**SECTION 6.86 - DRAINAGE PIPES, DRAINAGE PIPE ENDS**

**6.86.01—Description**

**6.86.02—Materials**

**6.86.03—Construction Methods**

**6.86.04—Method of Measurement**

**6.86.05—Basis of Payment**

 **6.86.01—Description:** This work shall consist of furnishing, preparing and installing drainage pipes of the size and type specified, bedding material, joint sealant, rubber gaskets, clamps, collars, grout, grout collars, drainage trench excavation, backfilling or satisfactory disposal of all materials, the removal of which is necessary for the proper completion of the work, connecting proposed drainage systems to existing systems, plugging or abandoning existing pipes and removal of existing pipe within trench limits, as shown on the plans or as directed by the Engineer.

 This Section shall also include removal of drainage pipes outside of drainage trench excavation limits, as defined in 2.86.03-1.

 **6.86.02—Materials:** The materials for this work shall meet the following requirements:

 Drainage Pipe, Drainage Pipe Ends, Sealers, Gaskets and connection hardware shall meet the requirements of M.08.01.

 Bedding Material shall meet the requirements of M.08.03-1.

 Granular Fill, if necessary, shall meet the requirements of M.02.01.

 Brick Masonry shall meet the requirements of M.11.03 and Mortar shall meet the requirements of M.11.04.

 Concrete used for Concrete Pipe Connections shall be Class “F” Concrete meeting the requirements of M.03.

 **6.86.03—Construction Methods:**

**(1) Drainage Trench Excavation:** Drainage trench excavation and backfilling shall be performed in accordance with 2.86.03 and the requirements of the plans.

 Where drainage pipe is to be laid below the surface, a drainage trench shall be excavated to the required depth, the bottom of which shall be graded to the elevation of the bottom of the bedding material.

 Where drainage pipe is to be laid in a fill area, the embankment shall be placed and compacted to a minimum elevation 12 inches above the top of the proposed pipe, whereupon the drainage trench excavation shall be performed and the pipe installed.

**(2) Rock in Drainage Trench Excavation:** When rock, as defined in 2.86.01-2, is encountered, work shall be performed in accordance with 2.86.03 and the requirements of the plans.

**(3) Drainage Pipe Installation:** New or re-laid drainage pipes shall be installed on 4 inches of bedding material (12 inches if over rock in ledge formation), the details as shown on the plans, or as directed by the Engineer. Prior to placement of the drainage pipe, in accordance with the plans, bedding material shall be pre-shaped to 10% of the total height of the pipe in order to keep the pipe in the center of the trench. Following placement of the drainage pipe, bedding material backfill shall be placed in accordance with the following table:

|  |  |
| --- | --- |
| **Internal Pipe Diameter** | **Required Bedding Material Backfill** |
| < 48 inches\* | 25% of total height of the pipe |
| ≥ 48 inches\* | 12 inches above the top of the pipe |
| \*Includes pipe arch of equivalent internal horizontal spanSee Standard Drawing |

 The placement of the drainage pipe shall start at the downstream end and progress upstream or as shown on the plans, or as directed by the Engineer. All drainage pipes shall be carefully laid in the center of the drainage trench, true to the lines and grades given. Bell ends shall face upgrade and all joints shall be tight.

 Joints in concrete pipe shall be sealed with cold-applied bituminous sealer, preformed plastic gaskets or flexible, watertight, rubber-type gaskets. Portland cement mortar shall not be used for sealing pipe joints except with permission of the Engineer.

 When cold-applied bituminous sealer is used, the bell and spigot ends shall be wiped clean and dry before applying the bituminous sealer to the pipe ends. Before the drainage pipes are placed in contact with each other, the spigot or tongue end shall be completely covered with bituminous sealer; then the pipe shall be laid to line and grade so the inside surface of all abutting pipes are flush. Additional bituminous sealer shall be applied to the joint after the connection has been made to ensure a water tight connection.

 Where the end of an existing drainage pipe is not compatible with the end of a proposed concrete pipe, the Contractor shall align the inner diameters of the pipes being connected, butt the pipe ends together, and construct a cast-in-place concrete pipe connection, as shown in the plans. Incompatible bell/spigot or tongue/groove ends shall be cut off as required to ensure the interior drainage pipe walls are aligned to provide a smooth transition between the pipes.

 Metal pipe and pipe arches shall be carefully joined and firmly clamped together by approved connecting bands, which shall be properly bolted in place before any backfill is placed.

 Newly installed drainage pipe which is not in true alignment, or which shows any settlement or distortion, shall be reinstalled in accordance with 1.05.03.

 When drainage pipe outside of proposed drainage trench limits is to be removed, it shall be removed to the limits shown on the plans and all remaining pipes shall be plugged with cement masonry.

 Where shown on the plans or directed by the Engineer, the Contractor shall plug abandoned existing pipes with cement masonry.

**(4) Drainage Pipe End Installation:** Reinforced concrete drainage pipe ends shall be placed on a prepared bed of the existing ground and accurately aligned as shown on the plans. The joints shall be sealed as specified in 6.86.03-3 and backfill shall be placed around both sides of the unit simultaneously to the elevation shown on the plans.

 Metal drainage pipe ends shall be placed on a prepared bed of the existing ground and accurately aligned as shown on the plans. After the attachment of the drainage pipe end, backfill shall be placed around both sides of the unit up to the elevation shown on the plans, exercising caution to avoid displacement or deformation of the unit.

