§706-01

SECTION 706 - CONCRETE, CLAY AND PLASTIC PIPE
706-01 NON-REINFORCED CONCRETE PIPE

SCOPE. This specification covers the material and quality requirements for non-reinforced concrete pipe 600 mm and smaller used for culverts.

GENERAL. The provisions of §706-02, Reinforced Concrete Pipe, shall apply except that all references to reinforcing steel shall be deleted. In addition, physical and dimensional requirements of concrete pipe under 300 mm in diameter shall be as stated in Table 1, Class 1, of ASTM C14. Plain concrete pipe 300 mm to 600 mm in diameter shall conform to Table 1, Class 2, of ASTM C14.

MATERIAL REQUIREMENTS. The provisions of §706-02, Reinforced Concrete Pipe, material requirements, shall apply except that all references to reinforcing steel shall be deleted.

TEST. All provisions of §706-02, Reinforced Concrete Pipe, test shall apply except as modified below.

All references to reinforcing shall be deleted.

The strength and absorption requirements for the respective diameter pipe sizes shall be as stated in Tables 1 and 2, ASTM C14. Details of the crushing strength test and absorption test shall comply with ASTM C14 except as follows:

Specimens for the absorption test shall consist of minimum 50 mm diameter cores drilled from the pipe wall or, at the manufacturer’s option, sawed specimens 100 mm square. The number of test specimens for absorption shall be as directed by the Materials Bureau.

BASIS OF ACCEPTANCE. The provisions of §706-02, Reinforced Concrete Pipe, shall apply.

706-02 REINFORCED CONCRETE PIPE
CLASSES II, III, IV, V

SCOPE. The material, fabrication, and physical requirements of reinforced concrete pipe and cattle pass.

GENERAL. Apply the requirements of AASHTO M 170M, Reinforced Concrete Culvert, Storm Drain and Sewer Pipe, Classes II, III, IV, and V, except as modified by this specification. Reinforced concrete pipe shall be machine made or wet cast in accordance with working drawings approved by the Department and in full compliance with the details of this specification. Pipe shall be manufactured under the inspection procedures stipulated by the written directives of the Materials Bureau.

Pipe manufactured for a specific class will be acceptable for any class having a lower design strength.

Methods of manufacture shall be categorized as either:

A. Wet cast units. Those made from concrete placed and consolidated by conventional equipment. These units develop resistance to freeze-thaw damage through the use of entrained air in the concrete. Air content in wet cast concrete shall range between 5.0% and 9.0%.

B. Machine made units. Those made by any method other than wet cast. These methods use very low slump concrete and the methods of consolidation produce a dense product with low permeability and good resistance to freeze-thaw damage.

MATERIAL REQUIREMENTS. All materials used for reinforced concrete pipe shall conform to the requirements of the specifications listed below:

<table>
<thead>
<tr>
<th>Material</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Portland Cement (Type 1, Type 2 or Type 3)</td>
<td>701-01</td>
</tr>
<tr>
<td>Concrete Repair Material</td>
<td>701-04</td>
</tr>
<tr>
<td>Coarse Aggregate</td>
<td>703-02</td>
</tr>
<tr>
<td>Concrete Sand</td>
<td>703-07</td>
</tr>
</tbody>
</table>
Reinforcement & Stirrups:
  Bar Reinforcement, Grade 420  709-01
  Wire Fabric for Concrete Reinforcement  709-02
  Bar Reinforcement, Grade 300  709-03
  Cold Drawn Wire for Concrete Reinforcement  709-09
Admixtures  711-08
Water  712-01
Concrete Pipe Joint Sealing Compound  705-16
Concrete Pipe Joint Elastomeric Gaskets  705-17
Flyash  711-10

Cementitious Content. Use a minimum cementitious content of 335 kilograms per cubic meter (Portland Cement plus Flyash). The maximum allowable total chloride content in concrete shall not exceed 0.10 percent by weight of cementitious material tested in accordance with written procedural directives of the Materials Bureau.

Pozzolans. Fly ash may constitute up to a maximum of 25 percent by weight of the cementitious material.

Admixtures. Calcium Chloride is not allowed in concrete. Admixtures, other than an approved Air Entraining agent for wet cast pipe, are not allowed unless otherwise approved by the Materials Bureau.

Reinforcement. Samples the reinforcement in accordance with the written directives of the Materials Bureau. Accept stirrups based on the manufacturer's certification, unless otherwise directed by the Materials Bureau.

Pipe Joint Materials
  A. Elastomeric Gaskets. The gaskets used in the installation of round pipe shall meet the specification requirements of §705-17 and only those types and sizes designated by the pipe manufacturer on the approved drawings of the particular pipe.
  B. Sealing Compounds. Concrete pipe joint sealing compound, meeting the specification requirements of §705-16, shall be used only on elliptical pipe and reinforced cattle pass.

FABRICATION REQUIREMENTS

Drawings. Submit detailed working drawings conforming to the Materials Bureau concrete pipe templates. All diameter sizes of a particular geometric shape can be included on one drawing. Separate template drawings are required for cattle pass, jacking pipe and special designs.
  Full approval of the working drawings is required prior to the manufacture of any concrete pipe.

Design, Reinforcement and Dimensions
  A. General. Apply the Design, Reinforcement and Permissible Variations requirements of AASHTO M 170M for Class II, III, IV and V pipe, walls B & C. The AASHTO tables show minimum reinforcement. The manufacturer may submit drawings detailing alternatives to the specified reinforcement and/or wall thickness for Materials Bureau consideration. To gain full approval, the pipe shall be manufactured and tested in accordance with the written procedural directives of the Materials Bureau.
  B. Reinforced Concrete Cattle Pass. Apply the requirements of NYSDOT Standard Sheet M603-4 with the following modification. A minimum length of 1200 mm is required for each section. Variations in laying lengths of two opposite sides of a cattle pass section shall not be more than 3 mm per 300 mm of diameter, with a maximum of 16 mm in any length of cattle pass, except where beveled or curved cattle pass lengths have been specified.
Concrete Batch Placement. Clean and properly assemble the forms prior to placing any concrete. Transport and place the concrete mixture such that no segregation of the concrete materials or displacement of the reinforcing steel occurs within the form.

Curing. Cure the pipe in accordance with AASHTO M 170M. Include the type of curing, curing time and any temperature requirements on the drawing template. The AASHTO M 170M compressive strength requirements do not apply except for cattle pass. Other methods of curing are subject to approval by the Director, Materials Bureau.

