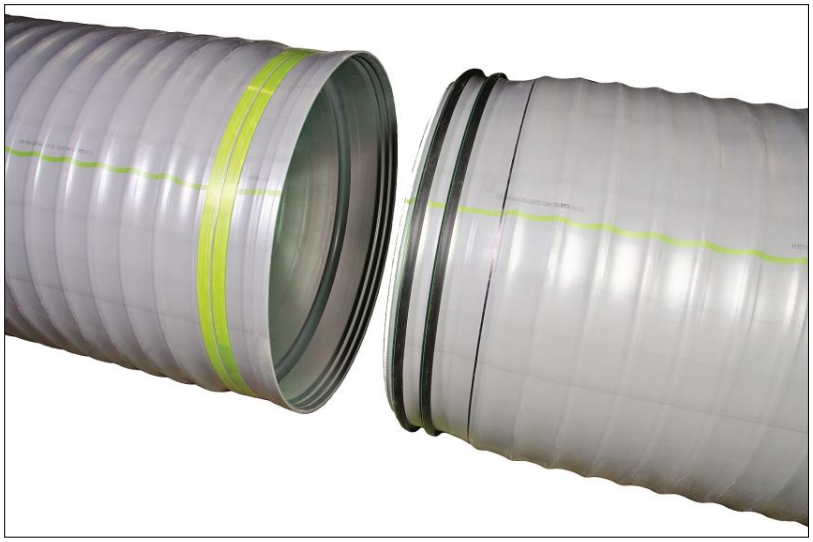
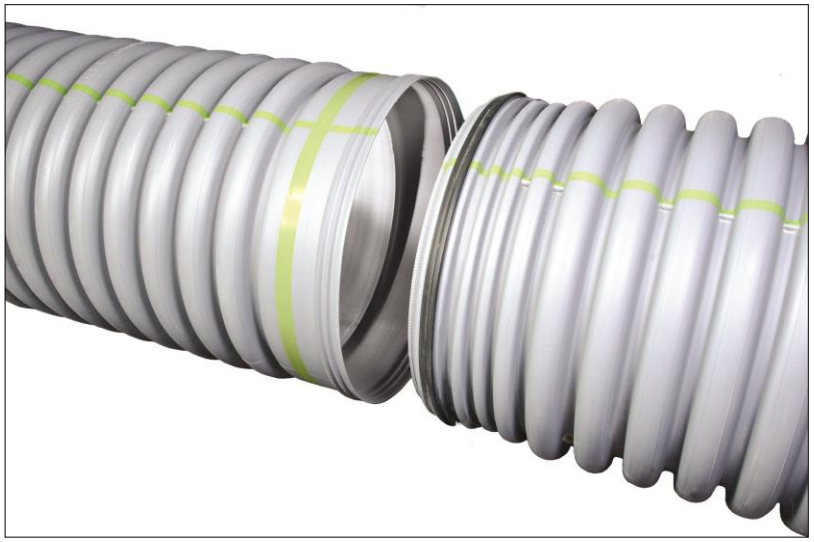
HIGH PERFORMANCE PIPE FOR STORM & SANITARY SEWERS





