715-R-574 MANDREL TESTING OF THERMOPLASTIC PIPES

(Revised 03-18-10)

The Standard Specifications are revised as follows:

SECTION 715, BEGIN LINE 38, DELETE AND INSERT AS FOLLOWS:

(a) Type 1 Pipe

Type 1 pipe shall be used for culverts under mainline pavement and public road approaches *and shall be in accordance with the following:*

Clay Pipe, Extra Strength.....907.08
Corrugated Aluminum Alloy Pipe and Pipe-Arches.....908.04
Corrugated Polyethylene Pipe, Type S .....~~907.19~~*
Corrugated Steel Pipe and Pipe-Arches 908.02
Non-Reinforced Concrete Pipe, Class 3.....907.01
Polymer Precoated Galvanized Corrugated Steel
Pipe and Pipe-Arches.....908.08
Profile Wall Polyvinyl Chloride Pipe .....~~907.22~~*
Reinforced Concrete Horizontal Elliptical Pipe.....907.03
Reinforced Concrete Pipe 907.02
Ribbed Polyethylene Pipe .....~~907.20~~*
Smooth Wall Polyethylene Pipe.....~~907.21~~*
Smooth Wall Polyvinyl Chloride Pipe.....~~907.23~~*
Structural Plate Pipe and Pipe-Arches 908.09

* *All thermoplastic pipes shall be from the Department's list of approved thermoplastic pipe and pipe liner in accordance with 907.16.*

(b) Type 2 Pipe

Type 2 pipe shall be used for storm sewers *and shall be in accordance with the following:*

Clay Pipe, Extra Strength.....907.08
Corrugated Polyethylene Pipe, Type S .....~~907.19~~*
Fully Bituminous Coated and Lined Corrugated Steel
Pipe and Pipe-Arches.....908.13
Non-Reinforced Concrete Pipe, Class 3.....907.01
Polymer Precoated Galvanized Corrugated Steel
Pipe and Pipe-Arches.....908.08
Profile Wall Polyvinyl Chloride Pipe .....~~907.22~~*
Reinforced Concrete Horizontal Elliptical Pipe.....907.03
Reinforced Concrete Pipe 907.02
Ribbed Polyethylene Pipe .....~~907.20~~*
Smooth Wall Polyethylene Pipe.....~~907.21~~*
Smooth Wall Polyvinyl Chloride Pipe.....~~907.23~~*

* *All thermoplastic pipes shall be from the Department's list of approved thermoplastic pipe and pipe liner in accordance with 907.16.*

(c) Type 3 Pipe

Type 3 pipe shall be used for culverts under all drives and field entrances. All Type 1 pipe materials are acceptable.

(d) Type 4 Pipe

Type 4 pipe shall be used for drain tile and longitudinal underdrains *and shall be in accordance with the following:*

Clay Pipe** 907.08
Corrugated Polyethylene Drainage Tubing.....~~907.17~~*
Corrugated Polyethylene Pipe, Type S** .....~~907.19~~*
Corrugated Polyethylene Pipe, Type SP .....~~907.19~~*
Drain Tile** 907.11
Non-Reinforced Concrete Pipe 907.01
Perforated Clay Pipe** 907.09
Perforated Polyvinyl Chloride Semicircular Pipe .....~~907.18~~*
Profile Wall Polyvinyl Chloride Pipe .....~~907.22~~*

* *All thermoplastic pipes shall be from the Department's list of approved thermoplastic pipe and pipe liner in accordance with 907.16.*

** These materials shall be used for drain tiles only.

(e) Type 5 Pipe

Type 5 pipe shall be used for broken-back pipe runs where coupled or jointed pipe is desirable *and shall be in accordance with the following:*

Corrugated Aluminum Alloy Pipe and Pipe-Arches.....908.04
Corrugated Polyethylene Pipe, Type S .....~~907.19~~*
Corrugated Steel Pipe and Pipe-Arches 908.02
Fully Bituminous Coated and Lined Corrugated
Steel Pipe and Pipe-Arches.....908.13
Polymer Precoated Galvanized Corrugated Steel
Pipe and Pipe-Arches.....908.08
Profile Wall Polyvinyl Chloride Pipe .....~~907.22~~*
Ribbed Polyethylene Pipe .....~~907.20~~*
Smooth Wall Polyethylene Pipe.....~~907.21~~*
Smooth Wall Polyvinyl Chloride Pipe.....~~907.23~~*

* *All thermoplastic pipes shall be from the Department's list of approved thermoplastic pipe and pipe liner in accordance with 907.16.*

(f) Slotted Drain Pipe

Slotted drain pipe shall be used to drain paved median and concrete gutter areas. Slotted drain pipe shall be in accordance with 908.14.