Joints. Use either bell and spigot or tongue and groove design. Design the joints so as to permit effective jointing to reduce leakage and infiltration and to permit placement without irregularities.

Marking. In addition to the AASHTO M 170M requirements, the pipe markings shall be identified on the inside barrel. If the diameter is less than 450 mm the markings may be stenciled on the outside of the pipe.

Each pipe length with elliptical or quadrant reinforcing shall have the word “top” indelibly marked on the inside and outside of the barrel at the appropriate location.

Pipe Repair. In no case shall more than 10% of the lot be repaired. Pipe may be repaired at the plant or in the field using 701-04 Concrete Repair Material. The repair will be acceptable if, in the opinion of the Department, the repairs are sound and properly finished and cured, and the repaired pipe conforms to the requirements of these Specifications and the written procedural directives of the Materials Bureau.

**REQUIREMENTS**

Strength. Apply the requirements of AASHTO M 170M. Conduct, in the presence of a representative of the Department, such number and type of three-edge bearing tests as the Materials Bureau deems necessary to establish the quality of pipe.

Each manufacturer furnishing pipe under these specifications shall be equipped with a testing machine of a type approved by the Materials Bureau to carry out this test. Employ a commercial testing agency to calibrate the testing machine according to ASTM E4 at a minimum of once a year. Upon request of the Materials Bureau, a record of this calibration shall be furnished.

Reinforced concrete cattle pass will not require a three-edge bearing test. Cast concrete cylinders during production and achieve a minimum 28-day compressive strength of 25 MPa as certified by the manufacturer.

Absorption Requirements For Machine Made Pipe. For all pipe the maximum average absorption shall not exceed 8.0% by weight for the last three specimens tested. Specimens for this test shall be cores from each lot drilled by the manufacturer in the presence of a representative of the Department. The cores will be tested by the Materials Bureau in accordance with the test method specified in ASTM C497 except that under “absorption test” the drying period shall be 48 hours at a temperature of 110°F. Plug the holes when cores are taken. Plugs shall be sound and properly finished and cured according to the requirements of “Pipe Repair.”

Freeze-Thaw Requirements. The Materials Bureau reserves the right to test the pipe for durability by freeze-thaw testing. The test will be run in accordance to the written procedural directives of the Materials Bureau.

**SAMPLING AND TESTING.** The Reinforced Concrete Pipe units manufactured under the requirements of this specification shall be separated into specific and identifiable production lots. The maximum number and type of units in a lot shall be in accordance with the written procedural directives of the Materials Bureau.

A. All. Both Machine-Made and Wet Cast Reinforced Concrete Pipe Shall be subject to the Three Edge Bearing Test. The test procedure shall be as shown in procedural directives issued by the Materials Bureau.
Bureau.

B. Machine-Made Reinforced Concrete Pipe. The Absorption Test shall be performed on machine-made reinforced concrete pipe lots in accordance with the requirements detailed above and at the frequency directed in procedural directives issued by the Materials Bureau.

C. Wet Cast Reinforced Concrete Pipe. The Air Content of the wet cast concrete unit will be determined on a lot basis in accordance with either of the following methods at the option of the Department:

1. End Product Testing. The testing of hardened concrete for air content will be performed by the Materials Bureau on 100 mm diameter cores, drilled by the manufacturer under the supervision of a Department representative.

2. Production Testing. The testing will be performed by the manufacturer, subject to the approval of the Materials Bureau. It will consist of testing the plastic concrete for compliance to the air content required by this specification. The Department reserves the right to test the hardened concrete at any time in which case the manufacturer will drill 100 mm diameter cores at the direction of a Department representative. Sampling and test procedures for this option may be obtained from the Materials Bureau.

SHIPPING. No units will be considered for shipment unless the units are free from defects as noted under Pipe Repair in this specification and according to the written procedural directives of the Materials Bureau.

OTHER REQUIREMENTS. In addition to the above tests, the pipe will be subject to inspection at any time prior to placing, and rejection may be made through failure to comply with the criteria shown in the written procedural directives of the Materials Bureau.

BASIS OF ACCEPTANCE. Pipe units will be accepted in stock lot quantities at the manufacturing location in accordance with the written procedural directives of the Materials Bureau.

706-03 REINFORCED CONCRETE ELLIPTICAL PIPE

SCOPE. This specification covers the material and quality requirements for both horizontal and vertical elliptical reinforced concrete pipe of the classes HE-II, HE-III, HE-IV, VE-IV, VE-V, VE-VI for use as culvert pipe. Pipe designed for placement with the major axis horizontal is designated as horizontal elliptical pipe. Pipe designed for placement with the major axis vertical is designated as vertical elliptical pipe.

GENERAL. The general provisions of §706-02, Reinforced Concrete Pipe, shall apply.

MATERIAL REQUIREMENTS. The following sections of §706-02 shall apply except as modified below: Materials, Drawings, Fabrication, Curing, Repairs, Strength Requirements, Absorption Requirements, and Basis of Acceptance.

In the case of elliptical pipe, the working drawings indicate the equivalent round pipe diameter, rise, span and class. A tolerance of plus or minus 2% from the nominal rise and span of the pipe as shown on the approved working drawing will be permitted.

Variations in laying lengths of two opposite sides of a pipe section shall not be more than 10 mm/m of equivalent diameter, with a maximum of 16 mm in any length of pipe, except where beveled or curved lengths have been specified.

Use concrete pipe joint sealing compound, meeting the specification requirements of §705-16 in the pipe joint.

Each pipe length shall, immediately upon completion of manufacture, be plainly and permanently marked with waterproof paint on the inside of the barrel with the following information:

- Name or trademark of manufacturer.
- Date of manufacture
§706-03

- “NYS Lot No.
- Class and Equivalent round pipe diameter.

All reference to Classes II, III, IV and V under the §706-02, enumerated above, shall be deemed to include all classes of elliptical pipe.

Whenever reference is made under §706-02 to AASHTO M170M and AASHTO M207M shall apply for reinforced Elliptical Concrete Pipe.

**BASIS OF ACCEPTANCE.** Pipe will be accepted in stock lot quantities at the manufacturing location in accordance with procedural directives of the Materials Bureau.

**706-04 PRECAST CONCRETE DRAINAGE UNITS**

**SCOPE.** This specification covers the material and fabrication requirements for precast concrete drainage units including transverse drainage interceptors.