SaniTite® HP
HIGH PERFORMANCE

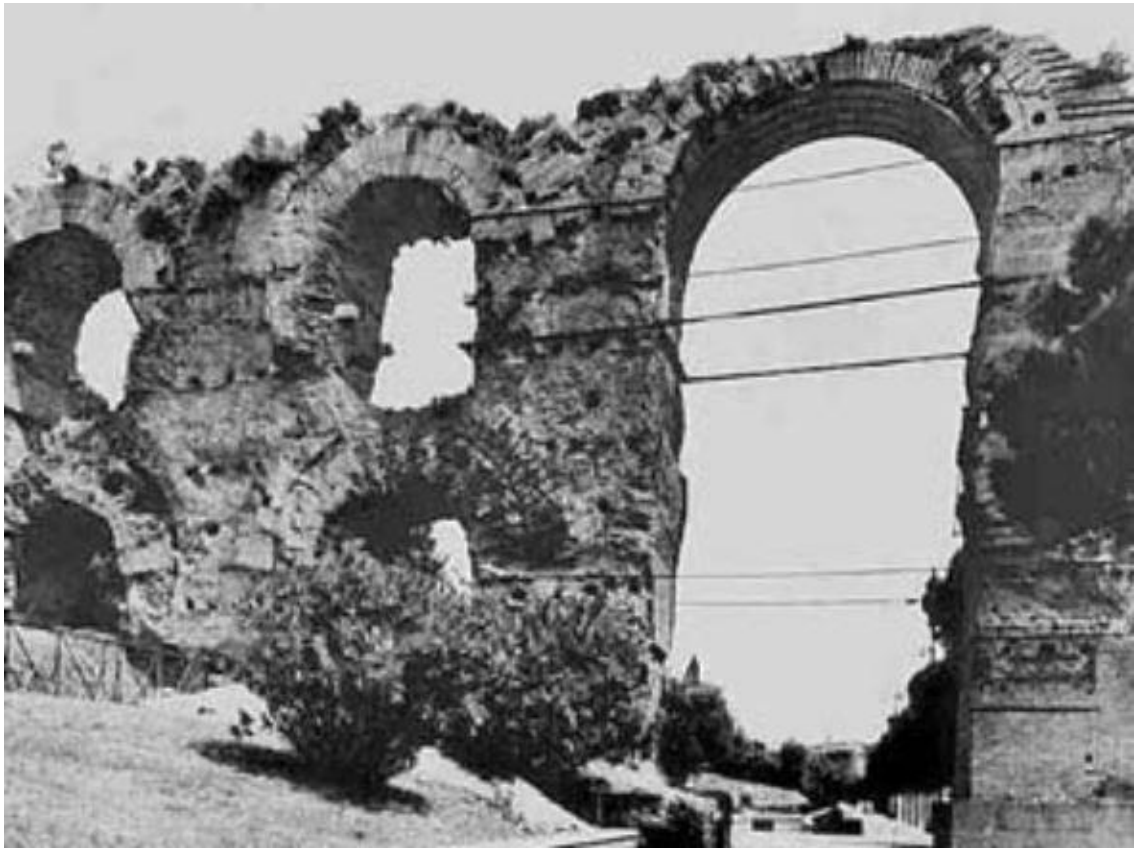
HP Storm
HIGH PERFORMANCE

Presented By: Justin C Piccillo, P.E.

What Not To Do With Storm Pipe

A Brief History of Pipe

The Romans were the first to use aqueducts, for running water and sewer



History of Storm/Sanitary Sewer Pipe

In the early years, pipe joints were purposely not sealed so that groundwater could help drain soils and convey solids.

Of course, this was well before the EPA was established!

Wood Pipe

13th Century

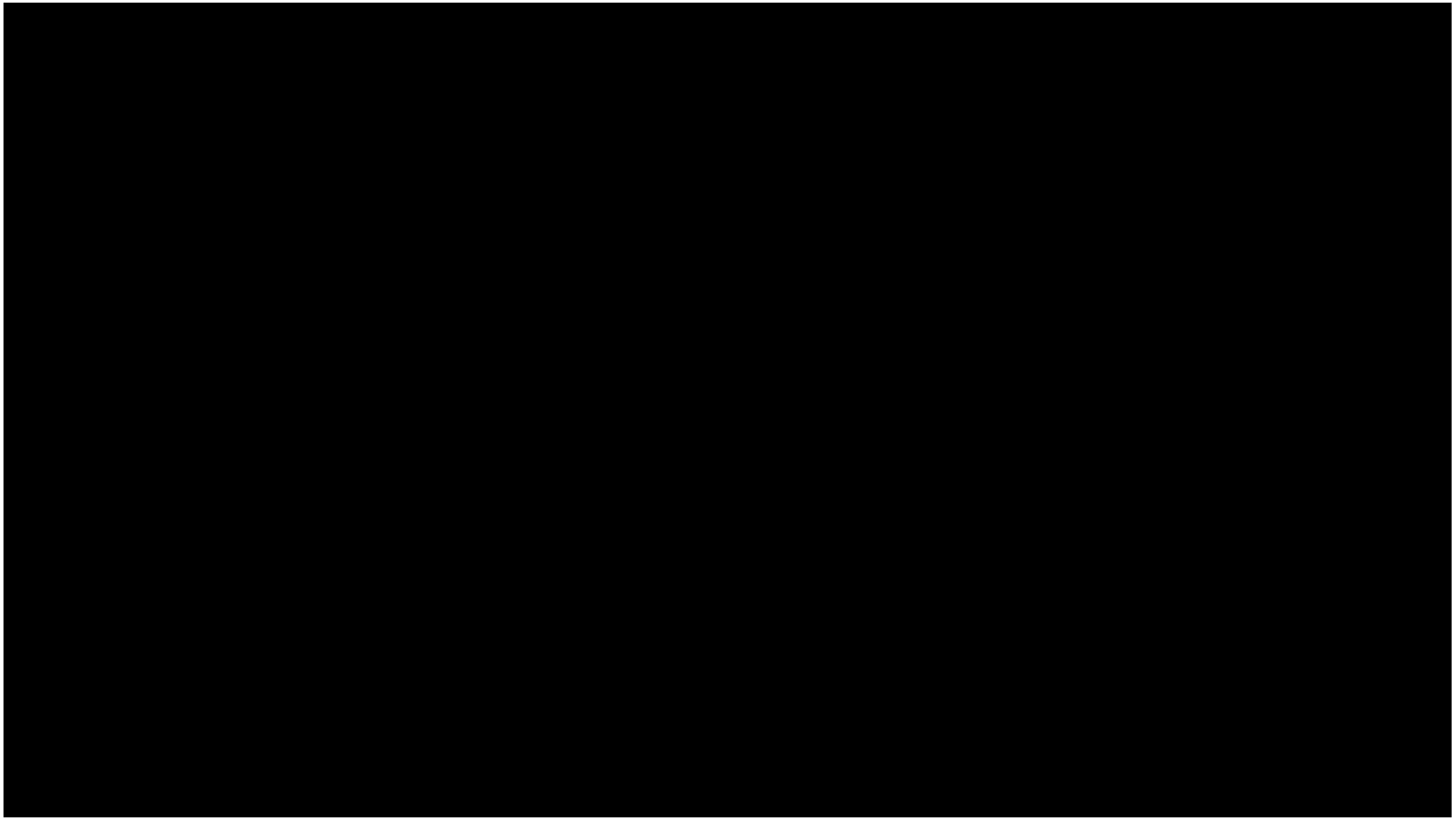
- **Wood pipe systems in London have been found that date back to the 13th century.**
- **Remarkably, the cities like New York and Philadelphia also claim to have wood pipes still in service.**

