SECTION 603
CULVERTS, STORM DRAINS, SANITARY SEWERS, STOCKPASSES, AND UNDERPASSES

603.01 DESCRIPTION. This work is furnishing and installing culverts, storm drains, sanitary sewers, stockpasses, underpasses, further referred to as pipe.

603.02 MATERIALS. Furnish materials meeting the following Subsection requirements:

Culvert Sealers	707.02
Reinforced Concrete Pipe	708.01
Concrete Pressure Pipe	708.02
PVC Sewer and Drain Pipe	708.05
PVC Water Pipe	708.06
Polyethylene Corrugated Drainage Pipe or Tubing	708.07
Ductile Iron and Steel Water Pipe	709.01
Corrugated Steel Pipe and Pipe Arches.	709.02
Steel Structural Plate Pipe and Pipe Arches	709.03
Bituminous Coated Corrugated Steel Pipe, Pipe Arches, Steel Structural Plate Pipe and Pipe Arches	709.04
Pre-coated, Galvanized Steel Culverts and Underdrains	709.05
Corrugated Steel Pipe for Underdrains	709.06
Corrugated Aluminum Pipe and Pipe Arch Culverts	709.07
Corrugated Aluminum Pipe for Underdrains	709.08
Seamless Steel Pipe	709.09
Slotted Corrugated Steel Pipe	709.11

Materials will be acceptance inspected at the manufacturing source.

603.03 CONSTRUCTION REQUIREMENTS.

603.03.1 General. The locations and pipe lengths shown in the Contract are an estimate only and may be revised. Order pipe using only the Project Manager furnished list of sizes and lengths.

Repair or replace pipe damaged during delivery, storage, or placing at Contractor expense.

When the Contract allows optional types of pipe material for culverts at specific locations, any of the material types shown in the Contract may be used for that installation.

Provide the Project Manager in writing, at the Preconstruction conference, a list of proposed materials for use at each location optional material is allowed.

The type and quantity of material for bidding is listed in the Contract in columns under the heading "Basic Bid Items". The information in these columns is what would be required to complete the planned installation using the Basic Bid Pipe,

which is concrete, when it is an option. If concrete is not an option, steel pipe is the basic bid pipe. Include terminal sections, where required.

Each pipe size is paid for at the unit price bid and is full compensation for the pipe regardless of the pipe optioned by the Contractor. Only work shown in the "Basic Bid Items" columns on the plans is paid for at a given installation, and the quantities are based on measurements for the basic pipe. Additional work that is required due to field conditions and not associated with the selected pipe is measured and paid for on quantity changes that would result if the basic bid pipe been installed. All pay items are measured and paid for based on the basic bid pipe in the Contract.

Strut pipe arches if specified in the Contract.

603.03.2 Excavation and Foundation Preparation. Excavate and prepare the pipe foundation as specified in Section 207.

Place bedding material meeting Section 207 requirements and the Detailed Drawings.

603.03.3 Installation.

A. Prefabricated Non-metal Pipe. Lay non-metal pipe on the foundation in standard lengths starting at the outlet end, with the groove or bell ends upgrade. Recess the bell ends into the foundation.

Join the pipe ends to form a positive, tight-fitting joint by applying uniform pressure along the entire circumferential ends of the sections. Place pipe using methods that prevent pipe damage. Replace pipe damaged during placing at Contractor expense.

Make the joints watertight for round concrete pipe, used for irrigation, storm drainage, or sanitary sewage, or other purposes subject to continuous flow, sealing them with rubber gaskets meeting Subsection 707.02.1. Use flexible plastic joint seal compound for concrete arch pipe joints that meet Subsection 707.02.2 requirements.

The culvert joints for normally dry installations may be sealed with rubber-type gaskets or an approved joint-sealing compound, except where open joints are specified.

Construct angles, turns, and branch connections using pre-fabricated sections or construct as shown in the Detail Drawings.