**GENERAL.** Precast concrete drainage units shall be machine made or cast at a manufacturers yard in conformance with these specifications and to the size, shape and requirements shown on the standard sheets or plans. Drainage units shall be manufactured under inspection procedures stipulated by the directives of the Materials Bureau.

**A. Machine-made units** are those made by the following methods:
- Packerhead
- Roller suspension
- Centrifugal
- Machine tamped
- Machine vibrated
- Other methods as defined by the Materials Bureau.

These methods use very low slump concrete and the methods of consolidation produce a dense product with low permeability and good resistance to freeze-thaw damage.

**B. Cast units** are those made from concrete placed and consolidated by conventional equipment.

These units develop resistance to freeze-thaw damage through the use of entrained air in the concrete.

**MATERIAL REQUIREMENTS**

**General.** All materials used in the manufacture of precast concrete drainage units shall conform to the requirements of the specifications following list:

- Frames and Grates 655
- Portland Cement (Types 1,2,or 3) 701-01
- Concrete Repair Material 701-04
- Concrete Grouting Material 701-05
- Coarse Aggregates 703-02
- Concrete Sand 703-07
- Concrete Pipe Joint Sealing Compound 705-16
- Concrete Pipe Joint Elastomeric Gaskets 705-17
- Masonry Mortar 705-21
- Bar Reinforcement, Grade 420 709-01
- Wire Fabric for Concrete Reinforcement 709-02
- Cold Drawn Wire for Conc. Reinforcement 709-09
- Plastic Coated Fiber Blankets (for curing) 711-03
- Membrane Curing Compound (clear w/fugitive dye) 711-05
Bar reinforcement for Transverse Drainage Interceptors shall meet the requirements of §709-04 Epoxy Coated Bar Reinforcement, Grade 420.

The ends of chairs or spacers, used to support or locate reinforcing steel, that may come in contact with the faces of the form shall be made or coated with non-corrosive material.

The manufacturer shall maintain at the manufacturing site a record of materials used and their sources, and a copy of the concrete mix design for a minimum of 3 years following the final payment of the project.

**FABRICATION REQUIREMENTS**

**Drawings.** When working drawings are necessary for the manufacture of precast drainage units, five prints of each drawing shall be submitted to the Engineer for review and approval. Unless otherwise shown in the contract plans, internal unit dimensions shall have a tolerance of ± 10 mm, all other dimensions, including reinforcing steel location, shall have a tolerance of ± 5 mm.

**Round Units.** Precast bases, floors, risers, conical top sections, grade rings and flat slab tops shall conform to the design, dimension and reinforcement requirements of ASTM C478.

The C478 requirements for splices, laps and welds shall not apply. All bar reinforcement steel shall be tied as specified under *A. Tying* below. Tack welding or any other welding of specified bar reinforcement will not be allowed. Welding for cage stability will be permitted provided that redundant steel is added in each direction and tied to the cage. The redundant steel shall be thirty (30) bar diameters, minimum, in length and shall be positioned so that the midpoint is located at the weld.

Wire fabric splices shall be secured by one of the following methods:

**A. Tying.** Under this method the ends shall lap to a length of not less than thirty (30) diameters of the reinforcement and the lap shall contain a longitudinal member. A sufficient number of laps shall be tied to maintain continuity of the cage through the period of placement and curing of the concrete.

**B. Welding.** Each circular member shall be lapped a minimum of 50 mm and welded by one of the following methods:

- Electric arc welding
- Resistance spot welding
- Fusion welding
- Oxyacetylene torch welding

By whichever method the lap is welded, the weld shall develop a minimum of fifty (50) percent of the specified strength of the wire.

**Rectangular Units.** Precast bases, floors, risers, grade rings and flat slab tops shall be fabricated to the dimension and reinforcement details shown on the plans and standard sheets or in accordance with approved drawings when they are required. Splices for all required reinforcement steel shall be as specified under Round Units.

**Concrete**

**A. Mix Requirements.** The manufacturer shall formulate and utilize concrete mixes, for the various drainage units, which meet the following requirements:

- Cement Content, kg/m³, 340 (minimum)
- Compressive Strength:
§706-04

Rectangular Units, MPa, 28 days 25 (minimum)
Round Units, MPa, 28 days 30 (minimum)
Absorption, % (Machine Made Units Only) 8.0 (maximum)
Air Content, % (Cast Units only) 5.0 - 9.0

Coarse Aggregate Gradation:
Cast Round Units ASTM C33, #7 or Type CA1 of Table 501-2
Cast Rectangular Units Type CA1 or CA2 of Table 501-2
Machine Made Units Not specified

The manufacturer may substitute fly ash meeting the requirements of §711-10 up to a maximum of 15 percent of the minimum portland cement by weight.

B. Placement. The forms shall be cleaned and properly assembled before any concrete is placed therein. The transportation and placement of concrete mixture shall be accomplished by methods that will prevent the segregation of the concrete materials and the displacement of the reinforcing steel from its proper position in the form. For cast units the manufacturer shall properly consolidate the concrete by external or internal vibrators or a combination of both.

C. Curing. Drainage units shall be cured by any one of the methods described in the following paragraphs. After removal of forms and before curing begins, units shall be sheltered from direct sunlight and drafts. The curing process shall commence no later than eight hours after the removal of the forms. Curing shall be accomplished to the satisfaction of the Materials Bureau. If at any time curing temperatures fall below the specified minimum for the chosen curing procedure, the curing period shall be increased accordingly. Precast concrete drainage units shall not be subjected to freezing temperatures until the required 28 day compressive strength is achieved, unless otherwise specified or approved by the Director, Materials Bureau.

1. Steam Curing. Units may be placed in a curing chamber, free from outside drafts, and cured in a moist atmosphere maintained at a temperature between 40°C and 75°C, by the injection of steam for a period of not less than 12 hours or, when necessary, for such additional time as may be needed to enable the units to meet the strength requirements. The temperature inside the enclosure shall not be increased or decreased at a rate greater than 20°C per hour. Steam curing shall not commence until at least two hours have elapsed since completion of placement of concrete in the forms. When a curing chamber is not available, units may be placed in an enclosure of canvas and subjected to steam at the temperature and for the time specified above. The enclosure shall be so erected as to allow full circulation of steam around the entire unit. The interior surfaces of the curing room or canvas jackets and the surfaces of the unit shall be entirely moist at all times. The manufacturer shall provide automatic temperature recorders to continuously record the curing temperatures. Steam cured units shall not be exposed to temperatures below freezing until at least 3 days after casting unless otherwise approved by the Director, Materials Bureau.