(g) Slotted Vane Drain Pipe

Slotted vane drain pipe shall be ~~smooth wall polyvinyl chloride pipe~~ in accordance with ~~907.23~~ *908.14.* ~~The slotted vane drain casting shall be in accordance with 910.05(b). The finish shall be standard black asphalt emulsion. Individual units shall have a minimum weight (mass) of 155 lbs (70 kg).~~

(h) End Bent Drain Pipe

End bent drain pipe shall be perforated profile wall polyvinyl chloride pipe ~~in accordance with 907.22~~ or perforated smooth wall polyvinyl chloride pipe ~~in accordance with 907.23~~ *from the Department's list of approved thermoplastic pipe and pipe liner in accordance with 907.16.*

(i) Underdrain Outlet Pipe

Pipe shall be ~~in accordance with 907.22 or 907.24~~ *profile wall polyvinyl chloride pipe or smooth wall pipe for outlets from the Department's list of approved thermoplastic pipe and pipe liner in accordance with 907.16.*

SECTION 715, BEGIN LINE 315, DELETE, AND INSERT AS FOLLOWS:

All pipes, except underdrains, will be visually inspected for acceptance a minimum of 30 days after the completion of backfill operations. Pipes that cannot be visually inspected shall be video inspected for acceptance in accordance with 718.07. The Engineer will determine the sections of pipe to be video inspected. *A copy of the video inspection shall be provided in a format acceptable to the Engineer prior to performing the mandrel testing.*

~~After the visual or video inspection, all polyethylene and smooth wall polyvinyl chloride pipes 36 in. (900 mm) or less in pipe pay item diameter shall be mandrel tested. The mandrel shall be a go/no go mandrel with a minimum of nine arms or prongs and a diameter of 5% less than the pipe pay item diameter. If the mandrel does not pass through the pipe when pulled by hand or the mandrel damages the pipe, the deficient pipe shall be removed, replaced, and mandrel tested a minimum of 30 days after the backfill has been replaced.~~

After the visual or video inspection, the Contractor shall check pipe deflection by performing a mandrel test for all pipes manufactured from materials listed in the following table or as otherwise directed.

PIPES REQUIRED TO BE MANDREL TESTED			
Pipe Material	*Standard Specifications*	*AASHTO*	*ASTM*
Corrugated Polyethylene Pipe	*907.19*	*M 294*	
Ribbed Polyethylene Pipe	*907.20*		*F 894*
Smooth Wall Polyethylene Pipe	*907.21*		*F 714*
*Profile Wall Polyvinyl Chloride Pipe**	*907.22*	*M 304*	
Smooth Wall Polyvinyl Chloride Pipe	*907.23*	*M 278*	*F 679*

* *Mandrel testing will not be required for profile wall polyvinyl chloride pipe in accordance with 907.22 that also is in accordance with ASTM F 949.*

The mandrel shall have a minimum of nine arms or prongs and a diameter that is 95% of the nominal pipe diameter. The Contractor shall provide a proving ring that is 95% of the nominal pipe diameter for each mandrel.

The Contractor shall pull the mandrel through the pipe by hand. If the mandrel does not pass through the pipe, the Contractor shall measure and report the minimum diameter of the deficient pipe to the Engineer.

If the minimum diameter of the deficient pipe is between 92.5% and 95.0% of the nominal pipe diameter, the Contractor shall provide an evaluation of the deficient pipe prepared by a professional engineer. The evaluation shall consider the severity of the deflection and its effects on structural integrity, environmental conditions, and the design service life of the pipe. A report summarizing the evaluation and including the professional engineer's recommendation for acceptance, remediation, or replacement of the pipe shall be submitted to the Engineer for final determination.

If the minimum diameter of the deficient pipe is equal to or less than 92.5% of the nominal pipe diameter, the deficient pipe shall either be replaced or a remediation plan shall be prepared by a professional engineer and submitted to the Engineer for final determination.

The deficient pipe shall be replaced if the professional engineer's remediation plan recommends replacement of the pipe or if the pipe has been damaged.

Deficient pipe shall at a minimum be replaced between the nearest pipe joints or to the nearest structure. Replaced or remediated pipe sections shall be mandrel tested a minimum of 30 days after the completion of backfill operations.

