

SPECIFICATION SECTION 07950 – CAST INSITU CONCRETE BOX CULVERTS

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SPECIFICATION SECTION 07950 – CAST INSITU CONCRETE BOX CULVERTS

1. DESCRIPTION

This Specification Section prescribes the construction of the reinforced Concrete Box Culverts for the existing or relocated irrigation channels and drainage ditches and also for the vehicles and pedestrians. This work shall include headwalls, wing walls, approach slabs (if indicated on the Drawings), apron, inlet and outlet structures (for channels) as well as associated related erosion and scour protection works and any incidentals.

2. MATERIAL REQUIREMENTS

2.1 Reference Standards

The most recent editions of the following Standards shall be applied to the Works covered by this Specification.

AASHTO M259	Precast Reinforced Concrete Box Sections for Culverts, Storm Drains, and Sewers
AASHTO T11	Materials Finer than 75-µm (No.200) Sieve in Mineral Aggregates by Washing
AASHTO T27	Sieve Analysis of Fine and Coarse Aggregates
AASHTO T89	Determining the Liquid Limit of Soils
AASHTO T90	Determining the Plastic Limit and Plasticity Index of Soils
ASTM D543	Evaluating the Resistance of Plastics to Chemical Reagents
ASTM D570	Water Absorption of Plastics
ASTM D638	Tensile Properties of Plastics
ASTM D2240	Rubber Property-Durometer Hardness

2.2 Materials for Box Culverts

2.2.1 Bedding

- (a) Sand bedding shall be; a porous, free draining granular material free of excess moisture, muck, roots, sod, or other deleterious material and uniformly graded from coarse to fine meeting the gradation as shown below. The material shall also conform to the following:

Table 1. Requirements for Bedding Materials

Plasticity Index, AASHTO T90	6 max.
Liquid Limit, AASHTO T89	30 max.
Gradation	
Sieve Size	Percent by Weight Passing Designated Sieve (AASHTO T27 and T11)
12.5mm	100
No. 200	0 - 75

- (b) Lean concrete bedding shall be bedding or blinding in accordance with the requirements of Specification Section 07100 Concrete and Concrete Structures

2.2.2 Cut off Plates (Water Stop)

- (a) Cut off plates shall be furnished and installed in accordance with; the details indicated on the Drawings, the provisions in this Specification Section and as directed by the Engineer.
- (b) Cut off plates shall be manufactured either from neoprene or from polyvinylchloride (PVC), at the option of the Contractor.
- (c) Field splices for neoprene cut off plates shall be, either vulcanized, mechanical, using stainless steel parts or made with a splicing union of the same materials as the cut off plate, at the option of the Contractor.
- (d) Fabricated plastic cut off plates with a uniform cross section that are free from porosity and other defects shall be used. If approved, an equivalent standard shape may be furnished.
- (e) Cut off plates shall be fabricated from a homogeneous, elastomeric, plastic compound of basic polyvinyl chloride and other material. The use of any reclaimed material shall not be permitted.
- (f) Certification from the producer showing test values for the following properties shall be provided:

Table 2. Required Test Values for Cut Off Plates

Tensile strength, ASTM D638:	9.65 Mpa
Elongation at breaking, ASTM D638:	250% min.
Hardness (shore), ASTM D2240:	60 – 75
Resistance to alkali, ASTM D543 - Max. % change:	-0.10 to +0.25
Max. change in hardness (shore):	+/-5 shore
Min. decrease in tensile strength:	- 15%
Water absorption, ASTM D570:	- 0.50% max.

2.2.3 Concrete, Reinforcing Steel and Others

The materials used for all structural work described in this Specification Section shall be in conformity with the requirements of the Specification Sections shown in Table 3.

Table 3 Requirements for Concrete, Reinforcing Steel and Other Materials

Material/Work	Relevant Specification Section
Concrete.	Specification Section 07100: Concrete and Concrete Structures

Reinforcing Steel for Concrete	Specification Section 07500: Reinforcing Steel
Excavation	Specification Section 03200: Structural Excavation
Backfill (Granular Material)	Specification Section 03200: Structural Excavation Specification Section 03400: Embankment

3. CONSTRUCTION REQUIREMENTS

3.1 Shop Drawings and Schedule

3.1.1 Shop Drawings

- (a) The Contractor shall furnish the Engineer with shop drawings containing the construction details for Box Culverts indicated on the Drawings and as directed by the Engineer. Shop drawings shall be submitted to the Engineer for respective approval by the Engineer.
- (b) Construction of the Box Culverts shall begin only after the issue of the Engineer's approval to the shop drawings submitted by the Contractor.