2. Controlled Atmosphere Curing. This method applies to machine made units only. The units shall be placed in a curing chamber or enclosure as in 1. Steam Curing, for a minimum of 12 hours at a temperature of 10°C or above. The units shall then be cured outdoors for a minimum of seven days. Controlled atmospheric curing will be allowed between April 1 and November 1, unless otherwise approved by the Materials Bureau.

3. Water Spray Curing. Under the conditions of enclosure described in the above paragraph on “Steam Curing”, units may be cured by subjecting them to a continuous fine spray of water in an enclosure maintained at a temperature of not less than 20°C for a period of not less than 72 hours or such additional time as may be necessary to meet the strength requirements.

4. Saturated Cover Curing. The sides and top of each unit shall be covered with heavy burlap or other suitable material saturated with water before applying and kept saturated and at a
temperature of not less than 20°C for 72 hours or such additional time as may be necessary to meet the strength requirements.

5. Membrane Curing Compound. The membrane curing compounds used under this method shall appear on the Department's current Approved List of Membrane Curing Compounds under B. Clear (with fugitive dye). The membrane curing compound shall be applied to the concrete surface within 15 minutes following the finishing operation or form removal, whichever is applicable. The compound shall be applied as per manufacturer's instructions at a minimum coverage rate of 1 L/3.5 m². This method of curing may not be used on any concrete surface which is to have plastic concrete bonded to it. Another approved method of curing shall be used when this condition exists. The application of curing compound is not required on any formed surface if the form is left on until the required 28 day strength is achieved.

6. Other Methods. Other methods of curing are subject to approval by the Director, Materials Bureau.

Joints. Joints between precast riser sections shall be formed with male and female ends so that when the sections are assembled they will make a continuous and uniform unit.

Joint Sealant Materials. Joints between precast sections are to be sealed with flexible watertight Elastomeric Gaskets, Pipe Joint Sealing Compounds, Masonry Mortar, Concrete Grouting Material or Concrete Repair Material meeting the requirements of the Standard Specifications. If elastomeric Gasket Sealers are used then the shape, size and placement shall be recommended by the precast manufacturer.

Steps for Drainage Units. Steps for drainage units shall conform to §725-02 Steps for Manholes. Steps in risers and conical top sections shall be aligned to form a continuous ladder with rungs equally spaced vertically in the completed unit at a maximum distance of 400 mm. Steps shall be embedded into the walls of the section a minimum of 75 mm. If the steps are grouted, the grouting material shall conform to §701-04 Concrete Repair Materials or §701-05 Concrete Grouting Material. If plastic inserts are used for installing steps, they shall be approved by the Materials Bureau.

The rung shall project a minimum clear distance of 100 mm from the walls of the section measured from the point of embedment.

Frames for Grates. Frames cast into the top slab or top of the uppermost riser shall be secured and held in place by a minimum of 4 stirrups or studs per frame, welded to the frame near the corners. Parallel bar frames shall contain shear stud anchors, for the purpose of transferring loads, as required and detailed on the standard sheet for parallel bar grates and frames. Shear stud anchors, when required, shall replace the frame securing stirrups or studs.

Repair. Drainage units that contain minor defects caused by manufacture or mishandling may be repaired. Minor defects shall be considered as those that are small, less than 200 mm diameter holes or spalls that do not penetrate deeper than the steel reinforcement. Repairs shall be made using a concrete repair material conforming to §701-04. The repair shall be finished to the proper shape and cured. It shall withstand a moderate blow with a 450 gram hammer.

Drainage units that have cracks completely through the wall of the unit, honeycombing greater than 150 mm diameter or greater than 15 mm deep, or large spalls are not acceptable and shall not be repaired.

MARKING. The manufacture shall plainly mark each individual piece with permanent waterproof paint on the inside surface. The following information shall be included:

- Name or trademark of manufacturer.
- Date of manufacture.
- NYS DOT Lot No. (“NYS DOT . . “). (Place on End Product Testing Units Only)
- “NYS DOT 706-04”
- Maximum Placement Depth in Meters. (“MPD. .m”) Placed on rectangular drainage units only.
Based on reinforcement and allowable placement depths indicated on the Standard Sheets or plans. Includes base slabs, bases and risers.

- Each flat slab top that doesn’t have an integral frame or a design that readily indicates the top surface shall have the words “INSTALL THIS SIDE UP” placed on its top surface.

**SAMPLING AND TESTING.** The sampling and testing for cast units to assure that the concrete is in conformance with the specification requirements may be performed by one of the following methods as determined by the Department. Machine made units shall be sampled and tested as noted in End Product Testing.

**A. Production Testing.** This testing will be performed by the manufacturer subject to the approval of the Materials Bureau and will consist of testing the plastic concrete for compliance to the air content required by the specifications and casting of concrete cylinders for compressive strength requirements. Test cylinders used to determine the required compressive strength shall be cured with the units they represent. The sampling procedures and test methods may be obtained from the Materials Bureau. Testing frequency will be determined by the Materials Bureau. Testing equipment and facilities shall meet the approval of the Materials Bureau. The Department reserves the right to test the plastic or hardened concrete at any time. If hardened concrete is tested, 100 mm diameter cores shall be drilled by the manufacturer under the supervision of a Department representative. Core holes shall be plugged and repaired in accordance with the requirements of “Repair.”

**B. End Product Testing.** The testing of hardened concrete will be performed by the Materials Bureau on 100 mm diameter cores drilled by the manufacturer under the supervision of a Department representative. Compliance with the specification of stock lots represented by the cores will be determined by the following testing:

1. **Machine Made Units.** Absorption and compressive strength.

2. **Cast Units.** Air content and compressive strength.

Sampling and testing frequency will be determined by the Materials Bureau. Methods of test for air content and compressive strength may be obtained from the Materials Bureau. Absorption testing will be done in accordance with the test method specified in ASTM C497 except that under “Absorption Test” the drying period shall be 48 hours at a temperature of 110°C. The average absorption shall be determined from three specimens and shall not exceed the maximum absorption specified.

Core holes shall be plugged and repaired in accordance with the requirements of “Repair.”

**SHIPPING.** No units will be considered for shipment unless the units are free from defects as noted under “Repairs” of this specification and all specification requirements including the compressive strength requirements are achieved.

