

736 – PRECAST CULVERTS

SECTION 736

PRECAST CULVERTS

736.1 DESCRIPTION

Design, provide and install precast culvert units as shown in the Contract Documents. Do not substitute Precast Culvert elements with cast-in-place culvert elements without approval from the State Bridge Office (SBO).

BID ITEMS

Precast Arch Culvert
Precast Rigid Frame Culvert

UNITS

Linear Foot
Linear Foot

DESIGN:

- Design the precast culvert units in accordance with the AASHTO LRFD Bridge Design Specifications, latest version.
- Precast wings and headwalls are prohibited at stream crossings.
- Cast-in-place end sections shall conform to KDOT Standard BR031.

For fill heights less than or equal to 3 feet:

- Use epoxy coated reinforcing steel and air entrained concrete
- Use a distribution slab meeting the requirements of KDOT Standard BR031.
- Use an approved “non-coal tar” bridge backwall protection system to cover the middle 1/3 of the top of precast arch culverts, the complete top slab of precast rigid frame culverts and the uppermost 12 inches of the outside walls.
- Indicate on the shop drawings the limits of the bridge backwall protection system.

Prior to beginning foundation construction, submit complete design calculations, including loadings, for the Engineer’s review. Design calculations and loadings may be submitted prior to the working drawing submittal. Submit design calculations sealed by a Kansas licensed Professional Engineer.

Prior to fabrication, submit to the Engineer for review and approval, working drawings including the supplier’s manufacturing specifications, details of all phases of construction, including layout, joint details, lifting devices, casting methods, construction placement and details of any cast-in-place sections. Submit working drawings according to **SECTION 105**.

Designate proposed transportation methods, and submit over-height and overload permits, if required, with the working drawings.

When required, submit falsework plans and calculations sealed by a Kansas licensed Professional Engineer according to **SECTION 708**.

PRECAST CULVERT LOAD RATING:

Include a Load Rating Table on the working drawings and provide the SBO with a LFR and LRFR rating and support calculations for the structure. The load rating shall take into consideration varying fill depths and KDOT live load criteria. For LFR Load Rating, include HS-20-44, KDOT rating vehicles for Inventory and Operating rating factors. Rate the Heavy Equipment Transport (HET) vehicle for Operating rating factor. For LRFR, use HL-93 for Inventory and Operating. Submit a Load Rating Report along with the working drawings. Include in the Load Rating Report a summary rating table, assumptions used in the load rating, the depth of fill, material strengths and any other significant information required to load rate the precast culvert. The Load Rating will include all elements of the proposed system including, but not limited to stub-walls and connections.

736.2 MATERIALS

a. General. Submit to the Engineer a list of sources of material or fabrication locations for items which may require sampling, inspection or certification before use. Provide the Engineer samples of all materials requiring testing and approval, once the materials become available.

Allow the Engineer free access to the manufacturing plant at all times for the purpose of inspecting materials, plant facilities and manufacturing and curing procedures. Inform the Engineer of planned concrete

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placement and curing schedule before work is started.

Use materials that comply with the applicable requirements:

| | |
|---|--------------------------------|
| Grade 4.0 and 4.0 (AE) Concrete | SECTIONS 401 & 402* |
| Aggregates for Not On Grade Concrete | SECTION 1102 |
| Reinforcing Steel (Grade 60) | DIVISION 1600 |
| Reinforcing Steel (Epoxy Coated) (Grade 60) | DIVISION 1600 |
| Welded Wire Fabric | DIVISION 1600 |
| Bolts, Threaded Rods, Nuts..... | DIVISION 1600 |
| Structural Steel | DIVISION 1600 |
| Joint Seals..... | DIVISION 1500 |
| Bridge Backwall Protection System..... | DIVISION 1700 |
| Geotextile Fabric | DIVISION 1700 |
| Aggregates for Backfill | DIVISION 1100 |

*For precast reinforced culverts constructed according to this specification, KT-73 testing is not required.

b. Precast Culvert.

(1) Calcium Chloride or admixtures containing Calcium Chloride are prohibited.

(2) Reinforcing Steel. Fabricate reinforcing steel for the precast elements and place in accordance with the detailed working drawings. Longitudinal distribution reinforcement may consist of welded wire fabric or deformed billet-steel bars. Welding is prohibited on reinforcing bars or wire fabric, except original welding required in manufacturing the wire fabric is acceptable.

