

# Special Specification 4098

## Precast Long Span Culvert Structures




---

### 1. DESCRIPTION

Furnish, construct, and install precast long span culvert structures.

---

### 2. MATERIALS

Provide new materials that comply with the details shown on the plans, the requirements of this item, and the pertinent requirements of the following items:

- Item 421, "Hydraulic Cement Concrete,"
- Item 422, "Concrete Superstructures,"
- Item 426, "Post-Tensioning,"
- Item 440, "Reinforcement for Concrete."

- 2.1. **Concrete.** Use Class "H" concrete meeting the requirements of Item 421, "Hydraulic Cement Concrete," except where otherwise specified herein or otherwise shown on the plans.
- 2.2. **Reinforcing Steel.** Fabricate and place reinforcing steel in accordance with the detailed shop drawings submitted by the manufacturer and the requirements of Item 440, "Reinforcement for Concrete". Use steel reinforcement consisting of welded wire fabric conforming to ASTM A 185 or A 497, or deformed billet steel bar reinforcing conforming to ASTM A 615, Grade 60.
- 2.3. **Curing Materials.** Use curing materials conforming to Item 422, "Concrete Superstructures".
- 2.4. **Pre-Stressing.** Where required by design, prestress in accordance with item 426, "Post-Tensioning".

---

### 3. GENERAL

- 3.1. **Designation.** The type and size of structure will be indicated on the plans using the following convention – Precast Culvert Structure (XX ft span)(XX ft rise)(XX ft length):
- The dimension shown for the span of the structure will describe the horizontal dimension between the inside faces of the walls of the structure;
  - The dimension shown for the rise of the structure will describe the vertical dimension between the top of the foundation and the inside face of the top slab of the structure;
  - The dimension shown for the length of the structure will describe the combined length of the culvert sections to provide the clear roadway width as shown on the plans.
- 3.2. **Design.** Design culvert sections and headwalls in accordance with these specifications and in reasonably close conformity with the lines, grades, design, and dimensions shown on the plans or as established by the Engineer. Submit an actual design of the sections to the Engineer for approval before submission of shop drawings. Provide design submissions and shop drawings bearing the seal of a registered professional engineer licensed to practice in the State of Texas. Refer to the plans and show drawings for the section dimensions and the reinforcement details

Refer to the plans and shop drawings for the section dimensions and the reinforcement details. Design the precast long span culvert sections and precast headwalls for earth dead loading, structure dead loading, HL-93 live loading, and rail impact loading, when applicable.

Provide a 1-in. minimum of concrete cover over the reinforcement. Design the reinforcement to insure that the clear distance of the end circumferential wire is not less than 1 in. or more than 2 in. from the end of the culvert. Assemble reinforcement utilizing single or multiple layers of welded wire fabric or utilizing a single layer of deformed billet-steel bars.

Manufacture precast long span culvert sections with flat butt ends such that when the sections are laid together they will make a continuous line of sections with a smooth interior that is free of appreciable irregularities. Accomplish this in conformance with the permissible variations of this Specification.

Manufacture precast headwall sections to fit curvature of arch sections such that when sections are laid they will make a continuous perpendicular fascia on the exposed side of the structure that is free of appreciable irregularities. Construct uniform and symmetrical vertical joints, where required. Accomplish this in conformance with the permissible variations of this Specification.

#### 4. CONSTRUCTION

4.1. **Fabrication.** Unless otherwise shown on the plans, fabricate long span culvert sections and headwalls in accordance to Item 424, "Precast Concrete Structural Members (Fabrication)", and DMS-7300, "Precast Concrete Fabrication Plans".

Continuously cure precast long span culvert sections and headwalls for a minimum period of 3 curing days and until the design strength has been attained. A curing day is defined as a calendar day when the temperature, taken in the shade away from artificial heat, is above 50°F for at least 19 hr. or for colder days, if satisfactory provisions are made to maintain the temperature at all surfaces of the concrete above 50°F for the entire 24 hr.

Mark precast long span culvert sections, made in a plant, with the following markings:

- Culvert Section Span x Culvert Rise x Height of Fill,
- Date Manufactured, and
- Name or Trademark of Manufacturer.

Indent markings into the culvert section or paint with waterproof paint. Locate the markings on the inside of the vertical leg of the culvert section.

Provide handling devices or lifting holes as shown on the shop drawings in each section for the purpose of handling and setting.

4.1.1. **Fabricating Tolerances.** Table 1 shows the allowable tolerances for precast long span culvert sections.

**Table1**  
**Allowable Tolerances for Long Span Culvert Sections**

Dimension	Tolerance
Span	±1/2 in.
Width	±1/4 in.
Height (inside and Outside Length of Leg)	±1/4 in.
Slab Thickness	±1/4 in.
Leg Thickness	±1/4 in.
Haunch Thickness	±3/4 in.
Skew	±1/8 in. per ft. of width; ½ in. Max
Horizontal Alignment	±1/4 in.
Mating Edge Batter	±1/4 in.
Bearing Surfaces: Deviation from Plane	±1/16 in.
Position of Strand: Vertical	±1/4 in.
Position of Strand: Horizontal	±1 in.
Position of Handling Devices	±6 in.
Local Flatness of any Surface	±1/4in. in 10 ft.
Arch	±3/4 in.
Diagonal	±1 in.