SECTION 715, BEGIN LINE 458, DELETE, AND INSERT AS FOLLOWS:

~~Mandrel testing of polyethylene and smooth wall polyvinyl chloride pipes 36 in. (900 mm) or less in pipe pay item diameter will not be measured for payment.~~

SECTION 715, BEGIN LINE 463, DELETE AND INSERT AS FOLLOWS:

715.14 Basis of Payment

The accepted quantities of pipe will be paid for at the contract unit price per linear foot (meter) for pipe of the type, shape, and size specified, complete in place.

Pipe end sections, concrete anchors, and safety metal end sections will be paid for at the contract unit price per each for the size specified, complete in place. A concrete anchor attached at one end of twin pipes will be paid for as two concrete anchors. A concrete anchor attached at one end of triple pipes will be paid for as three concrete anchors. ~~Structure backfill will be paid for in accordance with 211.10. If utilized as a substitute for structure backfill or if used to backfill thermoplastic pipes fabricated of non-hydrostatic design basis resins, flowable backfill will be paid for as structure backfill. Otherwise, flowable backfill will be paid for in accordance with 213.09.~~

SECTION 715, BEGIN LINE 649, DELETE AND INSERT AS FOLLOWS:

The cost of providing ~~the~~ video inspection equipment, technician, ~~videotapes, or computer disks~~*and a copy of the video inspection* shall be included in the cost of ~~the~~ video inspection for pipe. ~~No additional payment will be made for repair or removal of pipes, backfill, the video re-inspection of the repairs or replaced pipe, and all other work associated with the repair or removal of unaccepted pipes.~~

No additional payment will be made for repair, remediation, or replacement of pipes, backfill, video inspection of the repaired, remediated, or replaced pipe, and all other work associated with the repair, remediation, or replacement of unacceptable pipes.

The cost of mandrel testing shall be included in the cost of the pipe.

SECTION 716, BEGIN LINE 81, DELETE AND INSERT AS FOLLOWS:

716.02 Materials

Materials shall be in accordance with the following:

Clay Pipe, Extra Strength	907.08
Polyvinyl Chloride Pipe	~~907.23~~*
Reinforced Concrete Pipe	907.02
Smooth Wall Polyethylene Pipe	~~907.21~~*
Steel Pipe	908.11
Water	913.01
Cellular Grout	725

* *All thermoplastic pipes shall be from the Department's list of approved thermoplastic pipe and pipe liner in accordance with 907.16.*

SECTION 718, BEGIN LINE 9, DELETE AND INSERT AS FOLLOWS:

718.02 Materials

Materials shall be in accordance with the following:

Coarse Aggregate, Class E or Higher, Size No. 8 or 9	904
Concrete, Class A	702
Geotextile for Underdrains	918.03
Reinforcing Bars	910.01
Sod, including Nursery Sod	621
Structure Backfill	904
Underdrain Pipe	715.02(d)
Underdrain Outlet Pipe	~~907.22, 907.24~~ *

* *All thermoplastic pipes shall be from the Department's list of approved thermoplastic pipe and pipe liner in accordance with 907.16.*

SECTION 907, BEGIN LINE 137, DELETE AND INSERT AS FOLLOWS:

907.16 ~~P~~*Thermo*lastic Pipe ~~Manufacturer~~ Requirements

A list of approved ~~P~~*thermo*plastic ~~P~~*p*ipe *and pipe liner*~~, Fittings, Solvent Cement, and Elastomeric Seals~~ will be maintained by the Department. The list will specify the manufacturer, *and thermo*plastic pipe~~, solvent cement, or elastomeric seals~~ designation. All of these materials shall comply with the applicable AASHTO or ASTM requirements *listed in the following table* and will only be accepted from qualified manufacturers. The manufacturer is defined as the plant which produces the *thermo*plastic pipe~~, fittings, solvent cements, or elastomeric seals~~. The manufacturer shall become qualified by establishing a history of satisfactory quality control of these materials as evidenced by the test results performed by the manufacturer's testing laboratory.

~~Manufacturers requesting to be qualified to supply plastic pipe, fittings, solvent cements, or elastomeric seals shall submit the following to the Materials and Tests Division.~~

~~(a) a quality control plan which encompasses all aspects of the production process starting with the raw materials and concluding with the shipment of the finished product. The quality control plan shall provide for a 95% or greater statistical assurance that the materials will be in accordance with the specifications, and include type and frequency of sampling and testing;~~

~~(b) documentation indicating that the manufacturer's testing laboratory is in accordance with the provisions of AASHTO R 18;~~

~~(c) a monthly summary of all test results for the previous 12 months production for each type of plastic pipe, fittings, solvent cements and elastomeric seals;~~