**BASIS OF ACCEPTANCE.** Precast concrete drainage units will be accepted in either stock lot quantities or by certification as determined by the Department. The details of the acceptance procedures shall be in accordance with Department directives.

When quality assurance testing is performed by the manufacturer under the provisions of “Production Testing” and the manufacturer's name appears on the Department's Approved List, the precast drainage units may be shipped when the compressive strength requirement is attained. A certification that the unit(s) shipped conform to specification shall include documentation that the reinforcing steel, when required, meets specification requirements, that the reinforcing steel conforms to the size and positioning shown in the contract documents and that the concrete conforms to specifications.

When the precast concrete drainage units are sampled and tested in accordance with End Product Testing, the units will be accepted in stock lot quantities at the manufacturing location. In addition the manufacturer shall supply the Department's representative a certification that the reinforcing steel conforms to the size and positioning shown in the contract documents or required by the specifications.
706-05 POROUS CONCRETE PIPE UNDERDRAIN

SCOPE. This specification covers the material and quality requirements for porous concrete pipe and extra strength concrete porous concrete pipe underdrains.

GENERAL. Porous concrete pipe and extra strength porous concrete pipe shall be manufactured in accordance with approved working drawings and in compliance with details set forth below.

MATERIAL REQUIREMENTS. All materials shall comply with the requirements of §706-02, Reinforced Concrete Pipe, except that reinforcement shall not be used.

Drawings. Drawings shall be furnished in accordance with the provisions of §706-02.

FABRICATION. Porous concrete pipe and extra strength porous concrete pipe shall conform in size and shape to the details shown on the standard sheet for porous concrete pipe underdrain and the approved working drawing.

The inside surface of the pipe shall be straight and true to dimensions with a permissible variation from the true form of not more than 1 1/2 percent. A tolerance of 5% will be permitted in the diameter of the pipe. The wall thickness of the pipe may be greater than shown on the standard sheet, but it shall not be less than 95% of the stipulated wall thickness.

High early strength cement, calcium chloride or any other additive shall not be used unless otherwise approved by the Materials Bureau.

Concrete mix proportions will be such that will produce a concrete mix of such quality that the pipe will conform to the test and design requirements of these specifications.

Each length of pipe shall be clearly marked on the outside with the name or trademark of the manufacturer. Extra strength porous concrete pipe underdrain shall be clearly marked, "Extra Strength".

Curing. All pipe shall be cured in accordance with the provisions of §706-02.

Strength Requirements. The minimum ultimate strength for the size of the pipe being tested shall be as specified on the standard sheet. Requirements of §706-02 shall apply except that no determination of a 0.25 mm crack will be required and the ultimate strength values as determined on full length specimens shall be as specified on the standard sheet.

Infiltration Requirements. Pipe shall be tested for rate of infiltration in accordance with the method of test outlined in AASHTO Designation M176. The minimum rate of infiltration shall not be less than 0.15 liters per minute per millimeters of internal diameter per 300 millimeters of pipe for all sizes.

All tests shall be performed by the manufacturer at their plant and shall be witnessed by a representative of the Department. The number of samples for test shall be as directed by the Materials Bureau.

Other Requirements. In addition to the above tests, the pipe shall be subject to inspection at all times prior to placing and rejection will be made through failure to comply with any of the following conditions:

A. Dimensions. The pipe shall not vary in any dimensions more than permitted by this specification.

B. Fractures or Cracks. The pipe shall have no fractures or cracks passing through the shell or socket of the pipe, except that a single crack not exceeding 50 mm in length at either end of a pipe shall not be considered cause for rejection unless the defect exists in more than 5% of the lot offered for sampling and testing.

C. Quality. There shall be no defects that indicate imperfect mixing and molding.

D. Strength. There shall be no cracks that are sufficient to impair the strength, durability or serviceability of the pipe.
E. **Shape.** The shape of the pipe shall be such that there shall be no variation in alignment of more than 10 mm per linear meter.

**BASIS OF ACCEPTANCE.** The material will be considered for acceptance in stock lot quantities at the manufacturing location in accordance with procedural directives of the Materials Bureau.

In addition, the manufacturer shall furnish the Department representative at the plant a certification for each lot manufactured certifying that all pipe in the lot was manufactured in accordance with the terms of this specification and that the pipe details conform to drawings previously approved by the Department. Pipe shall be considered ready for acceptance when a lot conforms to the indicated test requirements. The manufacturer shall be permitted to retest to determine specification compliance.

Pipe not used within two years after its original acceptance shall be retested by the Department before it can be used.

### 706-06 POLYESTER FORMED IN PLACE PIPE LINER

**SCOPE.** This specification covers the material requirements for polyester formed in place pipe liners used in rehabilitation applications of culverts and storm drains.

**General.** The flexible liner will be fabricated from one or more layers of polyester felt. An impermeable polyurethane or polyvinyl chloride material will be bonded to the outside of the felt liner. Once inverted, the impermeable plastic membrane will become the inside of the pipe liner.

**MATERIAL REQUIREMENTS.** Supply a resin system material conforming to the following:

<table>
<thead>
<tr>
<th>Property</th>
<th>Standard</th>
<th>Required</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tensile Stress, MPa</td>
<td>ASTM D638</td>
<td>20</td>
</tr>
<tr>
<td>Flexural Stress, MPa</td>
<td>ASTM D790</td>
<td>30</td>
</tr>
<tr>
<td>Flexural Modulus, MPa</td>
<td>ASTM D790</td>
<td>1700</td>
</tr>
</tbody>
</table>

**Basis of Acceptance.** Acceptance of this material will be based on the manufacturer’s name appearing on the Approved List for rehabilitation of Culverts and Storm Drains.

### 706-07 REINFORCED CONCRETE PIPE END SECTIONS

**SCOPE.** This specification covers the material and fabrication requirements for reinforced concrete pipe end sections.

**GENERAL.** The general requirements of §706-02, Reinforced Concrete Pipe shall apply.

**MATERIAL REQUIREMENTS**

**General.** The material requirements of §706-02 shall apply except for the modifications indicated in the requirements below:

- Coarse aggregate gradation shall conform to the No. 1 Size Designation in §703-02, Coarse Aggregates, Table 703-04.
- The barrel portion of the end sections shall conform to the applicable provisions for Reinforced Concrete Pipe, Class III, Wall Designation B. However, the three-edge bearing test will not be required. In addition, neither the absorption test nor the compressive strength test will be included as part of the acceptance procedure.