Variations greater than specified in Table 1 are subject to review. These tolerances, however, do not relieve the Contractor from the responsibility of furnishing a completed structure that is in reasonably close conformity with the lines, grades, cross-sections, dimensions, and details specified. Correct members not meeting these tolerances, to achieve a satisfactory completed structure, at no additional expense to the Department. Correction may require replacement of the member.

Embedments must be firmly held in proper position to avoid movement during concrete placement. Place embedments in accordance with the manufacturer's recommendations.

- 4.1.2. **Defects and Repair.** Fine cracks on the surface of the member that do not extend to the plane of the nearest reinforcement are acceptable unless the cracks are numerous and extensive. Repair cracks that extend into the plane of the reinforcing steel in an approved manner. Excessive damage, honeycomb, or cracking will be subject to structural review. The Engineer may accept members with repairs that are sound, properly finished, and cured in conformance with pertinent specifications. When fine cracks on the surface indicate poor curing practices, discontinue further production of precast sections until corrections are made and proper curing is provided.

- 4.2. **Handling, Storage, Shipment, and Erection.** Properly handle, store, haul, and erect all members so that they are placed in the structure without damage.

Lift members with approved lifting devices as shown on the shop drawings or as approved.

Do not move members from the casting yard until all requirements of the pertinent items have been met. Do not haul members to the project site until at least 7 days have elapsed since casting unless otherwise approved.

The storage area must be clean and well drained. Prevent excessive or differential settlement of members by storing them on:

- Stable ground, and
- Dunnage of sufficient size, shape, and strength to prevent crushing.

Rearrange improperly stored members and inspect them for damage. Members that are improperly stored and become cracked, warped, or otherwise damaged in storage may be rejected.

- 4.3. **Installation.** Excavate and backfill in accordance with the requirements of Item 400, "Excavation and Backfill for Structures."

Install the precast long span culvert sections on foundations as shown on the plans. Construct the foundations to the elevations shown in the plans or as determined by the Engineer. Give the foundations a smooth float finish and insure they meet the strength requirements of Item 421, "Hydraulic Cement Concrete," for class "C" concrete before placing the culvert section. Construct the completed foundation surface in accordance with the grade shown on the plans. Vary the surface at most 1/4 in. in 10 ft. when tested with a 10-ft. straightedge.

Place the precast long span culvert sections as shown on the plans. Take special care in setting the sections to the true line and grade. Set sections on 6 in. wide × 6 in. long hard board, masonite or steel shims, located at support points as recommended by the manufacturer. Provide a minimum of 1/2 in. gap between the foundation and the bottom of the vertical legs. Fill the gap with cement grout (cement and water, or cement mortar compound of 1 part portland cement and 3 parts sand by volume and water).

Cover the butt joint made by adjoining culvert sections with a minimum of 6-in. wide joint wrap. Remove any dirt and thoroughly clean the surface of the section before applying the joint material. Use an external wrap per ASTM C 877, or an approved equal. Install the wrap according to the manufacturer's recommendation. Take care, during the backfilling operations, to keep the joint wrap in its proper location over the joint. Also seal the joints between the end bridge unit and the headwall and between the headwall segments as described above.

The designs given herein are for single cell precast units. When units are used in parallel for multicell installations, provide a means of positive lateral bearing by continuous contact between the sides of adjacent units. Concrete or grouting as detailed in the plans are considered means of providing such positive bearing. Extend the 6 in. wide joint wrap at least 18 in. from the top of the precast culvert section downward into the area of the positive bearing.

Conform to details shown in the plans or as directed when connecting precast sections to cast-in-place sections or to any required headwalls, wingwalls, retaining walls, riprap, or other structure.

Fill lifting holes with mortar or concrete and cure to the satisfaction of the Engineer. Use precast concrete or mortar plugs when approved.

---

## 5. MEASUREMENT

Measure this Item by the foot. Measure the flow line length, along the centerline, between the ends of the culvert.

When precast long span culverts are used in multiple barrel structures, the measured length will be the sum of the lengths of all barrels measured as described above.

Precast headwalls as shown in the plans are considered subsidiary to this item. Provide headwalls on either side of arch openings to the dimensions shown in the plans.

This is a plans quantity measurement item. The quantity to be paid is the quantity shown in the proposal unless modified by Article 9.2, "Plans Quantity Measurement." Additional measurements or calculations will be made if adjustments of quantities are required.

---

**6. PAYMENT**

The work performed and materials furnished in accordance with this Item and measured as provided under "Measurement" will be paid for at the unit price bid for "Precast Long Span Culvert Structures" of the various sizes and types specified.

This price is full compensation for furnishing, transporting, and placing concrete; reinforcing steel, mortar, and castings for shaping of beds; manufacture of the precast units and transporting to the project; backfill between precast units; jointing of sections; jointing material; connections to new or existing structures; breaking back, removing and disposing of portions of the existing structure and replacing portions of the existing structure as required to make connections and labor, materials, tools, and equipment except as otherwise noted on the plans. Concrete foundations, concrete riprap, and railing will be paid for separately under applicable items of work.