Construct pipe dead ends and branches using closed ends or stoppers of equal strength to the pipe wall, cemented to the pipe.

Flared end terminal sections used with concrete pipe may be precast standard sections or cast in place as shown in the Detail Drawings.

Cap one end of concrete pipe tee sections that connect to median inlets when specified. Use a pre-fabricated cap or construct a cap of reinforced concrete and connect to the tee section forming a watertight joint with a strength equal to the pipe wall strength.

Keep all trenches dry when placing pipe and until the joint filler has cured.

B. Prefabricated Corrugated Metal Pipe. Place the pipe on the foundation with each section approximately 1-inch (25 mm) apart. Follow the pipe manufacturer's instructions for connecting joints. Connect the sections with

bolted coupling bands shaped to fit the formed pipe. Tap the coupling bands with mallets as the bolts are tightened.

The difference in diameter of abutting pipe ends to be coupled must not exceed 1/2-inch (13 mm).

Do not damage the pipe coating.

Culverts for siphons are designated as "CSP Siphon or "CSP irrigation".

Construct field joints following the manufacturer's instructions for the type of pipe and coupling bands or devices used.

Construct the field joints for corrugated metal pipe to maintain the pipe alignment and prevent the fill material from infiltrating the joints. Provide circumferential and longitudinal strength using the structural joint performance criteria of Division 2, Section 23 of the AASHTO Standard Specifications for Highway Bridges. Assure the field joints for siphon and irrigation pipe installations are watertight and meet Subsection 709.02 requirements. Correct all installations not meeting any of these requirements at Contractor expense.

Conduct all required water-tightness tests on siphon and irrigation pipe installations using **MT-420** or an approved procedure.

Cap one end of steel and aluminum pipe tee sections that connect to median inlets. Use a metal cap of equal thickness to the pipe wall and attach it to the tee section forming a watertight joint of equal strength to the pipe wall strength.

Field coat aluminum or Type II aluminized pipe to be in contact with fresh concrete with an asphalt mastic meeting AASHTO M 243 requirements over the full surface to be in contact. The asphalt container's label must provide the following information:

a. Name of Product;
b. Specification;
c. Lot Number;
d. Date of Manufacture;
e. Quantity of Mastic in Container;
f. Manufacturer's Name and Address.

Separate aluminum pipe coupled to dissimilar metals by either a bituminous-coated coupling, polyvinyl sheeting, painted with rubber-base paints, or use aluminized steel.

C. Structural Plate Types. Follow the manufacturer's field erection recommendations and the Contract requirements. Do not start work until the Project Manager and Contractor have the manufacturer's specifications and instructions at the work site.

Do not place backfill until all plates in a ring are complete and all bolts in the structure are tightened to the manufacturer's specifications.

Compact backfill using hand-operated compaction equipment within 6 feet (1.8 m) of the pipe neat lines.

Tighten all bolts in the assembly to the pipe manufacturer's torque specifications.

Long-span structure requirements are specified in the Contract.

Match the existing pipe section extensions for existing steel structural plate pipe and pipe arch culverts and stockpasses. Remove beveled ends

on existing pipe, install the new pipe sections, and re-install or replace the beveled ends as specified.

Pipe end treatment and slopes are detailed in the Contract.

Replace damaged structural plates at Contractor expense.

D. **Ductile Iron Pipe.** Lay pipe to the specified line and grade, installing all appurtenances as specified. Uniformly support the pipe throughout its length, except at joints. Make depressions in the foundation for bells, couplings or other connectors at joints.

Bring the pipe to grade by working the material along the barrel of the pipe, leaving the joints un-supported. Flare, grind, file, or machine the pipe cut ends to make the connections. Prevent foreign material from entering the pipe during the work.

Do not deflect pipe beyond the manufacturer's allowable tolerances.

Inspect fittings for cracks, blowholes, chips, and coating damage before installation. Replace defective fittings.

Lower fittings into the trenches without damaging the inside lining or outside coating.

