S U P P L E M E N T A L S P E C I F I C A T I O N

AMENDMENT TO SECTION 603 -- CULVERTS AND STORM DRAINS

The purpose of this SS is to revise the structure of the Materials section and add new requirements for pipe manufacturers. Also adds the requirement that manufactures of polyvinyl chloride pipe (PVC) must participate in and maintain compliance with the AASHTO National Transportation Product Evaluation Program (NTPEP) that audits producers of plastic pipe, as well as stipulate any sawed pavement required for this work shall be subsidiary.

Amend 603.1.1 to read:

1.1 This work shall consist of furnishing and installing, or removing and relaying, pipes, pipe end sections, pipe sleeves, and post installation video inspection at the locations shown or ordered, including the necessary joints, fittings, and connections as required. **Sawed pavement**, common structure excavation to the depth specified in 206.4.1, secondary excavation required in the imperfect trench method, bedding, shaping of bedding, and backfill shall be included in this work.

Replace the Materials section with the following:

2.1 Reinforced Concrete Pipe, Circular.

2.1.1 Fabricator Certification. **Concrete pipe manufacturing plants shall be certified by the American Concrete Pipe Association through its "Quality Cast" plant certification program. The Fabricator shall submit proof of certification at delivery.**

2.1.2 This pipe shall conform to the requirements of AASHTO M 170 (AASHTO M 170M), except as follows: When fly-ash is used, only Class F, in accordance with AASHTO M 295 will be allowed. Wall A thickness will be allowed in Class III pipe only. When the plans call for reinforced concrete pipe capable of withstanding an ultimate load greater than 3750 D (175 kPa), the design requirements of Class V shall be met with further provision that the pipe will withstand the ultimate D-load specified.

2.1.3 Basis of acceptance of concrete pipe shall conform to AASHTO M 170 (AASHTO M 170M), Section 5.1.1. Test requirements shall be as provided in Section 11 with the further provision that the pipe will withstand an additional ten percent of the D-load specified or brought to destruction. Permissible variation in pipe tolerances shall conform to AASHTO M 170 (AASHTO M 170M), Section 12.

2.1.4 Workmanship and finish shall conform to AASHTO M 170 (AASHTO M 170M), Section 12. Pipe shall be subject to rejection on account of failure to conform to any of the specification requirements of AASHTO M 170 (AASHTO M 170M), Section 15. Individual sections of pipe may be rejected for the following reasons:

(a) Fracture or cracks passing through the wall, except for a single end crack that does not exceed the depth of a joint.
(b) Defects that indicate imperfect proportioning, mixing, and molding.

(c) Surface defects indicating honey-combed or open texture.
(d) Damaged or cracked ends where such damage would prevent making a satisfactory joint.
(e) Any continuous crack having a surface width of 0.01 in. (0.3 mm) or more and extending for a length of 12 in. (300 mm) or more, regardless of position in the wall of the pipe.
(f) The exposure of any steel in the barrel or the outside of the pipe indicating the displacement of reinforcement. Steel exposed at the ends will not be cause for rejection if a satisfactory joint can be made.

Table 1 - Minimum Strength Requirements – English (Metric)

D Load to produce the ultimate load = Class (kPa)	D Load to produce a 0.01 crack (0.3 mm crack (kPa))	AASHTO Designation Class
1500D (75)	1000D (50)	II
2000D (100)	1350D (65)	III
3000D (150)	2000D (100)	IV
3750D (175)	3000D (140)	V
4000D (200)	----	---

2.1.5 Markings on pipe shall conform to AASHTO M 170 (AASHTO M 170M), Section 16 with the following information clearly marked on each section of pipe.

(a) The pipe class and specification designation
(b) The date of manufacture
(c) The name or trademark of the manufacturer
(d) Identification of the plant

2.1.6 Concrete pipe shall be joined by using flexible water tight gaskets conforming to AASHTO M 198.

2.2 Corrugated Metal Pipes and Pipe-Arches--Steel.

2.2.1 Except as provided below, steel pipes and pipe-arches shall conform to AASHTO M 36/M 36M, Type I or II.

2.2.1.1 To facilitate field jointing, the ends of individual pipe sections shall meet the requirements of Section 7.7.1 of AASHTO M 36/M 36M.

