date of manufacture, manufacturer and identifying symbols, and numbers shown on Drawings to indicate its intended use.

1.7 ENVIRONMENTAL REQUIREMENTS

A. Masonry Work: Maintain materials and surrounding air temperature to minimum 50 degrees F prior to, during, and 48 hours after completion of masonry work.

B. Cold Weather Requirements: ACI 530/530.1.

PART 2 PRODUCTS

2.1 PRECAST REINFORCED MANHOLES AND STRUCTURES

A. Precast Manhole and Structure Sections: Reinforced precast concrete in accordance with ASTM C478.
   1. Joints for Precast Manholes and Structures for Sanitary Utility Sewer Service: O-ring rubber gaskets in accordance with ASTM C443.
   2. Joints for Precast Manholes and Structures for Other Utility uses: Butyl rubber gaskets in accordance with ASTM C990.

2.2 MASONRY CONSTRUCTION

A. Concrete Brick: ASTM C55, Grade S, Type II - Non-moisture controlled; except that the absorption of brick shall not exceed 10 lbs / cubic foot.

B. Clay or Shale Brick: ASTM C32, Grade SW, solid units.

C. Mortar: Conform to Division 700 of SCDOT Standard Specifications proportioned as described below. Do not add more water than is necessary to make a workable mixture.
   1. Mix No. 1: 1 part Portland cement, 1/4 part hydrated lime, 3-3/4 parts mortar sand (maximum).
   2. Mix No. 2: 1 part Portland cement, 1 part masonry cement, 6 parts mortar sand (maximum).

D. Grout: Non-shrink, non-metallic in accordance with Division 700 of SCDOT Standard Specifications with a compressive strength of at least 5,000 psi at 3 days.

2.3 CAST-IN-PLACE CONCRETE

A. Concrete: Class A Concrete conforming to Division 700 of the SCDOT Standard Specifications.
   1. Compressive strength of 3,000 psi at 28 days.

2. Air entrained.
3. Water cement ratio of 0.488 with rounded aggregate and 0.532 with angular aggregate.
4. Maximum slump of 3.5 inch for vibrated concrete and 4 inch for non-vibrated concrete.
5. Minimum cement content of 564 pounds per cubic yard for vibrated concrete and 602 pounds per cubic yard for non-vibrated concrete.

2.4 FRAMES AND COVERS

A. Product Description: Grey cast iron ASTM A48, Class 30B; size and shape as indicated on Drawings. Live load rating of HS 20 in paved areas.

2.5 CONFIGURATION

A. Provide size and shape as indicated on Drawings.

B. Foundation Slab: Cast-in-place or precast reinforced concrete integral with bottom section, level top surface.

2.6 ACCESSORIES

A. Steps: Conform to ASTM C-478 and current OSHA Regulations, minimum 12 inches wide spaced vertically 16 inches on center, made of copolymer polypropylene plastic encapsulating ½" grade 60 steel reinforcement. Vertical load resistance of 400 lbs and minimum pull-out resistance of 1000 lbs.

B. Strap Anchors: Stainless steel capable of supporting pipe or accessories indicated on Drawings, minimum 1 inch wide x 1/8 inch thick.

C. Geotextile Filter Fabric: Type 1 Engineering fabric in accordance with Section 804 of SCDOT Standard Specifications; non-woven, needle punched, non-biodegradable, and rot-proof.

D. Bituminous Interior Manhole Coating:
1. Manufacturers:
   a. Bitumastic.
   b. Beazer East, Inc.
   c. Substitutions: Equal per Section 01 60 00 - Product Requirements.

E. Watertight Polyethylene Manhole Insert:
1. Manufacturers:
   a. Parsons.
   b. Substitutions: Equal per Section 01 60 00 - Product Requirements.

2.7 BEDDING AND BACKFILL MATERIALS

A. Bedding: Clean course aggregate Gradation No. 57 conforming to Division 700 and 800 of the SCDOT Standard Specifications.

B. Backfill around Structures: As specified in Section 31 23 17 -Trenching.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify items provided by other Sections of Work are properly sized and located.

B. Verify built-in items are in proper location and ready for roughing into Work.

C. Verify correct size of manhole and structure excavation.

3.2 PREPARATION

A. Coordinate placement of inlet and outlet pipe or duct sleeves required by other Sections.

B. Do not install manholes and structures where site conditions induce loads exceeding structural capacity of manholes or structures.

C. Inspect precast concrete manholes and structures immediately prior to placement in excavation to verify manholes and structures are internally clean and free from damage. Remove and replace damaged units.

3.3 INSTALLATION – GENERAL

A. Excavation and Backfill:
1. Excavate and backfill for manholes and structures in accordance with Section 31 23 17 in location and to depth shown. Provide clearance around sidewalls of manhole or structure for construction operations, backfill, and placement of geotextile filter fabric if required.
2. When groundwater is encountered, prevent accumulation of water in excavations. Place manholes or structures in dry trench.
3. Where possibility exists of watertight manhole or structure becoming buoyant in flooded excavation, anchor manhole or structure to avoid flotation.

B. Place foundation slab, trowel top surface level.

C. Place precast manhole sections plumb and level, trim to correct elevations, anchor to foundation slab.

D. As Work progresses, install steps and other fabricated metal items.

E. Install cast-in-place manholes and structures supported at proper grade and alignment as shown on Drawings.

F. Cut pipe to connect to structure as indicated on Drawings.

G. Grout base of shaft sections to achieve slope to exit piping. Trowel smooth. Contour to form continuous drainage channel as indicated on Drawings.