(3) Hardware. Use the following:

- Structural steel anchors and plates to meet design, geometric and construction requirements.
- AISI type 304 stainless steel expanded coil inserts for detached headwall connections. Use AISI type 304 stainless steel coil rods and nuts in headwall connections. Use either AISI type 304 stainless steel plate washers or AASHTO M 270 (ASTM A709) Grade 36 plate washers hot dip galvanized as per AASHTO M 111 (ASTM A123) in connections.
- Dowel Bar Splicer System satisfying load requirements and geometric constraints.
- Provide corrosion protection coatings for all bolts, threaded rods, nut, fasteners, etc.
- Hook Bolts in the attached headwall connections per ASTM A307.
- All hardware shall either be AISI type 304 stainless steel or ASTM A 123 galvanized.

c. Materials for Sealing Joints of Precast Culverts. Provide Type III external sealing bands complying with ASTM C877. The basis of acceptance for external sealing bands will be a Type D Certification as specified in **SECTION 2600**.

d. Foundation Materials for Precast Culverts. Provide foundation materials to comply with the Contract Documents.

e. Markings. Legibly mark the following information on the outside face of each section with waterproof paint or other approved means:

- Date of manufacture;
- Name or trademark, and location of the manufacturer;
- Mass of culvert section in tons; and
- The top of the section.

f. Aggregates for Backfill. The backfill materials shall conform to SB-1, SB-2, or SCA-2, SCA-3 or SCA-5, **DIVISION 1100**.

g. Basis of Acceptance. Prequalification for the materials listed.

Precast culvert units will be accepted on the basis of satisfactory results of material tests performed by the Engineer, compliance with dimensional requirements, and visual inspection at the point of usage.

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736.3 CONSTRUCTION REQUIREMENTS

a. Foundation Preparation. Excavate and prepare the foundation according to the Contract Documents.

b. Installation of Precast Culvert. Provide a manufacturer's representative at the job site during the installation or placement of the first 10% of the structure sections and the installation or placement of the final 10% of the structure sections. Install according to the approved detailed working drawings.

c. Sealing Joints of Precast Culverts. Seal the joints as shown in the Contract Documents. Install the butyl rubber, rope-form joint sealant in the chamfer groove between all precast sections, prior to installing connection plates or hardware.

Install a Type III external sealing band at each precast joint, or cast-in-place cold joint. Completely cover the surface area of closure joints and extend the sealing bands an additional 6 inches beyond the limits of closure joints. Overlap the bands to shed water. Overlap the bands a minimum of 6 inches along the axis of the band; overlap the bands a minimum of 2 inches transverse to the axis of the band. Place the bonding material to extend a minimum of 18 inches from the joint location.

If geotextile is used to wrap the joint:

- Use only geotextile that has been properly stored. Store rolls in a manner which protects them from the elements. If stored outdoors, elevate and protect with a waterproof cover;
- Limit the exposure to the elements (between placement and covering) of the geotextile to a maximum of 7 calendar days;
- Do not drop any D_{50} backfill larger than 6 inches onto the geotextile from a height greater than 1 foot;
- Do not drop any D_{50} backfill smaller than 6 inches onto the geotextile from a height greater than 3 feet; and
- Do not contaminate the geotextile with grease, mud or other foreign substances. Replace contaminated or damaged geotextile. If approved by the Engineer, repair damaged geotextile by placing a patch over the damaged area and sewing the patch to the geotextile. Extend the patch a minimum of 1 foot beyond the perimeter of the damaged area. Replace contaminated or damaged geotextile, or repair if approved, at the Contractor's expense.

d. Cast-In-Place Construction. Construct cast-in-place foundations, closure joint systems, culvert sections, wingwalls, end caps, headwalls and other concrete elements according to the Contract Documents. Use epoxy coated reinforcement for all closure joints when the fill height, measured at the shoulder line, is less than or equal to 3 feet. Install pavement waterproofing membrane to extend 18 inches beyond the limits of all closure joint concrete or grout. This membrane is subsidiary to the culvert.

e. Backfill Thickness and Material. Use a minimum of 2 feet of approved granular material to backfill the sides and top of the structure. When manufacturer's recommendations require more granular material, install at no additional cost to KDOT.

f. Field Welding. Perform all field welding by an approved certified welder, using approved weld procedures.

736.4 MEASUREMENT AND PAYMENT

The Engineer will measure precast arch culverts and precast rigid frame culverts by the linear foot. Precast and cast-in-place end caps, headwalls and wingwalls are subsidiary to the culvert.

When shown as a bid item in the contract, foundation stabilization and concrete seal course will be measured and paid for according to **SECTION 204**. When not shown as a bid item in the contract, foundation stabilization and concrete seal course are subsidiary to the culvert.

Payment for "Precast Arch Culvert" and "Precast Rigid Frame Culvert" at the contract unit prices is full compensation for the specified work. The pavement waterproofing membrane is subsidiary to the culvert. The specified granular backfill is subsidiary to the culvert. Any additional granular backfill required by the manufacturer will be done at no additional cost to KDOT.