Install concrete thrust blocks against undisturbed soil.

Make pipe joint connections following the manufacturer's recommendations.

603.03.4 Backfilling.

A. **General.** Use backfill material free of sticks, sod, frozen soil, or other deleterious matter.

Do not permit stones, rocks, chunks of broken concrete, or other material larger than 3-inches (75 mm) within the top 2 feet (610 mm) of the top of water and sanitary sewer lines and within 1 foot (305 mm) of the pipe top for all other installations.

Replace the top 2 feet (610 mm) of backfill for excavations in existing roadway sections "in-kind".

Place backfill material in maximum 6-inch (155 mm) layers loose thickness and compact. Firmly tamp the backfill under the pipe haunches. Extend the backfill material placed above the excavation limits or the ground line beyond each side of the pipe equal to twice the pipe diameter or 12 feet (3.7 m), whichever is less.

Compact backfill equally on each side of the pipe to at least 1 foot (305 mm) above the pipe top.

Use equipment and methods for backfilling and compacting that do not distort, misalign, or damage the pipe. Replace pipe that is distorted, misaligned, or damaged at Contractor expense.

Do not allow heavy equipment to pass over any pipe until at least 4 feet (1.2 m) or one-half pipe diameter of backfill, whichever is greater, is placed and compacted over the pipe.

B. **Imperfect Trench Method.** Culvert installation using the imperfect trench method is shown in the Detail Drawings.

C. **Rock Embankment.** Install pipes placed in blasted or fractured rock embankments as follows: Envelope the exposed pipe surface above the level of the bedding trench with graded bedding material. Extend the

envelope to one-half the nominal pipe diameter or 3 feet (915 mm), whichever is greater. Completely surround the pipe with graded bedding material when a bedded trench is not specified.

Use graded bedding material meeting Subsection 701.04.1 requirements; placed and compacted meeting Subsection 603.03.4(A).

603.03.5 Restoration and Maintenance of Existing Pavement. Restore the existing pavement excavated for pipe installation using material equal to or better than the in place pavement. Restoration includes replacing and compacting excavated aggregate base with materials equal to those in the existing roadway and placing new bituminous surfacing equal to the existing, but not less than 0.25 feet (76 mm) in thickness. Place and compact the replacement bituminous surfacing to match the adjacent pavement providing a smooth riding surface, including the joints.

Maintain the restored pavement areas in good condition until the new pavement is placed.

603.04 METHOD OF MEASUREMENT.

603.04.1 Pipe. Pipe is measured by the linear foot (meter) in place from end-to-end of the installed structure along the bottom or pipe invert. Gasket material, specified coatings, coupling bands, bolts, bands, fittings, tees, risers, end sections, joint testing, restoring disturbed pavement, flared ends, beveled, skewed, and similar shapes or special designs, riser pipe lengths, and riser tee sections are not measured separately but are included in the pipe lengths measured.

Storm drain and sanitary sewer are measured by the linear foot (meter) from manhole center to manhole center.

Excess pipe installed and not ordered by the Project Manager is not measured for payment.

603.04.2 Excavation. Pipe excavation is measured by the cubic yard (cubic meter) under Subsection 207.04.

Foundation preparation and backfilling is included in the contract unit price for culvert excavation under Subsection 207.05.

When the imperfect trench backfill method is specified, the excavation of the fill and subsequent backfill in the prism above the pipe encasement is not measured separately.

603.04.3 Bedding and Foundation Material. Bedding and foundation material is measured by the cubic yard (cubic meter) in place.

603.05 BASIS OF PAYMENT.

603.05.1 Payment. Payment for the completed and accepted quantities is made under the following:

Pay Item	Pay Unit
Pipe (Type and Size)	Linear Foot (meter)
Excavation	Cubic Yard (cubic meter)
Bedding and Foundation	Cubic Yard (cubic meter)

Payment at the contract unit price is full compensation for all resources necessary to complete those items of work under the contract.