ITEM NO. 307

Concrete Structures

307.1 DESCRIPTION: This item shall govern the construction and repair of headwalls, wingwalls, box transitions, approach slabs, retaining walls, and other designated structures. All concrete structures shall be constructed and repaired in accordance with the specifications herein outlined and in conformity with the required lines, grades, sections and details shown in the contract documents or as directed by the Engineer. New Sanitary Sewer Structures shall be Polymer Concrete See Specification Item No. 850 Polymer Concrete Sanitary Sewer Structures or Specification Item No. 853 Glass Fiber Reinforced Polymer (FRP) Manholes and Structures.

307.2 REFERENCED STANDARDS: Reference standards cited in this Specification Item No. 307 refer to the current reference standard published at the time of the latest revision date.

1. San Antonio Water System (SAWS):
    a. Specifications for Water and Sanitary Sewer Construction
    b. SAWS Materials Specifications
2. City of San Antonio (COSA) Specifications for Construction
3. American Society of Mechanical Engineers
    a. ASME B 16.1 –Cast Iron Pipe Flanges and Flanged Fittings
4. American Society for Testing and Materials (ASTM) International:
    a. ASTM A 307 - Standard Specification for Carbon Steel Bolts and Studs, 60,000 psi Tensile
    b. ASTM A 615 - Standard Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement
    c. ASTM C 270 - Standard Specification for Mortar for Unit Masonry
    d. ASTM C 443 - Standard Specification for Joints for Circular Concrete Sewer and Culvert Pipe, Using Rubber Gaskets.
    e. ASTM C 478 - Standard Specification for Precast Reinforced Concrete Manhole Sections

f. ASTM C 890 - Standard Practice for Minimum Structural Design Loading for Monolithic or Sectional Precast Concrete Water and Wastewater Structures

g. ASTM C 913 – Standard Specifications for Precast Concrete Water and Wastewater Structures

h. ASTM C 923 - Standard Specifications for Resilient Connectors between Reinforced Concrete Manhole Structures and Pipes.

i. ASTM C 990 – Standard Specification for Joints for Concrete Pipe, Manholes, and Precast Box Sections Using Preformed Flexible Joint Sealants

j. ASTM C 1107 - Standard Specification for Packaged Dry, Hydraulic - Cement Grout (Nonshrink).

k. ASTM D 698 - Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lb/ft3).

l. ASTM D 2665 - Standard Specification for Poly Vinyl Chloride (PVC) Plastic Drain, Waste and Vent Pipe, and Fittings.

m. ASTM D 2996 - Standard Specification for Filament-wound Fiberglass (Glass-Fiber-Reinforced Thermosetting-Resin) Pipe.

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

o. ASTM F 2306 – Standard Specification for 12 to 60 in. [300 to 1500 mm] Corrugated profile Wall Polyethylene (PE) Pipe Fittings for Gravity-Flow Storm Sewer and Subsurface Drainage Applications.

p. ASTM F 2510 – Standard Specification for Resilient Connectors Between Concrete Manhole Structures and Corrugated High Density Polyethylene Drainage Pipes

q. ASTM D 698 - Standard Test Method for Laboratory Compaction Characteristics of Soil 3 Using Standard Effort (12,400 ft-lb/ft)

r. ASTM D 2665 - Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Drain, Waste and Vent Pipe and Fittings

s. ASTM D 2996 - Standard Specification for Filament-Wound "Fiberglass" (Glass-Fiber- Reinforced Thermosetting-Resin) Pipe

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

u. ASTM F 2306 – Standard Specification for 12 to 60 in. [300 to 1500 mm] Annular Corrugated Profile-Wall Polyethylene (PE) Pipe and Fittings for Gravity-Flow Storm Sewer and Subsurface Drainage Applications

v. ASTM F 2510 – Standard Specification for Resilient Connectors between Concrete Manhole Structures and Corrugated High Density Polyethylene Drainage Pipes.

5. American Water Works Association (AWWA)

   a. AWWA C 213 - Standard for Fusion Bonded Epoxy Coating for Interior and Exterior of Steel Water Pipelines

6. American Association of State Highway and Transportation Officials (AASHTO)

   a. M306: Standard Specification for Drainage, Sewer Utility and Related Changes.

307.3 SUBMITTALS: Contractor shall submit manufacturer's product data, instructions recommendations, shop drawings, and certifications. All submittals shall be in accordance with Engineer's requirements and submittals shall be approved prior to delivery.

1. Submit proposed design mix and test data for each type and strength of concrete.
2. Submit manufacturer's data and details of following items for approval:

   a. Frames, grates, rings, and covers.

   b. Materials to be used in fabricating drop connections.

   c. Materials to be used for pipe connections at structure walls.

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

   e. Installation instructions for forms.

   f Shop drawing of manhole sections, base units and construction details, including reinforcement, jointing methods, materials and dimensions.

3. Summary of criteria used in structure design including, as minimum, material properties, loadings, load combinations, and dimensions assumed. Include certification that structure design is in full accordance with ASTM C478 and /or ASTM C 890 and design criteria.

