Section 02605 - SEWER MANHOLES

1. SCOPE. This section covers standard and drop sewer manholes. Standard and drop manholes shall be constructed complete with covers, steps, fittings, and other appurtenances specified herein and in accordance with the Standard Details.

2. GENERAL. Manholes shall be constructed with precast concrete bases as indicated in the details.

Only manholes which are required to have inside and outside pipe and fittings for dropping sewage into the lower line will be designated as drop manholes.

Inside drop manholes shall be used for 8-inch to 12-inch diameter sewer unless indicated otherwise on the drawings.

Manhole inside diameters shall generally be as follows, unless otherwise directed by the Engineer or noted on the drawings, according to the largest sewer pipe connected to the manhole:

PIPE DIAMETER (inches)	MANHOLE DIAMETER (feet)
8 to 16	4
18 to 36	5
39 to 54	6
54 and larger	8

The minimum diameter of all drop manholes shall be 5 feet.

All manhole components shall be designed to withstand a H-20 loading. All precast manholes installed in the NCDOT right-of-way shall be approved by NCDOT. All design calculations, documentation, and any other information required by NCDOT shall be provided by and at the expense of the Contractor.

The maximum separation between manholes shall be in accordance with NCAC 2H .0219(i)(2)(I).

3. QUALIFICATIONS

3.1. The Precast Manufacturer shall comply with one of the following requirements:

(1) Retain an independent testing or consulting engineering firm approved by the Engineer for Precast Plant Inspection. The basis for Plant Inspection shall be the National Precast Concrete Association Quality Control Manual or the Manual for Quality Control for Plants and Production of Precast and Prestressed Concrete Products. The above firm shall inspect the Precast Plant 2 weeks prior to and at 1 week intervals during production of materials for this project and issue a report, certified, by a registered Engineer that materials, methods, products, and quality control meet the requirements of the above quality control manuals.

3.2. The Precast Manufacturer shall have a recognized Quality Improvement Process installed at the manufacturing facility.

3.3. Concrete compressive strength testing shall be performed in a laboratory inspected by the CCRL of the National Bureau of Standards or approved NCDOT laboratory. Testing shall be performed by the Grade I ACI Certified Laboratory Technicians or by Level I PCI Certified Technicians.

4. MATERIALS.

Concrete for Precast Manholes and Inverts	ASTM C478, C890, C891, C923.
Compressive Strength	4,000 psi minimum at 28 days.
Air Content	4 percent minimum.
Cement	564 pounds minimum per cubic yard.
Coarse Aggregate	ASTM C33, sound, crushed, angular stone.
Fine Aggregates	ASTM C33, free from organic impurities.
Chemical Admixtures	ASTM C494, shall not contain calcium chloride.
Air Entraining Admixtures	ASTM C260.
Precast Concrete Riser and Base Sections	Circular, uniform outside diameter; ASTM C478, except as modified herein.
Minimum Wall Thickness	1/12 of inside diameter, plus one inch.

Reinforcement	ASTM A615 grade 60 deformed bar, ASTM A82 or ASTM A185 welded wire fabric.
Precast Concrete Cone Sections	Eccentric, ASTM C478; wall thickness and reinforcement as specified for riser sections.
Precast Transition Cone Sections	Eccentric transition from 60 inch and larger manholes to 48 inch diameter risers cones and flat slab top sections. The minimum transition slope shall be 45 degrees.
Precast Transition Top Sections	Eccentric transition from 60 inch and larger manholes to 48 inch diameter risers, cones, and flat top sections
Precast Flat Slab Top Sections	HS-20 per ASTM 890 with 24 inch opening.
Precast Adjusting Rings	Concrete, Circular, ASTM C478. HDPE, Circular, ASTM D-1248
Lift Loops Lifting Device	ASTM steel strand. Lifting loops made from deformed bars are not acceptable. OSHA 1926.704
Nonshrinking Grout	Cormix "Supreme", L&M "Crystex", Master Builders "Masterflow 713 Grout" or "Set-Grout", Sauereisen Cements "F-100 Level Fill Grout", UPCO "Upcon Super Flow", or U.S. Grout "Five Star Grout".
Epoxy Grout	Two component, solvent free, moisture insensitive, high modulus, high strength, ASTM C-881, Type I and II, Grade 3, Class B and C, Epoxy Resin Adhesive.
Resilient Manhole/Pipe	Flexible watertight, synthetic