2.2.1.2 Section 9.1.3 of AASHTO M 36/M 36M does not apply.

2.2.2 The specified thickness in the case of steel shall be as shown on the plans. The minimum thickness of steel culvert sheets shall meet the requirements of AASHTO M 218.

Table 2 - Thickness and Equivalent Gauges -English (Metric)

Steel Thickness, in. (mm)* "Specified"	Sheet Gauge Number
0.064 (1.63)	16
0.079 (2.01)	14
0.109 (2.77)	12

0.138 (3.51)	10
0.168 (4.27)	8

*Thickness measured on tangent of corrugation.

2.2.3 Strutted pipes shall be furnished 5 percent elongated, when specified.

2.3 Plastic Pipe.

2.3.1 Manufacturers of **Polyvinyl Chloride (PVC) pipe** and Polyethylene (PE) pipe must participate in and maintain compliance with, the AASHTO National Transportation Product Evaluation Program (NTPEP) that audits producers of plastic pipe. A certificate of compliance, as required by 106.04 shall be provided for each shipment.

2.3.2 Polyvinyl chloride profile wall pipe shall conform to the requirements of AASHTO M 304. PVC pipe shall not be used in applications where it will be exposed to long term ultraviolet light without approved protection for the exposed area.

2.3.3 Polyethylene pipe shall conform to the requirements of AASHTO M 294, Type C, Type S, or Type D as specified on the plans.

2.3.4 Only soil tight pipefittings supplied or recommended by the manufacturer shall be used, unless otherwise specified.

2.3.4.1 When watertight joints are specified, watertight pipefittings supplied or recommended by the manufacturer shall be used and shall conform to the appropriate AASHTO standard.

2.3.5 When the item description calls for Plastic Pipe (pipe material is not specified), either polyvinyl chloride or polyethylene pipe shall be furnished and shall meet the requirements of **2.3.**

2.4 Drainage Pipe. When the Item calls for Drainage Pipe (pipe material is not specified) either concrete pipe 2000 D (100 kPa) or plastic pipe for drainage pipe shall be furnished. Reinforced concrete pipe shall meet the requirements of 2.1. Plastic pipe shall meet the requirements of **2.3**.

2.5 Pipe Sleeve (24" and under).

2.5.1 Pipe sleeves for electrical conduit shall be as specified in 614. Other pipe sleeves shall meet the load bearing requirement as well as special design considerations.

2.5.2 Steel pipe for pipe sleeve, bored, shall conform to ASTM A 53, with joints welded.

2.6 Pipe for Slope Drainage.

2.6.1 Manufacturers of polyethylene pipe for slope drain shall conform to the requirements of **2.3.1 and AASHTO M294, Type C.**

2.6.2 The pipe coupler for polyethylene pipe shall consist of a plastic coupler and 2 stainless steel bands installed on the exterior corrugations. Slope pipe coupling bands shall engage a minimum of two full corrugations of each pipe section being joined, shall be reinforced with a minimum of three high-strength nylon ties, and in all other respects shall meet the criteria for the "Downdrain Joint" category of Section 26 of the AASHTO LRFD Bridge Construction Specifications.

2.7 Pipe for Drives and Minor Approaches.

2.7.1 It shall be the Contractor's option to furnish reinforced concrete pipe or corrugated aluminized steel type 2 pipe, unless otherwise specified, for pipe for drives and minor approaches. Reinforced concrete pipe shall meet the requirements of 2.1. Corrugated aluminized steel pipe shall meet the requirements of 2.2. The strength or thickness shall meet the requirements of Table 3. **Where cover is 2' or greater, and where load requirements can be met, polyethylene pipe, meeting the requirements of 2.3, may be used.**