4. Materials and procedures for corrosion-resistant liner and coatings or concrete additive, if required.

5. Seal submittal drawings by Professional Engineer registered in State of Texas.

307.4 MATERIALS:

1. Concrete: All concrete shall conform to the latest provisions of Item No. 300, "Concrete (Class A)" or the most applicable approved equal provision, or the concrete shall be of a class as noted in the contract documents.

2. Reinforcing Steel: All reinforcing steel shall conform to the provisions of Item No. 301, "Reinforcing Steel."

3. Membrane Curing Compound: Provide membrane curing compounds that conform to the latest provision of TxDOT's DMS-4650, "Hydraulic Cement Concrete Curing Materials and Evaporation Retardants" or most applicable approved equal provision.

4. Expansion Joint Materials: Provide materials that conform to the latest provision of TxDOT's DMS-6310, "Joint Sealants and Fillers" or most applicable approved equal provision.

5. Cast Iron Castings: All cast iron castings shall conform to the latest provision of the City of San Antonio Department of Public Works' Standard Specifications for Construction Item No. 409, "Cast Iron Castings", or most applicable approved equal provision.

6. Metal for Structures: Metal for structures shall conform to the latest provision of the City of San Antonio Department of Public Works' Standard Specifications for Construction Item No. 302, "Metal for Structures", or most applicable approved equal provision.

307.5 CONSTRUCTION METHODS:

1. Forms: Forms shall be of wood, metal or other approved materials and shall conform to the following requirements

   a. Wood Forms:

1) Unexposed concrete surfaces, No. 2 common or better lumber.

2) Exposed concrete surfaces, dressed and matched boards of uniform thickness and width.

b. Plywood: Commercial Standard Douglas Fir, moisture resistant, concrete form plywood, not less than 5 ply and at least 9/16th of an inch in thickness. The face of the plywood shall be free from knot holes and other blemishes.

c. Metal Forms: Metal forms of an approved type that will produce surfaces equal to or better than those specified for wood forms.

1) Forms may be constructed of any of the above substances or of other material if suited to the intended purpose and when approved by the Inspector.

2) Forms shall be built mortar tight and of sufficient strength to prevent bulging between supports and shall be set and maintained to the line and grade designated until the concrete is sufficiently hardened to permit removal.

3) All details of form construction shall be subject to the approval of the Inspector and, in special cases, the approval of the Engineer may be required.

4) Permission to place concrete will not be given by the Inspector until all form work has been placed in accordance with the above requirements.

5) If at any stage of the work, the forms show signs of bulging, sagging or moving, that portion of the concrete causing such conditions shall be immediately removed, if required by the Inspector, and the forms reset and securely braced against further movement. All form resets will be at no additional cost to SAWS and will not warrant any claims for delays on the project.

6) All corners and edges, which will be exposed after construction, shall be chamfered with triangular chamfer strips ¾ inch measured on the sides.

2. Placing Reinforcement: All steel reinforcement shall be placed in accordance with Item No. 301, "Reinforcing Steel."

3. Placing Concrete: The base slabs of inlets, junction boxes, headwalls, culverts and other structures shall be placed and allowed to set before the remainder of the structure is constructed.

a. Suitable provisions shall be made for bonding the sidewalls to the base slab by means of longitudinal keys so constructed as to prevent the percolation of water through the construction joints.

b. Before concrete is placed in the walls, the keyed-edge joints shall be thoroughly cleaned of all shavings, sticks, trash or other extraneous materials.

c. The top slabs of culverts and like structures may be poured monolithic with the walls, provided the walls are poured and allowed to set a minimum of 1 hour, no more than 2 hours, shall elapse between the placing of the concrete in the wall and that in the top slab; such interval is to allow for shrinkage of the concrete in the wall.

d. Under adverse weather conditions, the minimum time will be increased by the Inspector.

e. All concrete shall be placed with the aid of mechanical vibrating equipment supplemented inside the forms.

f. Vibrating equipment shall be of the internal type and shall maintain a speed of 6,000 impulses per minute, when submerged in concrete. Vibrators shall be adequate in number of units to properly consolidate all concrete. Provide a backup vibrator for large concrete pours.

g. Form or surface vibrators shall not be used. The duration of vibration shall be limited to properly consolidate the concrete without causing objectionable segregation of aggregates.

h. Insertion of vibrators into lower courses that have commenced initial set, or the disturbance or reinforcement in concrete beginning to set, shall be avoided.

i. Concrete shall not be allowed to drop freely more than 5 feet in unexposed work, nor more than 3 feet in exposed work; where greater drops are required, a tremie or other approved means shall be employed.

j. Concrete shall not be placed when the ambient temperature is below 40^{o}F, nor where the concrete is likely to be subject to freezing before final set has occurred.

k. When the air temperature is expected to drop below 40^{o}F during the first 72 hours of the curing period, polyethylene sheeting or burlap-polyethylene blankets shall be placed in direct contact with the top surface of the concrete.

l. Concrete may be poured in temperatures below 40^{o}F, when poured in

protected areas, or where adequate protection can be provided against freezing, if approved by the Engineer.

m. When concrete is poured in air temperatures above 85°F, an approved retarding agent, meeting the latest provision of ASTM C494, Type B or most applicable approved equal provision, will be required in all concrete used in superstructures and top slabs of culverts unless directed otherwise by the Engineer.

