SECTION 603

REINFORCED CONCRETE PIPE

DESCRIPTION

603.01.01 GENERAL: This work shall consist of furnishing circular or elliptical, reinforced concrete pipe, siphons, and conduits of the size, classes, and dimensions and at locations shown on the plans or established by the Engineer and in accordance with the requirements of ASTM C76, C655, or C507 with design basis in accordance with Section 708, "Concrete and Clay Pipe and Drains" and where indicated in these specifications. The installation shall conform to the requirements of AASHTO LRFD Construction Specifications and where indicated in these specifications.

603.01.02 REFERENCE CODES AND STANDARDS:
(a) Uniform Standard Specifications for Public Works' Construction Off-site Improvements, Clark County Area, Nevada that will henceforth be referred to as “USS” Specifications and Drawings.
(b) Contract Special Provisions and Drawings.
(c) NRS 338.176, NAC 625.550.
(d) Most current ASTM, AASHTO, ACI or NDOT test & inspection procedures.
(e) Related Interagency Quality Assurance Committee (IQAC) procedures at www.accessclarkcounty.com/pubworks/iqac/IQAC.htm.

MATERIAL

603.02.01 GENERAL: Materials and their use shall conform to the applicable requirements of Subsection 601.02.01 of Section 601, "Pipe Culverts - General," and in addition thereto, the following requirements shall apply.

Prior to the use of these materials, the Contractor shall submit to the Engineer for approval a document certifying that the material meets these specifications and Section 708, "Concrete and Clay Pipe and Drains," from an authorized source approved by the Interagency Quality Assurance Committee (IQAC).

Flared end sections (precast) shall conform to the details and dimensions shown on the plans and, except for shape, shall conform to the material requirements of this section for reinforced concrete pipe.

Rubber gaskets are required for all circular pipes and mastic for elliptical, and shall conform to the requirements of Subsection 707.03.02, "Rubber Gaskets."

If joint mortar is required, it shall be as specified in Subsection 501.03.11, Class "C". Sand shall conform to the requirements of Subsection 706.03.04, "Grout and Mortar Sand" of these specifications.

The materials shall be mixed to a consistency suitable for the purpose intended. All mortar shall be used within 30 minutes after the mixing water has been added.

Admixtures of hydrated lime, fire clay, diatomaceous earth, or other approved inert material may be used in the mortar to facilitate workability if the Contractor elects. The amount of admixture to be added shall be the quantity determined by the Engineer.
CONSTRUCTION

603.03.01 GENERAL: Construction methods shall conform to the requirements of Subsections 601.03.01 through 601.03.06 of Section 601, "Pipe Culverts - General" and in addition thereto, shall meet the following requirements. All pipe installations shall conform to the workmanship and inspection requirements of AASHTO LRFD Bridge Construction Specifications and this specification as applicable.

No pipe shall be laid which is excessively cracked per subsection 603.03.07, checked, spalled, or damaged, and all such sections of pipe shall be permanently removed from the work. Pipes, which show defects due to handling, shall be rejected at the site of the installation regardless of prior acceptance.

603.03.02 EARTHWORK: Where pipes are to be installed in new embankment (projection), the embankment shall first be constructed to the required elevation as set forth below. The height of embankment to be constructed in advance of installing the pipe may be varied when permitted by the Engineer.

In the case of pipes 24 inches (600 millimeters) or less in diameter the roadway embankment shall be constructed to an elevation of 6 inches (150 millimeters) above the grade proposed for the top of the pipe, after which the trench shall be excavated and the pipe installed.

In the case of pipes more than 24 inches (600 millimeters) in diameter, the roadway embankment shall be constructed to an elevation of 30 inches (750 millimeters) above the grade proposed for the bottom of the pipe, after which the trench shall be excavated and the pipe installed.

When pipe having bells or hubs is used, cross trenches shall be excavated for them to prevent non-uniform loading of the joints.

603.03.03 LAYING CULVERT PIPE: Construction installation shall comply with the AASHTO LRFD Bridge Construction Specifications, Section 208, “Trench Excavation and Backfill”, and this subsection. The installation shall be conducted by a certified supervisor/foreman at the crew level who is responsible for the work. The certified person is the designated installation inspector for the contractor and shall generate a daily report attesting to the workmanship for the pipe zone locations as described in Table 2. This does not relieve the contractor responsibility for other Quality Control aspects of this and other specifications.

Installation Components:

(a) Bedding.
(b) Pipe Condition.
(c) Pipe Installation.
(d) Haunch Compaction.
(e) Complete Pipe Zone Compaction.

The bottom of the trench shall be graded and prepared to provide a firm and uniform bearing throughout the entire length of the pipe. Blocking shall not be used to bring the pipe to grade.