**Concrete Manufacturing.** The manufacturer shall formulate a concrete mix design, with a minimum cement content of 360 kilograms per cubic meter, such that the properties of the concrete meet the following requirements:
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<table>
<thead>
<tr>
<th>Property</th>
<th>Requirement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Air Content, %</td>
<td>5.0-8.0</td>
</tr>
<tr>
<td>Compressive Strength, MPa, Min., 28 days</td>
<td>25</td>
</tr>
</tbody>
</table>

**FABRICATION.** The requirements specified for reinforced concrete cattle pass and concrete proportions do not apply.

**SAMPLING AND TESTING.** Reinforced concrete pipe end sections manufactured under the requirements of this specification shall be separated into specific and identifiable stock lots. The maximum number of sections in a lot shall be in accordance with the Department directives.

The air content of the concrete will be determined with either of the methods in §706-02 Sampling and Testing, C. Wet Cast Reinforced Concrete Pipe, at the Department's option.

**BASIS OF ACCEPTANCE.** Reinforced concrete pipe end sections will be accepted in stock lot quantities at the manufacturing location in accordance with the Department directives and based on:

A. Compliance with air content requirements as determined by Department procedures, and

B. Manufacturer's certification of compliance with the manufacturing and strength requirements may be based on the results of compressive tests performed on cast cylinders representing the concrete mix design shown on the drawing.

**706-08 AND 706-09 (VACANT)**

**706-10 POLYVINYL CHLORIDE PIPE (relining)**

**SCOPE.** This specification covers the material requirements for polyvinyl chloride pipe when used in rehabilitation applications of culverts and storm drains.

**General.** The polyvinyl material from which the pipe and fittings are extruded or molded will not contain any reclaimed, reground or reworked material and will be comprised of virgin polyvinyl resins only. The resins used will meet the requirements contained in this specification. The pipe and fittings will be manufactured in such a manner so that all cross sections will be dense, homogeneous, and free from any imperfections.

**MATERIAL REQUIREMENTS.** The Polyvinyl Chloride pipe materials must conform to ASTM F1803 (Profile Wall) or ASTM F949 (Corrugated). All materials supplied will be clearly marked with the appropriate ASTM as certified.

**Basis of Acceptance.** Acceptance of this material will be based on the manufacturer’s name appearing on the Approved List for Rehabilitation of Culverts and Storm Drains.

**706-11 HIGH DENSITY POLYETHYLENE PIPE (relining)**

**SCOPE.** This specification covers the material requirements for high density polyethylene pipe when used in rehabilitation applications of culverts and storm drains.

**General.** The high density polyethylene material from which the pipe and fittings are extruded will not contain any reclaimed, reground or reworked material and will be comprised of virgin high density polyethylene resins only. The resins used will meet the requirements contained in this specification. The pipe and fittings will be manufactured in such a manner so that all cross sections will be dense, homogeneous, and free from any imperfections.
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MATERIAL REQUIREMENTS. The high density polyethylene pipe material must conform to ASTM F894 (Profile Wall) or ASTM F714 (Smooth Wall). All materials supplied will be clearly marked with the appropriate ASTM as certified.

Basis of Acceptance. Acceptance of this material will be based on the manufacturer's name appearing on the Approved List for rehabilitation of Culverts and Storm Drains.

706-12 SMOOTH INTERIOR CORRUGATED POLYETHYLENE PIPE

SCOPE. This specification covers the material and quality requirements for smooth interior corrugated polyethylene pipe and fittings.

MATERIAL REQUIREMENTS. The polyethylene material for the pipe and fittings shall meet the requirements of A.A.S.H.T.O. M294, Type S or Type SP. In addition, when checked with a 300 mm straight edge the smoothness of the interior liner shall not deviate more than 6 mm.

Basis of Acceptance. For smooth interior corrugated polyethylene pipe the Department requires the submission of Materials Details as defined in §101-02 Definitions of Terms. The manufacturer shall prepare and submit the appropriate material in accordance with the procedural directives of the Materials Bureau. Upon approval by the Materials Bureau, the name of the manufacturer and product along with the reference number and date assigned to the approved Materials Details will be placed on the Approved List. Such products shall then be accepted in stock lot quantities in accordance with the procedural directives of the Materials Bureau.

The supplier shall provide two copies of the approved Materials Details through the Contractor to the Engineer as part of the evidence of acceptability for the material at least 10 days prior to shipment of the product to the job site.

706-13 PERFORATED CORRUGATED POLYETHYLENE UNDERDRAIN TUBING

SCOPE. This specification covers the material and quality requirements for corrugated polyethylene tubing and fittings.

MATERIAL REQUIREMENTS. The corrugated polyethylene tubing and fittings 100 mm thru 250 mm in diameter shall meet the requirements of A.A.S.H.T.O. Designation: M252, Corrugated Polyethylene Drainage Tubing except that tubing manufactured from material meeting A.S.T.M. Designation D1248, Class B, shall also be acceptable.

Corrugated polyethylene tubing and fittings 300 mm in diameter shall meet the requirements of A.A.S.H.T.O. M252 except the pipe stiffness requirement shall be 310 kPa at 5% deflection.

Basis of Acceptance. Acceptance of this material will be based on the manufacturer's name appearing on the Department's Approved List and the manufacturer's certification of compliance with these requirements.

706-14 CORRUGATED INTERIOR POLYETHYLENE PIPE

SCOPE. This specification covers the material and quality requirements for corrugated interior polyethylene pipe and fittings.

MATERIAL REQUIREMENTS. The polyethylene material for the pipe and fittings shall meet the requirements of A.A.S.H.T.O. M294, Type C.

Basis of Acceptance. Corrugated interior polyethylene pipe will be accepted on the basis of the manufacturer's name appearing on the Department's Approved List and the manufacturer's certification of compliance with these requirements.
706-15 PVC PLASTIC DRAIN PIPE SYSTEM

SCOPE. This specification covers the material and quality requirements for poly (vinyl chloride) plastic drain pipe, fittings and solvent cement when used as a drain pipe system.

GENERAL. The PVC material from which the pipe and fittings shall be extruded or molded shall not contain any reclaimed, reground or reworked material whatsoever, but shall be compounded from virgin PVC resins, plasticizers, stabilizers, and such materials that when compounded, it shall meet the requirements contained in this specification.