H. Set cover frames and covers level without tipping, to correct elevations.

3.4 PRECAST CONCRETE MANHOLE AND STRUCTURE INSTALLATION

A. Install underground precast utility structures in accordance with ASTM C891.

B. Lift precast manholes and structures at lifting points designated by manufacturer.

C. When lowering manholes and structures into excavations and joining pipe to units, take precautions to ensure interior of pipeline and manhole or structure remains clean.

D. Set precast manholes and structures bearing firmly and fully on stone bedding, 8-inch minimum thickness, compacted to 95 percent maximum density per Section 31 23 17 or on other support system shown on Drawings.

E. Assemble multi-section manholes and structures by lowering each section into excavation. Install rubber gasket joints between precast sections in accordance with manufacturer's recommendations. Lower, set level, and firmly position base section before placing additional sections.

F. Remove foreign materials from joint surfaces and verify sealing materials are placed properly. Maintain alignment between sections by using guide devices affixed to lower section.

G. Joint sealing materials may be installed on site or at manufacturer's plant.

H. Verify manholes and structures installed satisfy required alignment and grade.

I. Remove knockouts or cut structure to receive piping without creating openings larger than required to receive pipe. Fill annular space with non-shrink grout.

3.5 MASONRY MANHOLE AND STRUCTURE INSTALLATION

A. Maintain masonry courses to uniform dimension. Form vertical and horizontal joints of uniform thickness.

B. Lay masonry units in running bond. Course one unit and one mortar joint to equal 8 inches.

C. Form flush mortar joints.

D. Lay masonry units in full bed of mortar, with full head joints, uniformly jointed with other Work.

E. Install joint reinforcement 16 inches on center.

F. Place joint reinforcement in first and second horizontal joints above base pad and below cover frame opening.

3.6 CAST-IN-PLACE CONCRETE MANHOLE AND STRUCTURE INSTALLATION

A. Prepare crushed stone bedding or other support system shown on Drawings to receive foundation slab as specified for precast manholes and structures.

B. Erect and brace forms against movement in accordance with Section 719 of SCDOT Standard Specifications.

C. Install reinforcing steel as indicated on Drawings and in accordance with Section 719 of SCDOT Standard Specifications.

D. Place and cure concrete in accordance with Section 719 of SCDOT Standard Specifications.

3.7 CONNECTION TO EXISTING SEWER WITH MANHOLE

A. Stake out location and burial depth of existing sewer line in area of proposed manhole or structure.

B. Carefully excavate around existing sewer line to adequate depth for foundation slab installation. Protect existing pipe from damage. Cut out soft spots and replace with granular fill compacted to 95 percent maximum dry density per Section 31 23 17.

C. Prepare crushed stone bedding or other support system shown on Drawings, to receive foundation slab as specified for precast manholes and structures.

D. Install manhole or structure around existing pipe in accordance with the appropriate paragraphs specified herein.

E. Block upstream flow at existing manhole or structure with expandable plug.

F. If flow is excessive, pump flow around new manhole to existing downstream manhole.

G. Use hydraulic saw to cut existing pipe at manhole or structure entrance and exit and along pipe length at a point halfway up the outside diameter on each side of the pipe. Bottom half of pipe shall remain as manhole flow channel. Saw cut to have a smooth finish with top half of pipe flush with interior of manhole or structure.

3.8 SANITARY MANHOLE DROP CONNECTIONS

A. Construct drop connections into sanitary manholes in accordance with Drawings.

B. Concrete encase pipe drop connection to minimum of 2 feet outside of manhole.

C. Form channel from pipe drop to sweep into main channel at maximum angle of 45 degrees.

3.9 CASTINGS INSTALLATION

A. Set frames using mortar and masonry as indicated on Drawings. Install radially laid concrete brick with 1/4 inch thick vertical joints at inside perimeter. Lay concrete brick in full bed of mortar and completely fill joints. Where more than one course of concrete brick is required, stagger vertical joints.

B. Do not install more than 3 courses of brick or more than 12 inches of masonry.

3.10 FIELD QUALITY CONTROL

A. Section 01 40 00 - Quality Requirements: Field inspecting, testing, adjusting, and balancing.

B. Perform soil compaction tests in accordance with Section 31 23 17.

C. Perform hydrostatic tests in accordance with Section 33 01 32.
1. Notify Engineer 72 hours in advance of test and have witness test.

D. Test cast-in-place concrete in accordance with ASTM C39.

E. Test concrete manhole and structure sections in accordance with ASTM C497.

F. Vertical Adjustment of Existing Manholes and Structures:

1. Where required, adjust top elevation of existing manholes and structures to finished grades shown on Drawings.
2. Reset existing frames, grates and covers, carefully removed, cleaned of mortar fragments, to required elevation in accordance with requirements specified for installation of castings.
3. Remove concrete without damaging existing vertical reinforcing bars when removal of existing concrete wall is required. Clean vertical bars of concrete and bend into new concrete top slab or splice to required vertical reinforcement, as indicated on Drawings.
4. Clean and apply sand-cement bonding compound on existing concrete surfaces to receive cast-in-place concrete.

END OF SECTION