Improving Technology

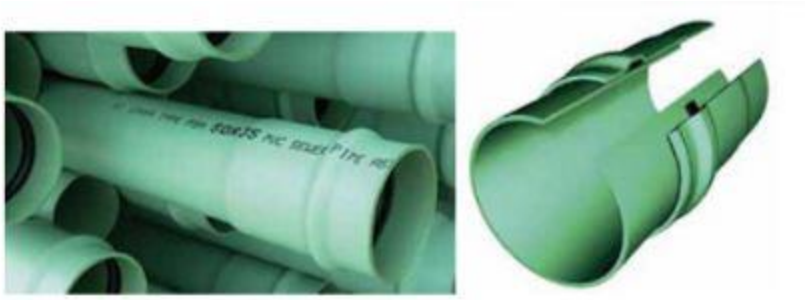
Early to Mid 1900's

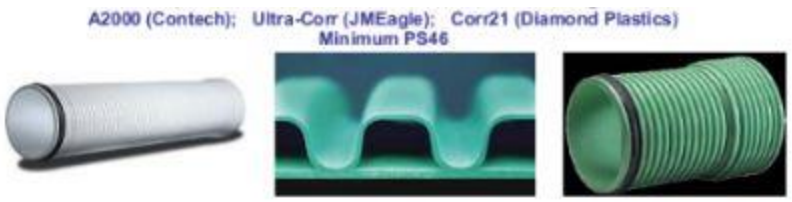
- **Cast Iron Pipe became popular for its structural properties, which allowed for complex sewer systems in rapidly developing areas**
  - **New York City**
- **Vitrified Clay provided a more economic option in areas where structural integrity was not a concern**
  - **Poor joint performance**
- **Precast Concrete Pipe eventually became a solution that provided better performance than clay pipe and was easier to manufacture than Cast Iron**

One Word: “Plastics”



Plastic Pipe



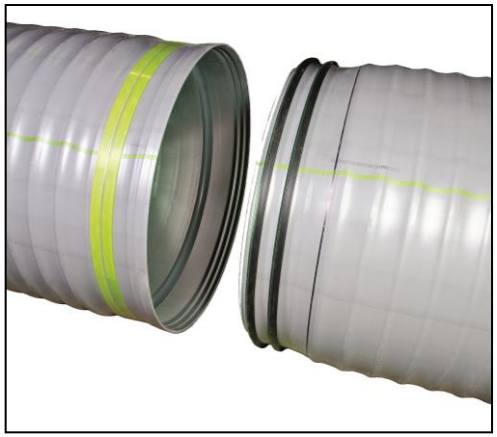


In the early 1940's, many materials are in short supply due to the war. Germany, a leader of plastics, begins to use PVC in tires and other applications.

By the late 1960's, PVC Pipe becomes the popular choice for many sanitary sewer projects.

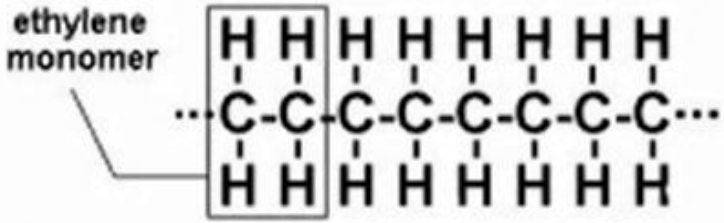
HDPE and PP Pipe

ADS: Pipe Groups

Group I	Group II	Group III	Group IV
			
Mega Green (PE)	N-12 (PE)	HP Storm (PP)	SaniTite HP (PP)

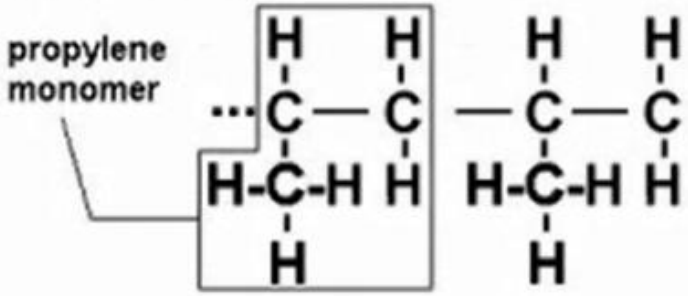
Polyethylene vs. Polypropylene

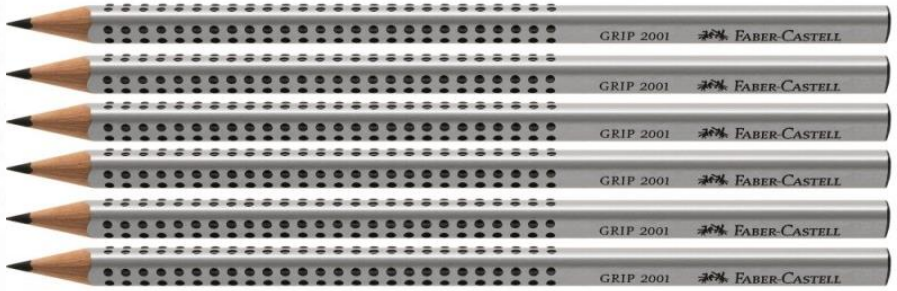
Polyethylene (PE)