Table 3 - Required Strength of Culvert Pipes

Material	Diameter	Strength Concrete	Thickness, in. (mm) "Specified" Steel	Pipe Stiffness Plastic
Reinforced Concrete	All	2000 D (100 kPa)		
Corrugated Metal	12"-18"(300-450mm) 24"-30"(600-750mm) 36" (900 mm)		0.064 (1.626) 0.079 (2.007) 0.109 (2.769)	
Plastic (Polyethylene)	All			Reference AASHTO M294

2.8 End Sections.

2.8.1 Metal End Sections.

2.8.1.1 Steel end sections shall be galvanized, sheet or corrugated as required, conforming to the requirements of AASHTO M 36/M 36M insofar as that specification applies. Sections shall be fabricated of the thickness of metal shown on the plans. When the item calls for metal end sections, steel shall be furnished, **with the minimum sheet thickness of 0.064 in (1.626 mm).**

2.8.1.1.1 Aluminized steel end sections shall be aluminum-coated (Type 2) conforming to the requirements of AASHTO M 36.

2.8.1.2 Galvanized bolts may be used for the assembly of end sections where more than one piece is used to form the skirt. Bolts shall conform to ASTM A 325/A 325M.

2.8.2 Concrete End Sections. Concrete end sections shall be reinforced concrete conforming to the pertinent provisions of 2.1 and to the requirements shown on the plans. Where a single cage of reinforcement is shown on the plans, sufficient steel shall be incorporated to maintain the integrity of the piece. Unless a different class is specified, end sections conforming to Class III minimum strength pipe shall be furnished.

2.8.3 Plastic End Sections. Polyethylene pipe end sections shall meet the materials requirements of AASHTO M 294.

2.9 Granular backfill shall conform to the requirements of 209.

2.10 Cement mortar shall conform to the requirements of 707.

2.11 Unsuitable material for bedding and backfilling pipes is either organic or one that cannot be placed to meet the required compaction or bearing capacity, with the effort normally required for this work. This definition shall only apply in cases where material properties, compaction or bearing requirements are not otherwise specified in the Contract documents.

2.12 Concrete class F, flowable fill may be requested in writing as a substitute for backfill material **in accordance with 520.1.2.1.1.f**.

Amend 603.2.9.1 to read:

2.9.1 Manufactures of Corrugated Polyethylene (PE) pipe **and Polyvinyl Chloride (PVC) pipe** must participate in, and maintain compliance with, the AASHTO "National Transportation Product Evaluation Program" (NTPEP) that audits producers of plastic pipe. A certificate of compliance, as required by 106.04, shall be provided for each shipment.

Add to 603.3.1:

3.1.10 Sawed pavement shall conform to 628.3.4.

Amend 603.5.1 to read:

5.1 The accepted quantities of pipe will be paid for at the Contract unit price per linear foot (linear meter) of the kind, type, and size specified complete in place, including **sawed pavement**, common structure excavation up to the depth specified in 206.4.1, secondary excavation required in the imperfect trench method, bedding, pre-shaping of bedding, and backfill, with the following stipulations:…

Replace the Key to Item Number for Pipes with the following:

KEY TO ITEM NUMBERS FOR PIPES

Item Number							Unit
603.0001						Video Inspection	Linear Foot (Linear Meter)
603	.A	B	C	D	E	Item Number	
	.A					Material or Use	
		B				Type of Material	
			C			Class, Thickness, or Other	
				D	E	Diameter or span rounded to nearest inch (or 100 mm)	
	.0					Reinforced Concrete Pipes	Linear Foot (Linear Meter)
		B				Type	
		0				Circular	
		1				Arch	
		2				Blank	
		3				Blank	
		4				Blank	
			C			Class	
			1			1500 D (Class II)	
			2			2000 D (Class III)	

3 3000 D (Class IV)
4 3750 D (Class V)

.1 Metal Pipes — Linear Foot (Linear Meter)

B Material
1 Corrugated Galvanized Steel
2 Blank
3 Corrugated Aluminized Steel (Type 2)
4 Blank
5 Corrugated Steel Pipe-Arch
6 Blank
8 Corrugated Steel Slotted Drain Pipe