The pipe and fittings shall be extruded or molded in such a manner that all cross sections shall be dense, homogeneous, and free from porosity or other imperfections.

The solvent cement shall be a solution of unplasticized PVC tetrahydrofuran and cyclohexanone.

MATERIAL REQUIREMENTS. The PVC material for the pipe and fittings shall meet the requirements of ASTM D1784 for Rigid Poly (Vinyl Chloride) Compounds and Chlorinated Poly (Vinyl Chloride) Compounds, Class 12444-B.

The molded or extruded pipe shall conform to ASTM D1785 for Poly (Vinyl Chloride) (PVC) Plastic Pipe, Schedule 80, PVC 1120.

The molded or extruded fittings shall conform to ASTM D2467 for Socket-Type Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80, PVC I.

The solvent cement shall meet the requirements of ASTM D2564 for Solvent Cements for Poly (Vinyl Chloride) (PVC) Plastic Pipe and Fittings.

DIMENSIONS. The dimensions and tolerances of the pipe and fittings shall conform to ASTM D1785 and D2467 respectively.

<table>
<thead>
<tr>
<th>Nominal Size</th>
<th>Outside Diameter (Millimeters)</th>
<th>Inside Diameter (Millimeters)</th>
<th>Wall Thickness Schedule 80 (Millimeters)</th>
</tr>
</thead>
<tbody>
<tr>
<td>100</td>
<td>114.3</td>
<td>97.2</td>
<td>8.6</td>
</tr>
<tr>
<td>125</td>
<td>141.3</td>
<td>122.3</td>
<td>9.5</td>
</tr>
<tr>
<td>150</td>
<td>168.3</td>
<td>146.3</td>
<td>11.0</td>
</tr>
<tr>
<td>200</td>
<td>219.1</td>
<td>193.7</td>
<td>12.7</td>
</tr>
<tr>
<td>250</td>
<td>273.1</td>
<td>242.9</td>
<td>15.1</td>
</tr>
</tbody>
</table>

MARKING. All material furnished shall be plainly marked in accordance with ASTM D1785, D2467, and D2564 for the pipe, fittings and solvent cement, respectively.

Basis of Acceptance. All pipe, fittings and solvent cement shall be accepted on the basis of the manufacturer's certification that the material conforms to this specification.

706-16 CELLULAR POLYSTYRENE PROTECTIVE COVER

SCOPE. This specification covers the material and quality requirements for cellular polystyrene when used as protective cover for pipes.

GENERAL. The protective cover shall be fabricated from rigid extruded cellular polystyrene such that it shall meet the requirements contained in this specification.

The polystyrene shall be extruded in such manner that all cross sections shall be uniform and free from imperfections.

MATERIALS REQUIREMENTS. The fabricated cellular polystyrene protective cover shall meet the following requirements:
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<table>
<thead>
<tr>
<th>Property</th>
<th>ASTM Test Procedure</th>
<th>Requirement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Density, kg/m³</td>
<td>D1622</td>
<td>32 ± 2</td>
</tr>
<tr>
<td>Compressive Strength, kPa</td>
<td>D1621</td>
<td>205 ± 35</td>
</tr>
<tr>
<td>Flammability</td>
<td>D1692</td>
<td>Self-Extinguishing</td>
</tr>
</tbody>
</table>

**DIMENSIONS.** The protective cover shall be fabricated in cylindrical half-sections of any convenient length for application to straight pipe and half-sections of suitable shape and length to protect any non-linear portions of the pipe or fittings.

The thickness of the protective cover shall be maintained within ±1.5 mm of the thickness shown on the plans.

The protective cover shall be fabricated such that it mates with the pipe without leaving gaps at the seams. It shall have the following maximum clearance between outside diameter of nominal pipe and inside diameter of protective cover:

<table>
<thead>
<tr>
<th>Nominal Pipe Size, Millimeters</th>
<th>Maximum Clearance, Millimeters</th>
</tr>
</thead>
<tbody>
<tr>
<td>3 to 38 incl.</td>
<td>.397</td>
</tr>
<tr>
<td>50 to 100 incl.</td>
<td>.794</td>
</tr>
<tr>
<td>125 to 280 incl.</td>
<td>1.984</td>
</tr>
<tr>
<td>300 and over</td>
<td>2.381</td>
</tr>
</tbody>
</table>

**BASIS OF ACCEPTANCE.** All protective cover furnished shall be marked with the following information: manufacturer's name, type of material, and nominal size.

All protective cover shall be accepted on the basis of the Manufacturer's certification that the material conforms to this specification.

**706-17 PRECAST CONCRETE BOX CULVERTS**

**SCOPE.** This specification covers the material and quality requirements for precast concrete box culverts.

**MATERIAL REQUIREMENTS.** The Material Requirements contained in §704-03 shall apply except as noted herein.

The concrete used to fabricate precast concrete box culverts shall have a minimum compressive strength of 35 MPa @ 28 days. Joint gasket material shall meet the requirements of ASTM D 1056, Grade #2A1 or #2A2. Reinforcing bar connectors shall meet the requirements of §709-10 Mechanical Connectors for Reinforcing Bar Splices (Epoxy Coated).

**FABRICATION.** Fabrication requirements contained in §704-03, along with the following shall apply.

**A. Design.** When the contract plans contain complete design details for the culvert, alternate designs will not be considered. When the contract plans do not contain complete design details for the culvert the Contractor shall be responsible for providing them. Precast concrete box culvert designs, submitted by the Contractor, shall meet the requirements of the NYSDOT Reinforced Concrete Box Culvert Design Guidelines. Design details for bridge size culverts shall also include load rating information. All box culvert designs shall be submitted by the Contractor, to the Department, for approval. The processing, approval and transmittal of box culvert designs will be in accordance with procedural directives of the Materials Bureau. Designs shall be submitted at least 45 days prior to the start of fabrication and shall include a complete set of working drawings and a complete set of design calculations. The drawings and design calculations shall be stamped by a Professional Engineer licensed, and registered, to practice in New York State. When the contract plans contain a complete design for the culvert, working drawings are still required. However, they do not have to be stamped by a Professional Engineer and design calculations are not required.
B. Working Drawings. Working drawings shall include complete and accurate details for connecting headwalls, cut-off walls, wingwalls, apron slabs and when required, bridge railing to the box culvert. Working drawings for bridge size culverts shall also include load rating information. Working drawings, and when required design calculations, shall be submitted to the Department for approval at least 45 days prior to the start of fabrication. The processing, approval and transmittal of working drawings will be in accordance with procedural directives of the Materials Bureau.