Applications: milk jugs, detergent bottles, drums, pipe

Polypropylene (PP)





Applications: automotive panels, yogurt containers, battery boxes, trays, etc.

Factors in Specifying Pipe Material

- **Material Strength/ Structural Properties**
  - **Rigid vs. Flexible Pipe**
- **Joint Performance**
- **Relevant Specifications / Industry Standards**
- **Installation Practices**
- **Service Life**
- **Approvals**

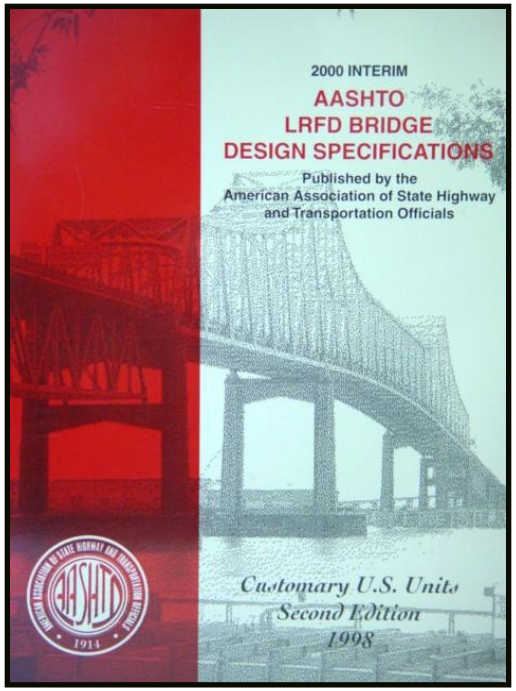
Material Strength / Structural Properties

HP Pipe Structural Design

- Structural design in accordance with AASHTO LRFD Bridge Design Specifications - Section 12: Buried Structures & Tunnel Liners

Design Elements:

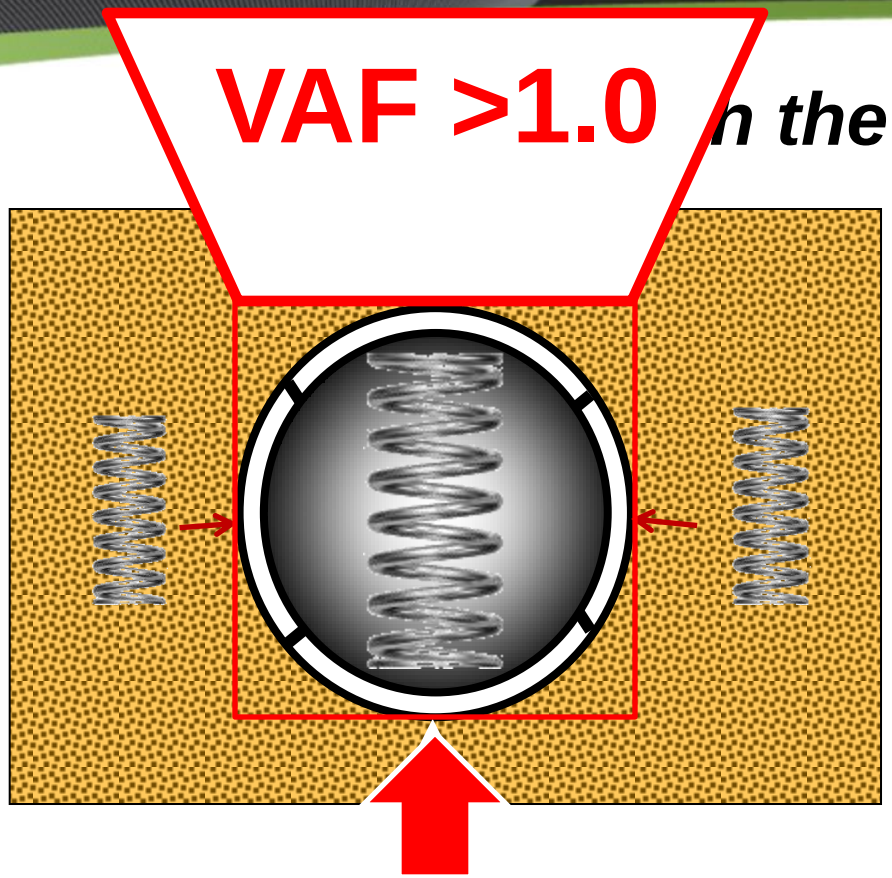
- Section Properties
- Material Properties
- Pipe/Soil Interaction
- Loading conditions
- Wall thrust
- Deflection
- Buckling
- Bending strain
- Combined strain



