[MICHIGAN](http://mdotcf.state.mi.us/public/design/englishroadmanual/)

DEPARTMENT OF TRANSPORTATION

SPECIAL PROVISION

FOR

**PRECAST CONCRETE BOX CULVERT, SPECIAL**

MET:RDM 1 of 4 APPR:MJF:DMG:10-14-21

**a. Description.** This work consists of designing, load rating, manufacturing, and constructing precast concrete box culverts and appurtenances. Furnish and install gaskets, joint tie assemblies, post-tensioning and geotextile blanket to seal culvert joints.

Perform the work in accordance with the standard specifications and as specified herein.

**b. Materials.** Furnish materials in accordance with subsection 406.02 of the Standard Specifications for Construction and as specified herein.

1. Joint Tie Assemblies.

A. Threaded Rods. Furnish steel threaded rods in accordance with *ASTM F1554*, *Grade 55, Supplemental Specification S1*.

B. Washers. Furnish steel plate washers in accordance with subsection 906.04 of the Standard Specifications for Construction. Furnish steel lock washers in accordance with *ANSI B18.21.1*.

C. Nuts. Furnish steel heavy hex nuts in accordance with *ASTM A563/A563M*, *Grade A*.

D. Pipe. Furnish steel pipe in accordance with *ASTM A53/A53M*, *Grade B, Schedule 80*.

E. Sealant. Furnish a sealant in accordance with subsection 713.02 of the Standard Specifications for Construction, Sealant for Perimeter of Beam Plates.

2. Post-Tensioning.

A. Tendons. Furnish tendons in accordance with subsection 905.08 of the Standard Specifications for Construction.

B. Hardware. Furnish anchorage hardware as recommended by the post-tensioning supplier that meets the approval of the Engineer. Hardware includes, but is not limited to strand wedges, wedge plates, bearing plates and rubber gaskets.

C. Grout.

(1) Post-Tensioning. Furnish Type E-1 expansive grout in accordance with section 1005 of the Standard Specifications for Construction.

(2) Horizontal Wall Joints. Furnish Type H-1 non-shrinking grout in accordance with section 1005 of the Standard Specifications for Construction.

D. Mortar. Furnish Type R-2 mortar in accordance with section 1005 of the Standard Specifications for Construction.

E. Seal Washers. Furnish neoprene washers in accordance with *ASTM C509* unless otherwise approved by the Engineer.

3. Inserts. Furnish concrete inserts as shown on the plans.

The basis of acceptance for the culvert, headwalls, and return walls is “Fabrication Inspection” per the MDOT *MQAP manual*.

**c. Construction.** Perform the work in accordance with subsection 406.03 of the Standard Specifications for Construction and as specified herein.

1. Certification. The manufacturing plant must possess current certification from *NPCA* or *ACPA*.

2. Design. Sections of culvert may be designed to be manufactured in upper and lower halves, to assist with transportation to the project, and joined at the project site to create a complete box. The design must account for temporary and permanent loading conditions of section halves and of the joined box section. If sections are manufactured in halves, ensure upper half vertical wall joints are staggered and not align with vertical wall joints of bottom halves when the sections are installed at the project site.

Design the culvert in accordance with *ASTM C1786, Standard Specification for Segmental Precast Reinforced Concrete Box Sections for Culverts, Storm Drains, and Sewers Designed According to AASHTO LRFD.*

The design may incorporate horizontal transverse post-tensioning. Ensure the post-tensioning design is in accordance with the *AASHTO LRFD Bridge Design Specifications*.

Account for and furnish all attachments necessary for a complete design and to facilitate construction.

3. Working Drawings. Prepare working drawings of fabrication details in accordance with subsection 104.02 of the Standard Specifications for Construction. The working drawings must include all details for the box culvert, joint tie assemblies and post-tensioning, if utilized. The working drawings must specify the post-tensioning force if the design utilizes post-tensioning. Submit the working drawings to the Engineer for review at least 14 days prior to fabrication and manufacturing. No extension of time or additional compensation will be provided in securing the Engineer’s approval.

4. Fabrication. Fabricate joint tie assemblies in accordance with Standard Plan R-84 series and section 707 of the Standard Specifications for Construction. Alternative joint tie assemblies may be approved by the Engineer. Galvanize steel components of joint tie assemblies in accordance with *ASTM A123/A123M* or *ASTM A153/A153M* as applicable.

