

*San Antonio Water System Standard Specifications for Construction*

**ITEM NO. 307  
CONCRETE STRUCTURES**

**307.1 DESCRIPTION:** This item shall govern the construction of box culverts, headwalls, wingwalls, bridges, box transitions, approach slabs, retaining walls, inlets, storm sewer structures, sanitary sewer structures and incidental structures. All concrete structures shall be constructed in accordance with specifications herein outlined and in conformity with the required lines, grades, sections and details shown on the plans or as directed by the Engineer.

**307.2 MATERIALS:**

1. Concrete: All concrete shall conform to the provisions of Item No. 300, "Concrete (Class A)" or shall be of a class as noted on the plans.
2. Reinforcing Steel: All reinforcing steel shall conform to the provisions of Item No. 301, "Reinforcing Steel."
3. Membrane Curing Compound: All membrane curing compound shall conform to the provisions of Item No. 305, "Membrane Curing."
4. Expansion Joint Materials: All expansion joint materials shall conform to the provisions of Item No. 304, "Expansion Joint Materials."
5. Cast Iron Castings: All cast iron castings shall conform to the provisions of Item No. 409, "Cast Iron Castings."
6. Metal for Structures: Metal for structures shall conform to the provisions of Item No. 302, "Metal for Structures."

**307.3 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

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uniform thickness and width.

- b. Plywood: Commercial Standard Douglas Fir, moisture resistant, concrete form plywood, not less than 5 ply and at least 9/16 th 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.

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. 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. 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. Permission to place concrete will not be given by the Inspector until all form work has been placed in accordance with the above requirements. 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 corners and edges, which will be exposed after construction, shall be chamfered with triangular chamfer strips  $\frac{3}{4}$  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. 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. Before concrete is placed in the walls, the keyed-edge joints shall be thoroughly cleaned of all shavings, sticks, trash or other extraneous materials. 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

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

All concrete shall be placed with the aid of mechanical vibrating equipment supplemented inside the forms. 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. 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. Insertion of vibrators into lower courses that have commenced initial set, or the disturbance or reinforcement in concrete beginning to set, shall be avoided.

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. Concrete shall not be placed when the ambient temperature is below 40° F, nor where the concrete is likely to be subject to freezing before final set has occurred. When the air temperature is expected to drop below 40° 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. Concrete may be poured in temperatures below 40° F, when poured in protected areas, or where adequate protection can be provided against freezing, if approved by the Inspector. When concrete is poured in air temperatures above 85° F, an approved retarding agent, meeting the requirements of ASTM C494, Type B, will be required in all concrete used in superstructures and top slabs of culverts unless directed otherwise by the Inspector.

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. Form removal from structures shall not begin until the concrete has attained the following compressive strengths:
  - a. 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.
  - b. When wall and top slabs are poured monolithically, wall forms shall not be removed until the concrete has attained a minimum compressive strength of 2000 psi.

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

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

- e. 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 plans.
- f. 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. The grooves of the finish shall be parallel to the centerline of the roadway. The average

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

The Contractor has the option of substituting the surface finish described in Item No. 311, "Special Concrete Surface Finish" 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. 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:
  - a. 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. The application of the mats shall not mar or disturb surfaces which will be exposed on completion.
  - b. Membrane-compound curing: Membrane-compound curing shall conform to the provisions of Item No. 305, "Membrane Curing."
7. Fine Grading: All fine grading of structure foundations shall provide for seating on firm, clean, natural earth foundation except as otherwise provided. Any under-cut foundations, except where authorized, shall be corrected to the satisfaction of the Inspector at the sole expense of the Contractor.
8. Excavation and Backfilling shall conform to Item No. 306, "Structural Excavation."

**307.4 MEASUREMENT AND PAYMENT:** 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.