Traffic (H-20 & HS-25) load bearing capability with minimal cover:

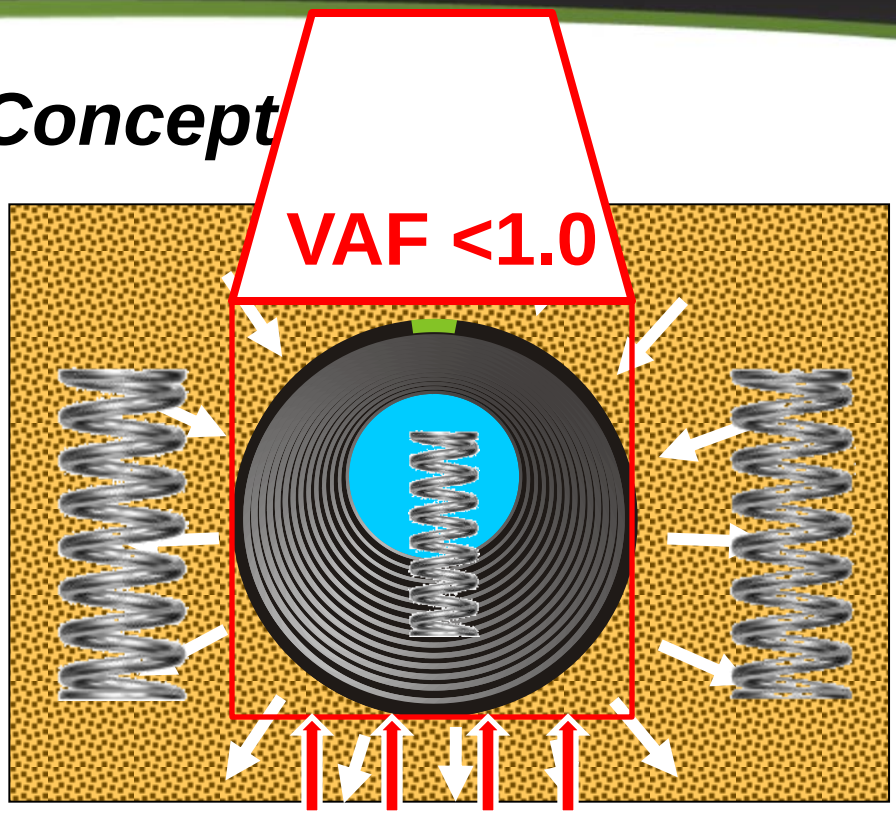
- 12” up to/including 48” diam
- 24” for 60” diameter pipe

Rigid verses Flexible



Rigid Pipe attracts load because it does not deflect

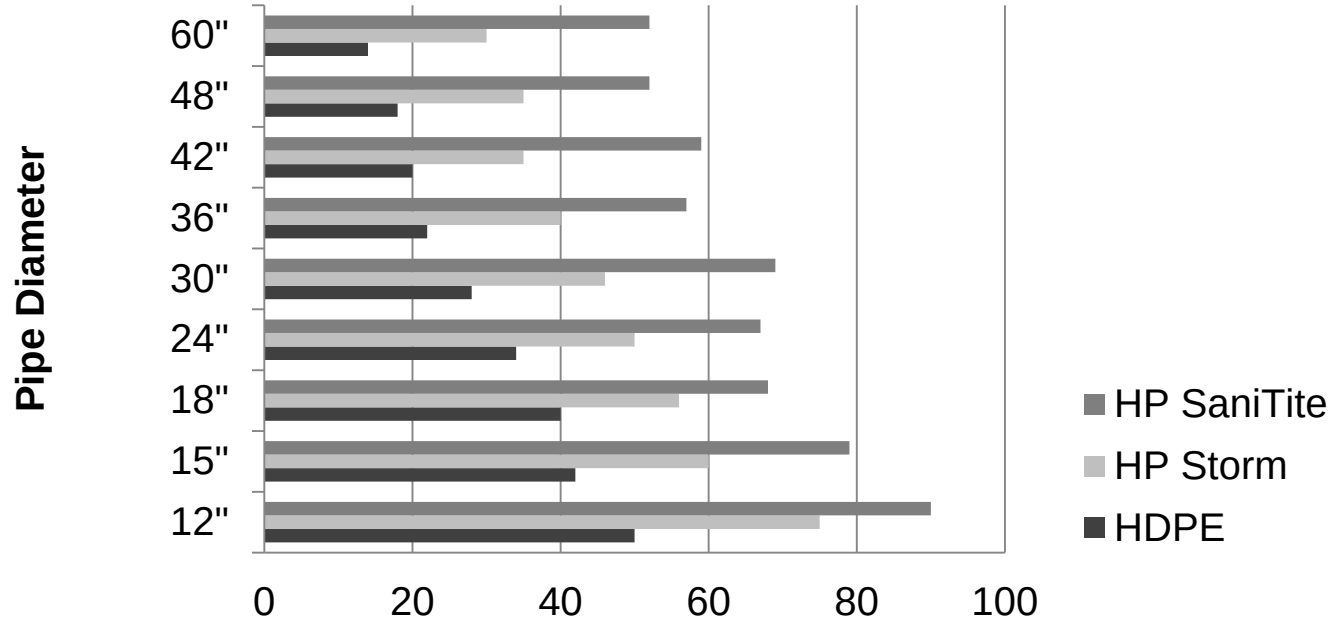
n the Concept



Flexible Pipe deflects to shed load to surrounding soil.