C Thickness in Inches (Millimeters)
Steel
0 0.064 (1.63)
2 0.079 (2.01)
4 0.109 (2.77)
6 0.138 (3.51)
8 0.168 (4.27)

.2 Pipe Sleeves — Linear Foot (Linear Meter)

B Material
0 Unspecified
1 Reinforced Concrete
2 Corrugated Steel
3 Blank
4 Plastic

C Type
0 Unspecified
1 PVC
2 Polyethylene

.3 End Sections — Each

B Material
0 Reinforced Concrete

C Class
1 1500 D (Class II)
2 2000 D (Class III)
3 3000 D (Class IV)
4 3750 D (Class V)

1 Blank
2 Blank
3 Plastic

C Type
1 Blank
2 Polyethylene
3 Blank

4 Steel
5 Blank
6 Aluminized Steel

C Steel Thickness in Inches (Millimeters)

1 0.064 (1.63)
2 0.079 (2.01)
4 0.109 (2.77)
6 0.138 (3.51)
8 0.168 (4.27)

9 Resetting _____ End Section

C Material
0 Unspecified
1 Reinforced Concrete
2 Corrugated Steel
3 Blank
4 Plastic

.4 Pipe for Slope Drainage — Linear Foot (Linear Meter)

B Material
0 Unspecified
1 Blank
2 Blank
3 Blank
4 Plastic

C Type
1 Blank
2 Polyethylene (Type C)

.5 Pipe for Drives and Minor Approaches — Linear Foot (Linear Meter)

B Material
0 Unspecified

.6 Laying or Relaying Drainage Pipe (Furnished by the State or Salvaged) — Linear Foot (Linear Meter)

B Material
0 Unspecified
1 Reinforced Concrete
2 Blank
3 Blank
4 Plastic

.7 Pipe, Jacked or Bored — Linear Foot (Linear Meter)

B Materials/Use
1 Reinforced Concrete under Roadbed
2 Reinforced Concrete under Railroad

C Class
1 1500 D (Class II)
2 2000 D (Class III)
3 3000 D (Class IV)
4 3750 D (Class V)

3 Blank
4 Blank

.8 Plastic Pipe — Linear Foot (Linear Meter)

B Materials
0 Unspecified

1 PVC
2 Polyethylene
3 Blank
C Type
1 Corrugated Interior (Type C)
2 Smooth Interior, Double Wall (Type S)
3 Smooth Interior, Triple Wall (Type D)
4 Blank
5 Corrugated Interior (Type C) (Watertight)
6 Smooth Interior, Double Wall (Type S) (Watertight)
7 Smooth Interior, Triple Wall (Type D) (Watertight)

.9 Drainage Pipe (Contractor's Option – Concrete or Plastic)) Linear Foot (Linear Meter)

B Materials
0 Unspecified

C Type
1 Blank
2 Smooth Interior, Double Wall (Type S)
3 Smooth Interior, Triple Wall (Type D)
4 Blank
5 Blank
6 Smooth Interior, Double Wall (Type S) (Watertight)
7 Smooth Interior, Triple Wall (Type D) (Watertight)

Examples (ENGLISH):

603.00215	15" Reinforced Concrete Pipe, 2000 D	Linear Foot
603.20004	4" Pipe Sleeve	Linear Foot
603.332_ _	_ _" Polyethylene End Section	Each
603.40012	12" Pipe for Slope Drainage	Linear Foot
603.44212	12" Polyethylene Pipe for Slope Drainage	Linear Foot
603.6	Relaying 0-24" Drainage Pipe	Linear Foot
603.60012	Relaying 12" Drainage Pipe	Linear Foot
603.821_ _	_ _" Polyethylene Pipe (Corrugated Interior)	Linear Foot
603.802_ _	_ _" Plastic Pipe (Smooth Interior)	Linear Foot
603.900_ _	_ _" Drainage Pipe	Linear Foot