C. Reproducible Drawings. Reproducible drawings are required for bridge size culverts only. Upon receipt of approved working drawings from the Materials Bureau, the manufacturer shall prepare a reproducible drawing, incorporating all changes and corrections shown on the approved working drawing. Reproducible drawings shall be submitted to the Materials Bureau for final approval.

Reproducible drawings shall be neatly drawn and clearly legible to produce microfilm negatives. The drawings shall be made in ink or reproduced from the working drawings, on tracing cloth or Mylar of acceptable quality. Reproducible drawings shall be cut to a standard size of 560 mm x 860 mm (nominal) and arranged to conform to the contract drawings. The margin line shall be drawn 13 mm from the top, bottom, and right-hand edges and 50 mm from the left-hand edge to permit binding. A space 75 mm by 280 mm, and parallel to the length of the sheet shall be reserved in the lower right-hand corner for title and approval signature. Each reproducible drawing shall have an identical (top right) corner box to the one shown on the contract drawings. The sheets shall be arranged so that, as far as possible, the notes will appear above each other near the right edge of the sheet.

D. General. Unless noted otherwise in the contract plans or approved working drawings the concrete cover over reinforcing steel shall be 25 mm minimum on the walls, floor slab and roof slab. When fill heights over the box culvert are less than 600 mm the concrete cover on the outside face of the roof slab shall be 50 mm minimum and all reinforcing steel in the top mat of the roof slab shall be epoxy coated or the concrete shall contain corrosion inhibitor.

Fill heights shall be measured from the top of pavement to the top of the culvert roof slab. Details for connecting headwalls, cut-off walls, wingwalls, apron slabs and when required, bridge railing to the box culvert shall be as shown in the contract plans or approved working drawings. Precast concrete box culvert sections shall be fabricated with a female joint on the upstream end and male joint on the downstream end. Joint depth shall be a minimum of 50 mm and a maximum of 105 mm. The ends of longitudinal reinforcing steel shall have 15 mm minimum concrete cover at the mating surface of the joint. The circumferential reinforcing steel shall have 25 mm minimum concrete cover, as measured to the outermost bars, at the mating surface of the joint. When interferences occur which prevent this, the concrete cover shall be increased accordingly as shown on the approved working drawings. Joints shall be fabricated such that when box culvert sections are fully drawn together the gap between adjacent culvert sections is 20 mm maximum. The outside mating surface of the joint shall have a continuous 25 mm x 25 mm gasket installed at the precast plant.

E. Corrosion Inhibitor. Corrosion inhibitor may be used in lieu of epoxy coated reinforcing. When corrosion inhibitor is selected for use, it shall be clearly noted on the working drawings and shall be used in all precast units produced to those drawings.

The corrosion inhibitor shall consist of a calcium nitrite solution as approved by the Director, Materials Bureau, containing 30 ±1% calcium nitrite solids by weight and weighing 1.27 ±0.01 kilograms per liter. A representative one liter sample, from each delivery of corrosion inhibitor intended for Department use, shall be taken at the precast plant for acceptance testing. Samples shall be taken by the Department's representatives as directed by the Materials Bureau. The Materials Bureau shall be permitted 14 days to complete the evaluation of each sample.

The calcium nitrite, which acts as an accelerator, may be used in conjunction with compatible admixtures to control setting time and workability of the concrete, however the use of a formulation of calcium nitrite solution which includes a set control ingredient may be used if setting times and increased water demands are of concern, consult the manufacturer of the product. The

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corrosion inhibitor shall be added to the mix immediately after air entraining and retarding admixtures have been introduced into the batch. The corrosion inhibitor shall be added to the concrete as an aqueous solution at a dosage rate of 20.0 liters per cubic meter.

An automated corrosion inhibitor dispensing system shall be required. The dispensing system shall meet the following requirements:

- Delivery accuracy of ±3% (by weight or volume)
- Program Quantity (liters, nearest tenth)
- System interlocks
- Print requirements:
  - Project number and/or batch number
  - Date and time
  - Delivered quantity (liters, nearest tenth)

Calibration shall be in accordance with procedures approved by the Director, Materials Bureau.

When a batching problem exists or is perceived, the Department reserves the right to test the hardened concrete at any time to verify the quantity of calcium nitrite present. Units with less than the specified amount of calcium nitrite shall be subject to rejection. If hardened concrete is tested, 100 mm diameter cores shall be drilled by the manufacturer under the supervision of a Department representative. Cores shall be a minimum of 100 mm in length unless otherwise approved by the Materials Bureau. Core holes shall be plugged and repaired in accordance with the requirements of repair indicated below.

F. Dimensional Tolerances. The dimensional tolerances contained in §704-03 shall apply except as noted herein:

- Internal and external unit dimensions shall not vary by more than 10 mm from the design dimensions
- Slab and wall thickness shall not vary from the design dimension by more than 5 mm for thicknesses less than 250 mm or 10 mm for thicknesses of 250 mm or greater
- The length of section shall not vary more than 10 mm from the design dimension
- Variations in laying lengths of two opposite surfaces of the box section shall not be more than 10 mm.

Curing. The Curing requirements contained in §704-03 shall apply.

Repair. The Repair requirements contained in §704-03 shall apply, except as noted herein. Minor defects in the mating surface of the joint, that do not come in contact with the joint gasket material and are 5 mm or less in depth, do not require repair.

SAMPLING AND TESTING. The Sampling and Testing requirements contained in §704-03 shall apply.

SHIPPING. The Shipping requirements contained in §704-03 shall apply.

BASIS OF ACCEPTANCE. The Basis of Acceptance requirements contained in §704-03 shall apply.

706-18 PERFORATED POLYVINYL CHLORIDE UNDERDRAIN PIPE

SCOPE. This specification covers the material and quality requirements for smooth-wall perforated polyvinyl chloride (PVC) plastic pipe, couplings and fittings intended for use in underdrains.

MATERIAL REQUIREMENTS. Perforated polyvinyl chloride underdrain pipe and fittings shall conform to A.A.S.H.T.O. M278 Class PS46.

BASIS OF ACCEPTANCE. Acceptance of the perforated polyvinyl chloride underdrain pipe will be based on the manufacturer's certification of compliance with these specifications.