Connectors	rubber sleeves with stainless steel clamp, drawbolt and nut; cast-in-sleeve; or "A" Lok.
Mastic	Fed Spec SS-S-210A; AASHTO M-198, Type B Butyl rubber and as follows: Cross-sectional area no less than the annular space times the height of the joint.
Vent Pipes	Grade B, FY = 35,000 psi, 3 inch diameter. Mesh stainless steel screen shall be in the opening.
Steel Straps and Anchors	ASTM A36, min yield strength 36,000 psi. ASTM A153 galvanized. Coated with Bituminous coating after installation.
Coating, interior & exterior	Bituminous, AASHTO M-190.
Coal Tar Paint	Koppers 300M or equal 21 mils.
Castings	ASTM A48, Class 30 traffic bearing type, machined smooth. All castings shall be American made.
Standard Manhole Rings and Covers	Vulcan Foundry, Inc., "V-B1384", Neenah "R-1550", U.S. Foundry "USF-669 Vented", or equal.
Watertight Manhole Rings and Covers	Vulcan Foundry, Inc., "V-2328", Neenah "R-1915H", U.S. Foundry "USF-669 BWT", or equal.
Manhole Steps	1/2 inch deformed steel bar, ASTM A615, Grade 60 minimum, totally encapsulated in copolymer poly-propylene, ASTM D4101.

5. MANUFACTURE. Precast base sections shall be provided with circular openings with continuous, circular, resilient connectors. For cut-in manholes, horseshoe-shaped boxouts for connecting piping to be grouted in shall be provided. Boxouts shall have surfaces grooved or roughened to improve grout bond.

Pipe to Manhole Connectors shall conform to ASTM C923. The location of the pipe connectors shall vary from the location shown on the Project Plans no more than 1/2 inch vertically and 5 degrees horizontally. Provide for control of the pipe OD to within the tolerances of the connector on flexible pipes larger than 12 inches.

Precast sections shall be provided with lifting holes on the inside or outside faces of walls to facilitate handling. The depth of lifting holes shall not be deeper than 2 inches less than the wall thickness. Lifting holes which penetrate through the wall are not acceptable.

Inverts shall meet the following requirements:

(a) All inverts shall be made of concrete as specified herein. Brick and mortar inverts are not acceptable.

(b) Pipe openings shall provide clearance for pipe projecting a minimum of 2 inches inside the manhole. The invert of the pipe shall match the elevation of the trough.

(c) Invert Troughs shall be formed and finished to provide a consistent slope from the pipe outlet to the inlets. The minimum outside bending radius from influent to effluent shall be 1.5 times the pipe ID. A 1/2 inch radius shall be provided at the intersection of 2 or more channels. The minimum concrete thickness from the bottom of the trough to the bottom of the base shall be 7 inches.

(d) Invert Benches shall have a float finish with a uniform 2-1/2 inches slope, plus or minus 1 inch, from the high point at the manhole wall to the low point at invert trough. A 1/4 inch radius shall be provided at the edge of the bench and trough.

(e) Depressions, high spots, voids, chips, or fractures over 1/4 inch in diameter or depth shall be filled with a sand cement paste and finished a texture reasonably consistent with that of the formed surface.

6. DELIVERY. Precast concrete sections shall not be delivered to the job until representative concrete control cylinders have attained a strength of at least 80 percent of the specified minimum.

7. HANDLING. Precast concrete sections shall be handled carefully and shall not be bumped or dropped. Hooks shall not be permitted to come in contact with joint surfaces.

8. INSPECTION. Precast concrete sections shall be inspected when delivered and all cracked or otherwise visibly defective units rejected.

9. CONSTRUCTION.

9.01. Bases. Precast base sections shall be cast monolithically without construction joints or with an approved galvanized or PVC waterstop in the cold joint between the base slab and the walls.

Precast concrete bases shall have the subgrade materials excavated to undisturbed earth and to a uniform elevation which will permit at least 6 inches of granular embedment material, as specified in the earthwork section, to be installed and compacted. The surface of the granular material shall be carefully graded and the base section accurately set so that connecting pipes will be on proper line and grade. The elevation of the granular material shall be adjusted as required until proper grade and alignment of the base section has been attained.

Extended base manholes shall have an extension of the base slab beyond the outside wall a distance of at least the slab thickness (6 inches minimum).

No wedging or blocking under precast concrete bases will be permitted.