Flexible Pipe Sheds Loads

Pipe Stiffness

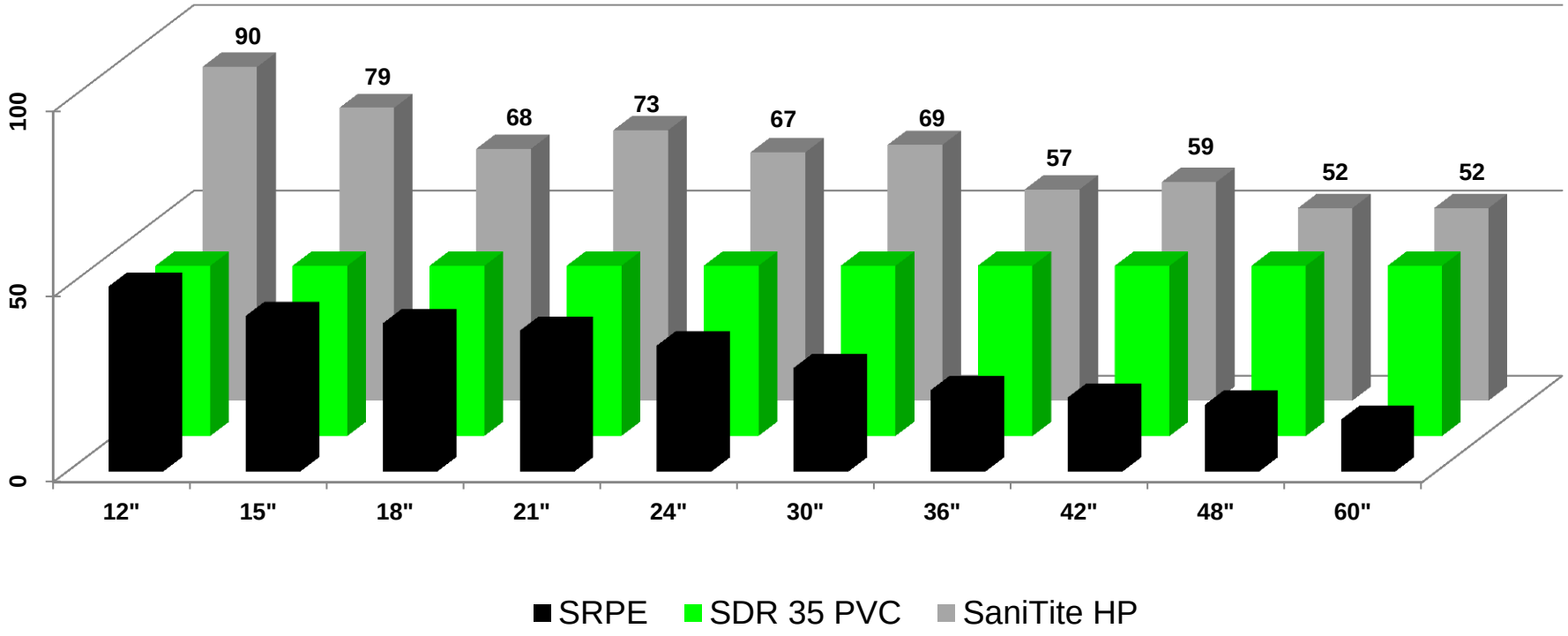


	12"	15"	18"	24"	30"	36"	42"	48"	60"
HP SaniTite	90	79	68	67	69	57	59	52	52
HP Storm	75	60	56	50	46	40	35	35	30
HDPE	50	42	40	34	28	22	20	18	14