~~(d) a material safety data sheet for each material produced; and~~

~~(e) to maintain qualification, the manufacturer shall submit to the Materials and Tests Division a monthly summary of all tests for each type of pipe, pipe fittings, solvent cements, and elastomeric seals produced. If a specific type of pipe, pipe fitting, solvent cement, or elastomeric seals is not manufactured in a given month, the monthly submittal shall state: "No type _____ pipe, pipe fitting, solvent cement, or elastomeric seals was manufactured during the month of _____, 20__".~~

~~The manufacturer shall provide the type of certification specified in the Frequency Manual and in accordance with 916 which designates that hydrostatic design basis, HDB, rated resins or non-HDB rated resins were used in the manufacture of the pipe and fittings.~~

SUMMARY OF THERMOPLASTIC PIPE SPECIFICATION REQUIREMENTS				
Pipe Material	*Standard Specifications*	*AASHTO*	*ASTM*	*Manufacturer Requirements*
Corrugated Polyethylene Drainage	*907.17*	*M 252*		*ITM 806, Procedure A*
Perforated Polyvinyl Chloride Semicircular	*907.18*		*D 3034*	*ITM 806, Procedure A*
Corrugated Polyethylene Pipe	*907.19*	*M 294*		*ITM 806, Procedure O*
Ribbed Polyethylene Pipe	*907.20*		*F 894*	*ITM 806, Procedure A*
Smooth Wall Polyethylene Pipe	*907.21*		*F 714*	*ITM 806, Procedure A*

Profile Wall Polyvinyl Chloride Pipe	*907.22*	*M 304*	*F 949*	*ITM 806, Procedure A*
Smooth Wall Polyvinyl Chloride Pipe	*907.23*	*M 278*	*F 679*	*ITM 806, Procedure A*
Type PSM Polyvinyl Chloride Pipe and	*907.24(a)*		*D 3034*	*ITM 806, Procedure A*
Schedule 40 Polyvinyl Chloride Pipe	*907.24(b)*		*D 1785*	*916, Type C Cert.*

907.17 Corrugated Polyethylene Drainage Tubing

Tubing and fittings shall be in accordance with AASHTO M 252. Perforations shall be required for tubing used as a longitudinal underdrain. Qualification requirements for the manufacturers shall be in accordance with ~~907.16~~ *ITM 806, Procedure A*.

907.18 Perforated Polyvinyl Chloride Semicircular Pipe

Perforated polyvinyl chloride semicircular pipe may be used as an alternate to 6 in. (150 mm) or less diameter pipe or tile. Pipe shall be in accordance with ASTM D 3034, SDR 35. This semicircular pipe shall have a smooth top and a smooth, semicircular bottom, nominally 4 5/8 in. (118 mm) in diameter, with perforations uniformly distributed along the top of the bottom section in accordance with AASHTO M 252 perforation requirements. The top section shall extend a minimum of 1/2 in. (13 mm) beyond the top of the semicircular section. The top section shall be approximately 6 3/8 in. (162 mm) wide including the sloping overhangs on each side. Qualification requirements for the manufacturers shall be in accordance with ~~907.16~~ *ITM 806, Procedure A*.

907.19 Corrugated Polyethylene Pipe

Pipe and fittings shall be in accordance with AASHTO M 294. ~~The compound used in manufacturing this pipe shall have a minimum cell class in accordance with 335420C as shown in ASTM D 3350.~~ Qualification requirements for the manufacturers shall be in accordance with ~~907.16~~ *ITM 806, Procedure O*.

907.20 Ribbed Polyethylene Pipe

Pipe and fittings shall be in accordance with ASTM F 894 ~~for the specified sizes~~. Qualification requirements for the manufacturers shall be in accordance with ~~907.16~~ *ITM 806, Procedure A*.

907.21 Smooth Wall Polyethylene Pipe

Pipe shall be in accordance with ASTM F 714 for nominal diameters of 39 in. (1000 mm) or less. Fittings shall be in accordance with ASTM F 1055. The pipe sizes shall be in accordance with ISO sizing system. The pipe dimension ratio shall be 26 or less. ~~The compound used in manufacturing this type of pipe shall have a minimum cell class in accordance with 335434C as shown in ASTM D 3350~~. Qualification requirements for the manufacturers shall be in accordance with ~~907.16~~ *ITM 806, Procedure A*.