Pipe sections shall be checked for alignment and grade at the time of joining the sections. Pipe laying shall begin at the downstream end of the pipeline except for extensions of existing pipes. Place the bottom of the pipe in contact with the shaped bedding throughout its full length. The first section of pipe to be laid shall be firmly placed to the designated line and grade at the outlet end with the groove end or bell end pointing in the direction to be followed by the pipe laying. Maintain the manufacturer’s recommended minimum and maximum cover at all times unless otherwise shown in the contract. Pipe will be inspected before any backfill is placed. Ensure that no rocks greater than 75 mm (3 in.) or other rigid or jagged material is present in the bedding.
material where pipe may be laid directly on the material. Take up and relay or replace pipe that is out of alignment, unduly settled, or damaged.

The interior of the pipe shall be kept free of dirt, and other foreign material as the pipe laying progresses, and left clean at the completion of the work. Any pipe, which is not in true alignment or which shows any undue settlement after laying, or is damaged, shall be taken up and re-laid at the Contractor's expenses.

**Backfill:** Prior to placing backfill material, all hanging holes in concrete culverts shall be completely filled with grout.

603.03.04 RUBBER GASKETED JOINTS: Circular reinforced concrete culvert pipe, shall use rubber or neoprene gasketed joints. Rubber gasketed joints may be used in lieu of other types of joints.

Rubber gaskets shall not be exposed to the direct rays of the sun for more than 72 hours.

The contractor shall make every effort to provide a concrete to concrete connection and pull the pipe completely home. Should gapping occur due to changes or corrections in horizontal or vertical alignment or radius turns, the gaps shall not exceed the gap tolerance indicated in Table 1. If pipes are laid that exceed these tolerances, the inner annular space between the pipe sections shall be completely filled with cement mortar (where pipe diameters allow for entry). If pipes are laid that exceed the tolerances in Column 2, the pipe will need to be removed and re-laid or an acceptable concrete collar will need to be installed.

<table>
<thead>
<tr>
<th>Inner Diameter of Pipe</th>
<th>Column 1 Maximum Joint Gap Tolerance</th>
<th>Column 2 Maximum Joint Gap Tolerance (with Grouting)</th>
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</thead>
<tbody>
<tr>
<td>12&quot; to 36&quot;</td>
<td>5/8&quot;</td>
<td>3/4&quot;</td>
</tr>
<tr>
<td>42&quot; to 48&quot;</td>
<td>7/8&quot;</td>
<td>1-1/8&quot;</td>
</tr>
<tr>
<td>54&quot; to 90&quot;</td>
<td>1.0&quot;</td>
<td>1-1/4&quot;</td>
</tr>
<tr>
<td>96&quot;</td>
<td>1-5/8&quot;</td>
<td>1-3/4&quot;</td>
</tr>
<tr>
<td>Sizes above 96&quot; up to 144&quot;</td>
<td>As recommended by Manufacturer</td>
<td>As recommended by Manufacturer</td>
</tr>
</tbody>
</table>

Where reinforced concrete collars or bells with rubber gaskets are used at the pipe joints, mortar will not be required in the outer annular space. Where pipes are used with exposed metal surfaces at the joint, both the inner and outer annular joint spaces between pipe sections must be completely filled with cement mortar, except that pipes less than 24 inches (61 centimeters) in diameter may be pointed inside by brushing smooth and removing all surplus mortar. The rubber gasket shall be the sole element depended upon to make the joint watertight for the purposes intended.

603.03.05 SIPHONS AND PRESSURE PIPE: Reinforced concrete pipe used for siphons or pressure pipe shall be laid in accordance with the above provisions, be connected by flexible, watertight rubber gasket joint, and prior to backfilling, be subject to the following hydrostatic test:

The pipeline shall be filled with water at a hydrostatic head of that required to maintain the designed pressure. The pressure head shall be maintained for a period of not less than 24 hours and any visible leak or other defects, which develop under test, shall be corrected by the Contractor at his expense. Sweating that

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1 In no case shall maximum joint gap tolerance exceed \( \frac{1}{2} \) of the length where the gasket seats within the pipe.
does not develop into a flow or drip will not be considered as leakage. The test shall be repeated until all leaks or other defects are eliminated

603.03.06 JUNCTIONS: All junctions of laterals with a main line or junctions of 2 or more main lines, which are not made in a manhole or concrete junction structure, shall be in a manufactured wye or tee of the same material as the conduits to which they are joined, and shall have the same or greater stiffness as the pipe.