Galvanize concrete inserts in accordance with *ASTM B633*, *Service Condition 4*.

5. Manufacture. Notify the Engineer at least 14 days prior to manufacturing. Provide the Department access to perform QA inspection.

Incorporate a shear key where top and bottom wall sections join.

Form holes in culvert sections to facilitate installation of joint tie assemblies unless an alternate joint tie assembly is approved by the Engineer that incorporates inserts instead of form holes.

Use a PVC conduit approved by the Engineer to form post-tensioning ducts.

Install concrete inserts as required by the design and as shown on the plans.

There must be at least 2 inches of clear cover over post-tensioning anchorages.

6. Installation. Install box culvert components in accordance with the approved working drawings. Ensure that adjacent segments line up with a maximum 1/2 inch gap. Fill the 1/2 inch maximum gap with grout. Install joint tie assemblies to a snug condition across all vertical and horizonal wall joints. The intent of the joint tie assemblies is to keep box culvert sections from separating over time. Do not tighten joint tie assemblies in an attempt to pull sections together. Install joint tie assemblies prior to backfilling operations. Fill annular space between holes in culvert and joint tie rods with sealant.

Use non-metallic or stainless steel leveling shims as necessary. After culvert sections are installed, fill voids in the horizontal shear key joint with a non-shrinking grout meeting the approval of the Engineer.

Place backfill equally on both sides of the box culvert. Use caution when placing backfill adjacent to joint tie assemblies. Repair or replace damaged joint tie assemblies, as approved by the Engineer, at no additional cost to the contract.

If not post-tensioning, construct box culvert joints in accordance with subsection 406.03.G.3 of the Standard Specifications for Construction.

If post-tensioning, satisfy the following requirements unless otherwise approved by the Engineer. Place seal washers, or other devices meeting the Engineer’s approval, between culvert sections at transverse conduit holes. After setting culvert sections in their final position, clean the culverts with water and place mortar in vertical and longitudinal joints. Forming may be required to contain mortar. Use Type R-2 mortar with a slump of 5 inches and place when the air temperature rises above 40 ºF. Fill spaces between culvert sections full depth. Rod the mortar into the space to form a tight, solid joint. Cure mortar for at least 48 hours. After the mortar cures, post-tension the sections transversely. Tension tendons to the force required by the design, except do not exceed the yield stress of the material. After tensioning, clean the annular space between the tendon and hole by flushing with water. Remove water with compressed air. With the grouting vent open at one end of the hole, inject Type E-1 grout under pressure to the opposite end. Continue injecting grout until material comes out through the open vents. Close open vents while maintaining grout pressure. Gradually increase pressure to at least 50 psi and hold for 15 seconds. Close the inlet valve.

Remove lifting devices from culvert sections after culverts sections are placed in their final position. Lifting devices may remain in place if they do not extend above the concrete surface. Ensure lifting devices remaining in place are fabricated from stainless steel or galvanized steel or epoxy coated steel. Fill pockets and voids, associated with lifting devices, with a non-shrink grout to the satisfaction of the Engineer.

**d. Measurement and Payment.** The completed work, as described, will be measured and paid for at the contract unit price using the following pay item:

**Pay Item Pay Unit**

Culv, Precast Conc Box, (span) foot by (rise) foot, Spec Foot

**Culv, Precast Conc Box, (span) foot by (rise) foot, Spec** will be measured by the foot along the centerline of the structure from fascia to fascia. The unit price for **Culv, Precast Conc Box, (span) foot by (rise) foot, Spec** includes:

1. Designing, manufacturing, load rating and installing the precast elements;

2. Precast or cast-in-place headwalls, wingwalls, aprons and curtain walls;

3. Closed-cell butyl rubber extrusion type gaskets;

4. External rubber gasket with compatible primer;

5. Cold applied culvert joint sealer;

6. Geotextile blanket for box culvert joints;

7. Inserts for reinforcing bars and connection hardware;

8. Joint tie assemblies; and

9. Post-tensioning and materials associated with post-tensioning.

10. Dewatering and maintaining the stream flow during all construction stages.