3.1.2 Work Scheduling

- (a) The Contractor shall not begin Box Culvert construction or concrete drain works without the Engineer's approval of the schedule and construction method. Temporary drainage works and/or temporary detours shall be in place and operating before the commencement of embankment Works or as directed by the Engineer.
- (b) No subgrade preparation or pavement overlay work (either in the road or the shoulder areas) shall commence until the culverts, headwalls and other minor structures below the subgrade level along that particular section of the Works are completed.

3.2 Rectification and Maintenance

3.2.1 Rectifying Unsatisfactory Work

- (a) All the work and materials for construction of Box Culverts shall be inspected by the Engineer before his approval on quality and dimensions. Based on the results obtained through the inspection, the Engineer will issue his approval on the inspected work or will instruct the Contractor to take necessary provisions of the measures for rectifying unsatisfactory item(s).

3.2.2 Maintaining Accepted Work

- (a) Notwithstanding the Contractor's obligation to rectify unsatisfactory or failed work the Contractor shall also be responsible for routine maintenance of all completed and accepted Box Culverts up to the issue of the Taking-Over Certificate.

3.3 Site Preparation

- (a) The Contractor shall excavate and prepare trenches and foundations for Box Culverts in accordance with the provisions of Specification Section 03200 Structural Excavation and Specification Section 03400 Embankment.
- (b) The Contractor shall be responsible for; all dewatering of the trenches (if needed), detours, Temporary Works and any other incidental works that might be necessary during construction.
- (c) The Contractor shall place supports and/or bedding material(s) in accordance with the requirements of the Drawings or as required or instructed by the Engineer in conformity with applicable Specification Sections.

3.4 Constructing Box Culverts

- (a) The Contractor shall construct Box Culverts in accordance with the Drawings or as indicated by the Engineer.
- (b) Unless otherwise required, all work shall be in accordance with the requirements of AASHTO M259.
- (c) All reinforced concrete work shall conform to the requirements of Specification Section 07100 Concrete and Concrete Structures. All excavation work shall comply with the provisions of Specification Section 03200 and all backfill work shall comply with the provisions of subsection 3.5 of Specification Section 03200 Structural Excavation and Specification Section 03400 Embankment, if applicable. Compaction for the backfill shall be carried out to both sides of the Box Culverts at the same time to the density of 95% of the maximum dry density determined according to Vietnamese Standard 22TCN 333-06, Method 2D.
- (d) Cut off plates shall conform to the cross section and to the minimum dimensions indicated in the Drawings.
- (e) If after placing concrete cut off plates are materially out of position or shape the surrounding concrete shall be removed, the cut off plates reset and the concrete replaced, all at the Contractor's expense.
- (f) Field splices for polyvinylchloride cut off plates shall be performed by heat sealing the adjacent surfaces in accordance with the manufacturer's recommendations. A thermostatically controlled electric source of heat shall be used to make all splices. The heat shall be sufficient to weld but not char the plastic.
- (g) Cut off plates when being installed shall be cut and spliced at changes in direction as may be necessary to avoid buckling or distortion of the web or flange.
- (h) Field splices shall develop water tightness equal to that of the unspliced

material and have a tensile strength of not less than 50 percent of the unspliced material.

- (i) Unless otherwise shown on the Drawings or indicated by the Engineer the Contractor shall construct all culvert aprons, endwalls, wingwalls, headwalls, inlets and outlets, approach slabs using reinforced concrete of the class indicated on the Drawings and in accordance with requirements and provisions of Specification Section 07100 Concrete and Concrete Structures.
- (j) Scour protection works shall normally be mortared stonework unless indicated otherwise on the Drawings.