Pipe Stiffness

SaniTite HP

Meets / Exceeds Minimum 46 pii as Required by ASTM F2764



Backfill With Native Soils

Trench Detail – Flexible Pipe Installation

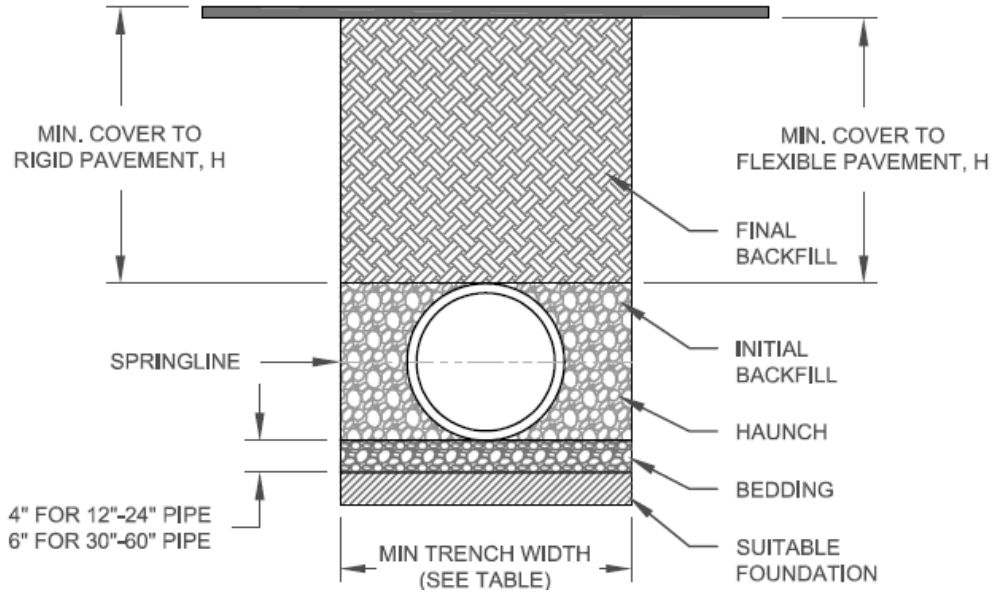


TABLE 3, MAXIMUM COVER FC

	CLASS I	CLASS II			CLASS III			CLASS IV
PIPE DIAM.	COMPACTED	95%	90%	85%	95%	90%	85%	85%
12" (300mm)	40 (12.2m)	28 (8.5m)	21 (6.4m)	16 (4.9m)	21 (6.4m)	17 (5.2m)	15 (4.6m)	14 (4.3m)
15" (375mm)	42 (12.8m)	29 (8.8m)	22 (6.7m)	17 (5.2m)	22 (6.7m)	17 (5.2m)	16 (4.9m)	15 (4.6m)
18" (450mm)	37 (11.3m)	26 (7.9m)	19 (5.8m)	14 (4.3m)	20 (6.1m)	15 (4.6m)	14 (4.3m)	13 (4.0m)
24" (600mm)	32 (9.8m)	23 (7.0m)	17 (5.2m)	13 (4.0m)	17 (5.2m)	13 (4.0m)	12 (3.7m)	11 (3.4m)
30" (750mm)	32 (9.8m)	23 (7.0m)	17 (5.2m)	13 (4.0m)	18 (5.5m)	14 (4.3m)	12 (3.7m)	12 (3.7m)
36" (900mm)	29 (8.8m)	21 (6.4m)	15 (4.6m)	11 (3.4m)	16 (4.9m)	12 (3.7m)	11 (3.4m)	10 (3.0m)
48" (1200mm)	24 (7.3m)	18 (5.5m)	14 (4.3m)	10 (3.0m)	14 (4.3m)	11 (3.4m)	10 (3.0m)	9 (2.7m)
60" (1500mm)	30 (9.1m)	22 (6.7m)	16 (4.9m)	12 (3.7m)	17 (5.2m)	13 (4.0m)	11 (3.4m)	8 (2.4m)

FILL HEIGHT TABLE GENERATED USING AASHTO SECTION 12, LOAD RESISTANCE FACTOR DESIGN (LRFD) PROCEDURE WITH THE FOLLOWING ASSUMPTIONS:
HEIGHT OR WATER (Hw) = CROWN +1',
UNIT WEIGHT OF SOIL (γ_s) = 120 PCF

***From ASTM D2321**

Joint Performance

Specifying Joints

“RCP shall be manufactured in accordance with ASTM C76”

This does not address joints at all…

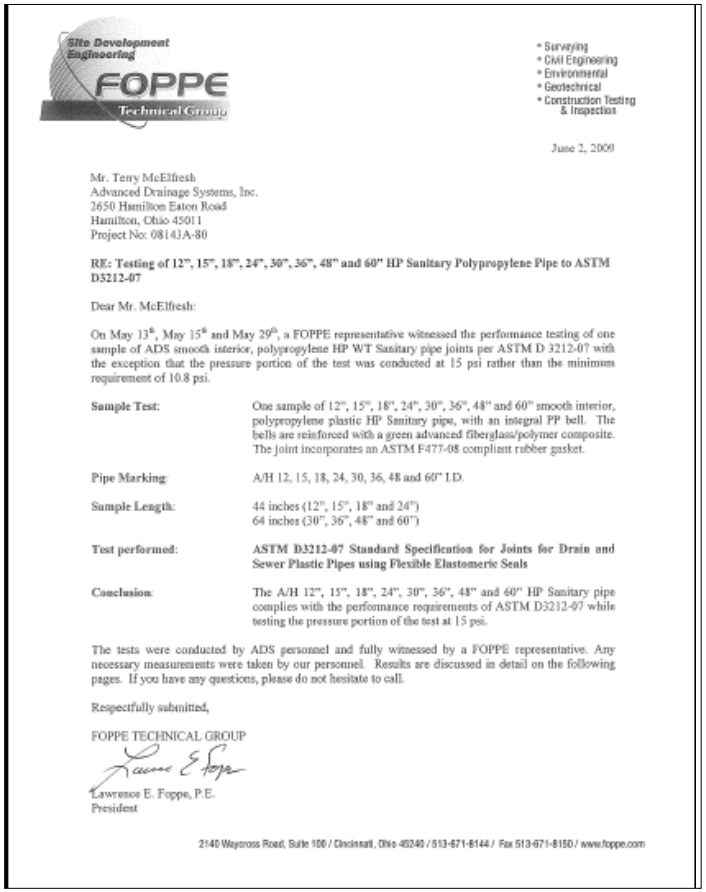
With increased scrutiny on Water Quality, joint performance downstream of SMPs becomes a bigger issue

Water-Tight Joints?