In no case shall the invert section through a manhole be greater than that of the outgoing pipe. The shape of the invert shall conform exactly to the lower half of the pipe it connects. Side branches shall be connected with as large radius of curve as practicable. All inverts shall be troweled to a smooth, clean surface.

The number of joints in the manhole shall be minimized.

9.02. Riser and Cone Sections. Circular precast sections with a minimum lay length of 16 inches shall be provided with a mastic gasket to seal joints between sections. Mastic gaskets shall be used only at temperature recommended by the manufacturer.

Any precast sections which are damaged shall be repaired with epoxy grout in a manner acceptable to the Owner.

Joints between precast components shall be sealed internally between the tongue and the groove and additionally around the external perimeter as follows:

(1) External seals shall consist of a polyethylene backed flat butyl rubber sheet no less than 1/16 inches thick and 6 inches wide applied to the outside perimeter of the joint.

(2) Internal seals shall consist of a plastic or paper-backed butyl rubber rope no less than 14 feet long and having a cross-sectional area no less than the annular space times the height of the joint.

9.03. Transition Top Sections. Transition top sections shall be furnished with vents when shown on the drawings or requested by Owner. The maximum amount of fill over the transition top section shall be 20 feet.

9.04. Manhole Steps. Manhole steps shall be provided in Bases, Risers, Cones, Transition Cones, and Transition Top sections aligned vertically on 15" centers. Steps shall be secured to the wall with a compression fit in tapered holes or cast in place. Steps shall not be vibrated or driven into freshly cast concrete or grouted in place. Step pull-out strength shall be 1,000 lbs. minimum when tested in accordance with ASTM C478.

The bottom step in base sections shall be a maximum of 26 inches from the top of the base slab.

9.05. Connecting Piping. The connecting pipe shall be carefully adjusted to proper line and grade, and the bedding material shall be compacted under the haunches and to the springline of the pipe for a distance of at least 6 feet from the manhole wall and to at least the minimum trench width. The pipe shall be installed in the resilient connector prior to backfilling outside the manhole and shall be resealed as required after completion of the manhole and backfill. All visible leakage shall be eliminated.

The connecting pipe for installation with resilient connectors shall be plain end, square cut spigots and shall not protrude more than two inches inside the manhole wall.

Manholes at locations connecting with a force main shall be coated with Koppers 300M or equal 21 mils.

9.06. Rings and Covers. No more than 12 inches of grade rings shall be installed on one manhole. All joints between cone, adjusting rings, and manhole frame shall be sealed with butyl sealant rope and sheet. In lieu of round concrete rings, all castings may be raised using round high density polyethylene (HDPE) rings or an approved equal. The manhole adjusting rings shall be molded from high density polyethylene as defined in ASTM Specification D-1248.

Frames shall be set in mastic on grade rings. In streets, road shoulders, and road rights-of-way, the covers shall be set to conform to the street or shoulder surface. If using HDPE rings, the contractor shall utilize flat and sloping units to match the required slope and or grade of the structure. In all other locations unless otherwise specified, manholes rim elevations shall be 2.0 feet above existing ground level.

10. DAMPPROOFING. Before backfilling is started, the outside joints of each manhole shall be wrapped with a polyethylene backed flat butyl rubber sheet no less than 1/16 inches thick and 6 inches wide applied to the outside perimeter of the joint.

11. PAINTING. Prior to installation, one coat of coal tar paint shall be applied to all castings, vent pipes, and straps. Before painting, surfaces shall be thoroughly cleaned and properly supported. All loose rust shall be removed by wire brushing. Castings, vent pipes, and straps shall not be handled until the paint is dry and hard.

12. DRAWINGS AND DATA. Drawings and data covering precast concrete sections and castings shall be submitted in accordance with the submittals section.

Data submitted for steel-reinforced plastic manhole steps shall include verification of the type and grade of steel used for reinforcement, typical chemical analysis of the steel, type and classification of the plastic, and reports of acceptance tests performed in accordance with ASTM C478, Section 12.6, and C497, Section 10.

Submit a detail of each Precast Concrete Manhole Section showing the following:

1. Certification that all components meet H-20 wheel load. Certification that all components meet ASTM C478.
2. Inside diameter, wall thickness, and base or top slab thickness.
3. Reinforcing, size, spacing, and location.
4. Step locations.
5. Concrete mix no. and design strength.

Step detail and material specification.

Pipe connector details, material specification and pipe installation procedure.

Joint material details and material specifications.

Submit the following:

All calculations must be sealed by a registered professional engineer registered in North Carolina.

End of Section