603.03.07 INSPECTION: All pipe joints and lengths shall be 100 percent inspected. Inspection and Testing by the contractor during and after installation to ensure proper performance. Installation of bedding and backfill materials, as well as their placement and compaction, shall adhere to the requirements of this section. During the initial phases of the installation process, inspection shall concentrate on detecting improper practice and poor workmanship. Errors in line and grade, as well as any improper assembly or backfill techniques, shall be corrected prior to placing significant backfill or trench fill. Bell/spigot joints shall be properly assembled to prevent the infiltration of soil fines. Gaskets shall be properly seated to prevent groundwater infiltration and should appear uniformly oriented around the pipe. Shallow cover installations shall be checked to ensure the minimum cover level is provided.

After the pipe has been bedded and backfilled to subgrade level, internal quality inspection shall be paid for and performed by the Contractor a minimum of 30 days after final backfill has been placed and prior to final acceptance by the Contracting Agency. The line shall be cleaned and inspected for cracks and joint gaps using visual physical measurement or other devices, including but not limited to calibrated television or video cameras, subject to approval by the Engineer. Cracks in pipes (both longitudinal and circumferential) that are less than 0.10 inch in width are generally considered non-structural flaws and need not be repaired. Cracks that are equal to or exceed 0.10 inch in width shall require an evaluation by a Nevada licensed professional engineer. The Contractor's engineer shall provide a recommendation regarding removal or repair subject to approval by the Contracting Agency. Pipe joints and lengths that do not meet the specification shall be repaired or pipe replaced at the contractors expense. All inspection results shall be submitted and approved by the Engineer before final payment. Damaged pipe will need to be repaired or replaced. Any The replacement pipe shall also be subject to the same testing. The video camera shall physically verify quality of the pipe installation and is not limited by poor lighting, waterproof, pipe length, or other limiting conditions of the installed environment.

For locations where the pipe does not conform, an evaluation shall be conducted by the Contractor and a recommendation by their Nevada Professional Engineer submitted to the Agency Engineer for review and approval considering the severity of the structural integrity, environmental conditions and the design service life of the pipe. Do not reinstall damaged pipe, but remove and replace with new pipe. The replacement pipe shall also be subject to the same testing.

All inspection and testing results shall be submitted to the Engineer for approval.

The Agency Engineer shall be allowed access to randomly inspect at least 10 percent of the total number of pipe runs.

METHOD OF MEASUREMENT

603.04.01 MEASUREMENT: Method of measurement shall conform to the requirements of Subsection 601.04.01, "Measurement" and in addition thereto, the following requirements shall apply.

The quantity of precast end sections, culvert pipe or oval pipe measured for payment will be the number of units of each size of each class complete and in place. Pre-cast pipe and cast-in-place sections that are an integral part of the manhole will not be included in the linear foot measurement for reinforced concrete pipe.
The measurement for the quantity of radius RCP will be measured as standard RCP of the equivalent size.

All measurements will be made in accordance with Subsection 190.01, "Measurement of Quantities."

**BASIS OF PAYMENT**

**603.05.01 PAYMENT:** Payment shall conform to the requirements of Subsection 601.05.01, "Payments," and in addition thereto, the following requirements shall apply.

The accepted quantities of reinforced concrete pipe measured as specified in Subsection 603.04.01, "Measurement," will be paid for at the contract unit price bid per linear foot (meter) for reinforced concrete pipe of the class and size specified, which shall be full compensation for removal of existing pavement (only if pavement removal is not included with roadway excavation) trench excavation, furnishing and placing bedding and backfill material, Type II aggregate base, compaction, furnishing and placing pipe and jointing mortar, covering open ends of laterals with plywood, cut and join connections, de-watering of trench, shoring, disposal of excess excavated material, protection and restoration, potholing to determine location of existing utilities, temporary pavement, video inspection cost, related items of work not otherwise provided for, and for all labor, tools, and equipment necessary to complete the work as shown on the plans, as specified herein, and as directed by the Engineer. End sections will be paid for at the contract unit price bid per each for the kind and sizes specified complete and in place, which payment shall include structure excavation and backfill for precast end sections.

All payments will be made in accordance with Subsection 109.02, "Scope of Payment."

Payment will be made under:

<table>
<thead>
<tr>
<th>PAY ITEM</th>
<th>PAY UNIT</th>
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<tbody>
<tr>
<td>(Size) Reinforced Concrete Pipe (class)</td>
<td>Linear Foot (Meter)</td>
</tr>
<tr>
<td>(Size) Oval Reinforced Concrete Pipe (class)</td>
<td>Linear Foot (Meter)</td>
</tr>
<tr>
<td>(Size) Reinforced Concrete Siphon Pipe (class)</td>
<td>Linear Foot (Meter)</td>
</tr>
<tr>
<td>(Size) Reinforced Concrete Pipe (class) Jacked.</td>
<td>Linear Foot (Meter)</td>
</tr>
<tr>
<td>(Size) Precast End Section</td>
<td>Each</td>
</tr>
<tr>
<td>(Size) Precast Oval End Section</td>
<td>Each</td>
</tr>
</tbody>
</table>