907.22 Profile Wall Polyvinyl Chloride Pipe

Pipe and fittings shall be in accordance with AASHTO M 304 *or ASTM F 949* ~~for nominal diameters of 36 in. (900 mm) or less~~. Perforations shall be required when used as a longitudinal underdrain or end bent drain pipe. Qualification requirements for the manufacturers shall be in accordance with ~~907.16~~ *ITM 806, Procedure A.*

907.23 Smooth Wall Polyvinyl Chloride Pipe

Pipe and fittings shall be in accordance with AASHTO M 278 for pipe sizes 4 in. through 15 in. (100 mm through 375 mm), and ASTM F 679 for pipe sizes 18 in. through 27 in. (450 mm through 675 mm). ~~The compound used in manufacturing pipe shall have a minimum cell class in accordance with 12454C as shown in ASTM D 1784.~~ Qualification requirements for the manufacturers shall be in accordance with ~~907.16~~ *ITM 806, Procedure A.*

907.24 Smooth Wall Pipe for Outlets

Pipe and pipe fittings shall be smooth wall, non-perforated plastic pipe. Qualification requirements for the manufacturers shall be in accordance with ~~907.16~~ *ITM 806, Procedure A.*

(a) Type PSM Polyvinyl Chloride Pipe and Fittings

Pipe and fittings shall be in accordance with ASTM D 3034, SDR 23.5.

(b) Schedule 40 Polyvinyl Chloride Pipe

Pipe shall be in accordance with ASTM D 1785 and shall have a minimum pipe stiffness of 150 psi (1030 kPa) at 5% deflection when determined in accordance with ASTM D 2412. *Material furnished under this specification shall be covered by a Type C Certification in accordance with 916 and shall reference ASTM D 1785 in the product printline.*

907.25 Thermoplastic Pipe Liners

Thermoplastic pipe liners shall be high density polyethylene or polyvinyl chloride pipe with sufficient rigidity to withstand the installation operation and shall exhibit a minimum amount of distortion. The liner shall be free from visible cracks, holes, foreign inclusions, or other defects. Thermoplastic pipe liners may be added to the Department's approved list by completing the requirements of ITM 806, Procedure A.

(a) Solid Wall HDPE Pipe Liner

Solid wall HDPE pipe liner shall be in accordance with ASTM F 714. The maximum standard dimension ratio, SDR, for the liner as defined in ASTM F 412 shall be 32.5. ~~The resin used in the fabrication of the liner shall have a minimum cell classification of 345464C as shown in ASTM D 3350.~~

A 12 in. (300 mm) section of the liner shall show no evidence of splitting, cracking, or breaking when compressed between parallel plates to 40% of its outside diameter within 2 to 5 min.

(b) Profile Wall HDPE Pipe Liner

Profile wall HDPE pipe liner shall be in accordance with ASTM F 894. The minimum liner ring stiffness constant, RSC, shall be 100. ~~The resin used in the~~

~~fabrication of the liner shall have a minimum cell classification of 345434C as shown in ASTM D 3350.~~

(c) Profile Wall PVC Pipe Liner

Profile wall PVC pipe liner shall be in accordance with ASTM F 949~~, with the exception that PVC material with a minimum cell classification of 12454B as shown in ASTM D 1784 is added to the list of acceptable PVC materials~~.

907.26 Solvent Cements for Polyvinyl Chloride Pipe and Pipe Fittings

Solvent cement for polyvinyl chloride pipe and fittings shall be in accordance with ASTM D 2564. ~~Qualification requirements for the manufacturers of this material shall be in accordance with 907.16~~*Material furnished under this specification shall be covered by a Type C Certification in accordance with 916.*

907.27 Elastomeric Seals

Elastomeric seals for joining plastic pipe shall be in accordance with ASTM F 477. ~~Qualification requirements for the manufacturers of this material shall be in accordance with 907.16.~~ *Material furnished under this specification shall be covered by a type B Certification in accordance with 916. The results of the following tests shall be provided on the type B certification.*

Test	*ASTM*
Tensile Strength	*D 412 or D 1414*
Ultimate Elongation	*D 412 or D 1414*
100% Modulus	*D 412 or D 1414*
Hardness (Durometer)	*D 2240 or D 1414*
Low-Temperature Hardness	*D 2240 or D 1414*
Compression Set	*D 395 Method B, or D 1414*
Accelerated Aging	*D 573*
Water Immersion	*D 471*
Ozone Resistance	*D 1149*
Elastomer Compound Effect on Pipe	*F 477*
Force Decay (Stress Relaxation)	*F 913*

SECTION 908, BEGIN LINE 216, INSERT AS FOLLOWS:

Slotted vane drain pipe shall be *smooth wall* polyvinyl chloride in accordance with 907.23 and shall be of the diameter specified. The casting shall be in accordance with 910.05(b). The finish shall be standard black asphalt emulsion. Individual units shall have a minimum weight (mass) of 155 lb (70 kg).