4. Form Removal: Forms shall be removed only with the approval of the Inspector and in a manner to insure complete safety of the structure when the structure as a whole is supported on shoring.

a. Form removal from structures shall not begin until the concrete has attained the following compressive strengths:

b. Vertical forms shall not be removed until the concrete has set a minimum of 24 hours, or the concrete has attained a minimum compressive strength of 500 psi.

c. When wall and top slabs are poured monolithically, wall forms shall not be removed until the concrete has attained a minimum compressive strength of 2,000 psi, or as directed by the Engineer.

5. Finish: Honeycomb and other minor defects shall be patched with one part of cement to 2 parts fine aggregate. All exposed surfaces shall be given one of the following finishes:

a. Rough Finish: Concrete for which no other finish is indicated or specified shall have fins and rough edges removed.

b. Smooth Finish: Smooth finish shall be given to the interior of inlets, junction boxes, culverts and other structures. Joint marks, fins and rough edges shall be smoothed off and blemishes removed, leaving finished surfaces smooth and unmarred, subject to approval by the Inspector.

c. Floor Finish: Floor finish shall be given to the floors of all inlets, culverts and other structures, and shall be struck off true to the required grade as shown in the contract documents and floated to a smooth, even finish by manual or mechanical methods. No coarse aggregate shall be visible after finishing.

d. Rubbed Finish: All exposed surfaces of retaining walls, wingwalls, headwalls and other structures, after patching and painting has been completed and the surface has been wetted, shall be given a first rubbing with a No. 16 Carborundum Stone.

i. After the first rubbing is completed and the ground material has been evenly spread, the material shall be allowed to take a reset.

ii. After sufficient aging, the surface shall be wetted and given a finish rubbing with a No. 30 Carborundum Stone, after which the surface shall be neatly striped with a brush and allowed to take a reset.

iii. On the inside surfaces of all culvert walls an area from the top slab, on a line 30 degrees from the vertical, to the bottom slab shall be rubbed as specified above.

e. The entire structure shall be left with a clear, neat, uniform finish, free from form markings and shall be uniform in color.

f. Sidewalk surfaces shall be given a wood float finish, a light broom finish, or may be stripped with a brush as directed by the Inspector or specified in the contract documents.

g. Roadway slabs shall be given a broom finish after completion of the floating or straight-edging operation, but before the disappearance of the moisture sheen.

i. The grooves of the finish shall be parallel to the centerline of the roadway.

ii. The average texture depth of the grooves shall be a minimum of 0.035 inches.

h. The Contractor has the option of substituting the surface finish described in the latest provision of the City of San Antonio Department of Public Works' Standard Specifications for Construction Item No. 311, "Concrete Surface Finish," or most applicable approved equal provision, on the surface areas listed in the specification.

6. Curing: Immediately after placing or finishing, concrete surfaces not covered by forms shall be protected from loss of surface moisture for not less than 4 curing days. When forms are left in place, they shall be kept sufficiently wet to reduce cracks in the forms and prevent the form joints from opening.

a. If forms are removed before 4 curing days have transpired, the formed surface shall be protected for the remainder of the 4 day curing period. Protection and curing shall be accomplished by one of the following methods and shall be subject to the approval of the Inspector during the entire curing process:

b. Water Curing: Water curing shall be effected by covering exposed surfaces

with cotton or burlap mats, previously wetted before applying, and kept thoroughly wet during the entire curing period.

c. The application of the mats shall not mar or disturb surfaces which will be exposed on completion.

d. Membrane compound curing: Provide membrane curing compounds that conform to the latest provision of TxDOT's DMS-4650, "Hydraulic Cement Concrete Curing Materials and Evaporation Retardants" or the most applicable approved equal provision.

7. Fine Grading: All fine grading of structure foundations shall provide for seating on firm, clean, natural earth foundation except as otherwise provided.

8. Any under-cut foundations, except where authorized, shall be corrected to the satisfaction of the Inspector, at the sole expense of the Contractor.

9. Excavation and Backfilling shall conform to the latest provision of the City of San Antonio Department of Public Works' Standard Specifications for Construction Item No. 306, "Structural Excavation" or the most applicable approved equal provision. All references therein to density and/or compaction levels are superseded by those of SAWS, described elsewhere in these standard specifications.

307.6 MEASUREMENT: No direct measurement or payment will be made for the work to be done or the equipment to be furnished under this item, but shall be considered subsidiary to the particular items of work for which unit prices are required in the proposal.

307.7 PAYMENT: No direct payment will be made for the work to be done or the equipment to be furnished under this item, but shall be considered subsidiary to the particular items of work for which unit prices are required in the proposal.

-End of Specification-