3.5 Placing Water Stops

- (a) Water stops shall be carefully placed and supported. If splicing of water stop is required thermal splices shall be installed according to the manufacturer's instructions to make them watertight. Splices should have a tensile strength of at least 80 percent of the reported tensile strength of the unspliced water stop. Water stops shall be prevented from being displaced or damaged by construction operations and other activities.
- (b) All surfaces of water stops shall be kept free from oil, grease, dried mortar, or any other deleterious materials embedded in the concrete. It shall be ensured that embedded portions of the water stop are completely enclosed in dense concrete.

3.6 Acceptance Criteria

- (a) The finished dimensions of Box Culverts shall be as shown on Table 4.

Table 4 Dimension Tolerances

Item	Dimension Tolerances
Center Position	±5 mm
Top Level	±5 mm
Invert Level	±5 mm
Dimension: Inner & Outer	− 10 to +20 mm*
Verticality	1 in 300
Top Grade Irregularities	±2.5 mm

Note: * Dimensions are width, length, thickness, height, etc. and they shall be checked by the inspection results of the formwork, if final measurement

is difficult.

- (b) Wing walls, headwalls (or endwalls), apron and approach slabs shall conform with Specification Section 07100 Concrete and Concrete Structures.
- (c) If the water stop is unacceptable the Contractor shall submit a proposal of remedial works for the Engineer's approval.

4. MEASUREMENT AND PAYMENT

4.1 Method of Measurement

- (a) The Cast Insitu Concrete Box Culverts shall be measured for payment on the basis of the quantities of the constituent parts which together comprise the finished Box Culvert. To these quantities of work the unit prices from the applicable Specification Sections shall be applied.
- b) The Cast Insitu Concrete Box Culverts provisions, material requirements and construction requirements identified in this Specification Section shall be measured for payment in the pay items identified in subsection 4.2 , tables 5 and 6 below.
- c) Any Cast Insitu Concrete Box Culverts Works not specifically identified in this Specification Section but which are necessary for the performance of the Works shall be deemed to be included in the pay items identified in subsection 4.2 , tables 5 and 6 below.

4.2 Basis of Payment

- (a) The work under this Specification Section shall be paid for in accordance with the applicable unit prices as indicated in the Bill of Quantities for the Specification Sections set out in the tables 5 and 6 below. Payment shall constitute full compensation for performing the requirements of the Contract for the item of work as specified including furnishing all necessary labor, materials, tools, equipment, tests and incidentals.
- (b) The Box Culverts and approach slabs but excluding the end walls, head walls, wing walls and aprons shall be measured and paid through the following items:

Table 5. Measurement and Payment

	Measurement By	Payment Through
Concrete, formwork and falsework	The number of cubic meters of actual volume in place	The respective Class of Concrete specified in Specification Section 07100 Concrete and Concrete Structures

Reinforcing steel	The computed weight as indicated in the reinforcing schedules	Specification Section 07500 Reinforcing Steel
Excavation and backfill	The number of cubic meters of the actual volume of excavation or fill in place based on the outside dimensions of the Box Culverts shown on the Drawings	- The respective class of excavation specified in Specification Section 03200 Structural Excavation - Backfilling specified in Specification Section 03200 Structural Excavation, Specification Section 03400 Embankment or Specification 03300 Borrow Material if applicable
Water stops, joints, elastite, formwork, falsework and bituminous layers		Not separately paid. Water stops shall be deemed to be Indirectly Paid Work for which full payment is included in the unit prices for other main items or distributed among all pay items listed in the Bills of Quantities

- (d) The head walls, wing walls and mortared stonework to Box Culverts for both waterway and underpasses for vehicles and pedestrians shall be measured and paid through the following items:

Table 6. Measurement and Payment

	Measurement By	Payment Through
Concrete, formwork and falsework	The number of cubic meters of actual volume in place	The respective class of concrete specified in Specification Section 07100 Concrete and Concrete Structures
Reinforcing steel	The computed weight as indicated in the reinforcing schedules	Specification Section 07500 Reinforcing Steel
Excavation and backfill	The number of cubic meters of the actual volume of excavation or fill in	Specification Section 03200 Structural Excavation, Specification Section 03400 Embankment or

	place based on the outside dimensions of the measured item on the Drawings	Specification Section 03300 Borrow Material if applicable
Mortared Stonework		Specification Section 12400 Slope Protection