 **6.86.04—Method of Measurement:** This work will be measured as follows:

 **Drainage Trench Excavation,** in accordance with 2.86.04,will not be measured for payment.

 **Rock in Drainage Trench Excavation** will be measured in accordance with 2.86.04.

 **Bedding Material** will not be measured for payment.

 **New and Re-laid Pipes and Pipe Arches** will be measured for payment by the actual number of linear feet of pipe or pipe arch of the various sizes and types, completed and accepted and measured in place along the invert. Coupling bands and fittings for pipes and pipe arches will not be measured for payment.

 **Reinforced Concrete Drainage Pipe Ends and Metal Drainage Pipe Ends** will be measured for payment as separate units.

 **Corrugated Metal Pipe Elbows** (of the Size and Type specified) will be measured for payment by the actual number of linear feet of pipe elbows completed and accepted, based on 6 linear feet per elbow, as shown on the plans. Coupling bands for elbows will not be measured for payment.

 **Concrete Pipe Connection** will be measured for payment by the number of each concrete pipe connection constructed at locations where proposed concrete pipes tie into an existing pipe with an incompatible end, completed and accepted by the Engineer.

 **Removal of drainage pipe** outside of drainage trench excavation limits, as defined in 2.86.03, will be measured for payment by the actual number of linear feet of drainage pipe removed.

 There will be no measurement for plugging existing pipes with cement masonry.

 **6.86.05—Basis of Payment:**

 **Drainage Trench Excavation** for the installation of drainage pipeswill not be paid separately but shall be included in the Contract unit price for the respective drainage pipe or pipe end item(s), in accordance with the provisions of 2.86.05.

 **Rock in Drainage Trench Excavation** will be paid for in accordance with the provisions of 2.86.05.

 **Bedding Material** necessary for the installation of drainage items described hereinwill be included in the Contract unit price for the respective drainage pipe or pipe end item(s). Bedding material required to fill voids when rock in drainage trench is encountered will not be measured for payment but shall be included in the Contract unit price for "Rock in Drainage Trench Excavation," in accordance with 2.86.05.

 **New Pipes and Pipe Arches** will be paid for at the Contract unit price per linear foot for "(Size and Type) Pipe (Thickness) – 0' to 10' Deep," "(Size and Type) Pipe (Thickness) – 0' to 20' Deep," "(Size) Pipe Arch (Thickness) – 0' to 10' Deep" or "(Size) Pipe Arch (Thickness) – 0' to 20' Deep" complete in place, including materials, drainage trench excavation, bedding material, equipment, tools, and labor incidental thereto.

 **Relaid Pipes and Pipe Arches** will be paid for at the Contract unit price per linear foot for "Relaid Pipe (Size and Type) – 0' to 10' Deep," "Re-laid Pipe (Size and Type) – 0' to 20' Deep," "Relaid Pipe Arch (Size and Type) – 0' to 10' Deep," or "Relaid Pipe Arch (Size and Type) – 0' to 20' Deep," complete in place, including all materials, drainage trench excavation, bedding material, equipment, tools, and labor incidental thereto.

 **Reinforced Concrete Drainage Pipe Ends and Metal Drainage Pipe Ends** will be paid for at the Contract unit price for each drainage pipe end of the Size and Type specified, complete in place, including all excavation, materials, attachment systems, equipment, tools and labor incidental thereto.

 **Corrugated Metal Pipe Elbows** will be paid for at the Contract unit price per linear foot for "(Size and Type) Corrugated Metal Pipe Elbow" including all materials, drainage trench excavation, bedding material, equipment, tools, and labor incidental thereto.

 **Concrete Pipe Connection** will be paid for at the Contract unit price each for "Concrete Pipe Connection" complete in place, including all materials, equipment, tools and labor incidental thereto.

 **Removal of drainage pipes** of all types and sizes,outside of drainage trench excavation limits, as defined in 2.86.03-1, will be paid for at the Contract unit price per linear foot for "Remove Existing Pipe – 0' to 10' Deep," or "Remove Existing Pipe – 0' to 20' Deep," which price shall include excavation, temporary trench protection, backfill, and all equipment, tools and labor incidental thereto.

 There will be no direct payment for the plugging of existing drainage pipes, but the cost thereof shall be included in the respective drainage Contract item(s).

 Pay Item Pay Unit

(Size and Type) Pipe (Thickness) – 0' to 10' Deep l.f.

(Size and Type) Pipe (Thickness) – 0' to 20' Deep l.f.

(Size and Type) Pipe Arch (Thickness) – 0' to 10' Deep l.f.

(Size and Type) Pipe Arch (Thickness) – 0' to 20' Deep l.f.

Relaid (Size and Type) Pipe– 0' to 10' Deep l.f.

Relaid (Size and Type) Pipe– 0' to 20' Deep l.f.

(Size and Type) Relaid Pipe Arch – 0' to 10' Deep l.f.

(Size and Type) Relaid Pipe Arch – 0' to 20' Deep l.f.

(Size) Reinforced Concrete Drainage Pipe End ea.

(Size) Metal Drainage Pipe End ea.

(Size and Type) Corrugated Metal Pipe Elbow l.f.

Concrete Pipe Connection ea.

Remove Existing Pipe – 0' to 10' Deep l.f.

Remove Existing Pipe – 0' to 20' Deep l.f.