Standards need to be equitable…

Water Tight Joint Testing (ASTM D3212)

- **Joint Assembled & Filled with water**
- **Joint deflected (misaligned) 5%**
- **Pressure to 10.8 psi (15 psi) for 10 min**
- **Visible leaks indicate a failure**



Site Development Engineering
FOPPE Technical Group

* Surveying
* Civil Engineering
* Environmental
* Geotechnical
* Construction Testing & Inspection

June 2, 2009

Mr. Terry McElfresh
Advanced Drainage Systems, Inc.
2650 Hamilton Eaton Road
Hamilton, Ohio 45011
Project No: 0814JA-80

RE: Testing of 12", 15", 18", 24", 30", 36", 48" and 60" HP Sanitary Polypropylene Pipe to ASTM D3212-07

Dear Mr. McElfresh:

On May 13th, May 15th and May 29th, a FOPPE representative witnessed the performance testing of one sample of ADS smooth interior, polypropylene HP WT Sanitary pipe joints per ASTM D 3212-07 with the exception that the pressure portion of the test was conducted at 15 psi rather than the minimum requirement of 10.8 psi.

Sample Test:	One sample of 12", 15", 18", 24", 30", 36", 48" and 60" smooth interior, polypropylene plastic HP Sanitary pipe, with an integral PP bell. The bells are reinforced with a green advanced fiberglass/polymer composite. The joint incorporates an ASTM F477-08 compliant rubber gasket.
Pipe Marking:	A/H 12, 15, 18, 24, 30, 36, 48 and 60" I.D.
Sample Length:	44 inches (12", 15", 18" and 24") 64 inches (30", 36", 48" and 60")
Test performed:	**ASTM D3212-07 Standard Specification for Joints for Drain and Sewer Plastic Pipes using Flexible Elastomeric Seals**
Conclusion:	The A/H 12", 15", 18", 24", 30", 36", 48" and 60" HP Sanitary pipe complies with the performance requirements of ASTM D3212-07 while testing the pressure portion of the test at 15 psi.

The tests were conducted by ADS personnel and fully witnessed by a FOPPE representative. Any necessary measurements were taken by our personnel. Results are discussed in detail on the following pages. If you have any questions, please do not hesitate to call.

Respectfully submitted,

FOPPE TECHNICAL GROUP

Lawrence E. Foppe, P.E.
President

2140 Waycross Road, Suite 100 / Cincinnati, Ohio 45240 / 513-671-6144 / Fax 513-671-6150 / www.foppe.com

Sustained External Pressure Test (ASTM F2764)

HOWEVER, PER ASTM F2764: 1,000-HR EXTERNAL TEST @ 10.8PSI

test methods in Test Method D2990, except as follows. Test shall include an additional stress level selected so as to produce rupture at approximately 10,000 h. Alternately, use time-temperature superposition methods.

7.9 *Creep Modulus*—Determine creep modulus at 73°F [23°C] in accordance with tensile creep test methods in Test Method D2990, except as follows. Test duration shall be 10,000 h. Tests shall include a minimum of 5 stress levels that are selected in approximately even increments up to and including 500 psi [3.45 MPa]. Alternately, use time-temperature superposition methods.

NOTE 7—The time-temperature superposition method in Test Method D6992 may be used to determine the tensile creep modulus and tensile creep rupture strength. These tests are intended to validate a material's proof-of-performance qualification and are not standard quality assurance tests.

7.10 *Sustained External Pressure Test* :

7.10.1 Test three joints in accordance with 7.10.3. Externally pressurize the specimen utilizing a suitable pressure vessel. Pressure the vessel with water to 10.8 psi (75 kPa) and monitor for leakage for 1000 h. Leakage of water into the pipe constitutes failure of the joint.

performed under this specification. The manufacturer shall afford the inspector all reasonable facilities for determining whether the pipe or fittings, or both, meet the requirements of this specification.

9. Rejection and Rehearing

9.1 If the results of any test(s) do not meet the requirements of this specification, the test(s) shall be conducted again in accordance with an agreement between the owner and the manufacturer. There shall be no agreement to lower the minimum requirement of the specification by such means as omitting tests that are a part of the specification, substituting or modifying a test method, or by changing the specification limits. In retesting, the product requirements of this specification shall be met, and the test methods designated in this specification shall be followed. If, upon retest, failure occurs, the quantity of product represented by the test(s) does not meet the requirements of this specification.

10. Certification

10.1 When specified in the purchase order or contract, a manufacturer's or independent laboratory's certification shall

Joint Integrity

Extended Bell with Ceramic Polymer Composite Reinforcement

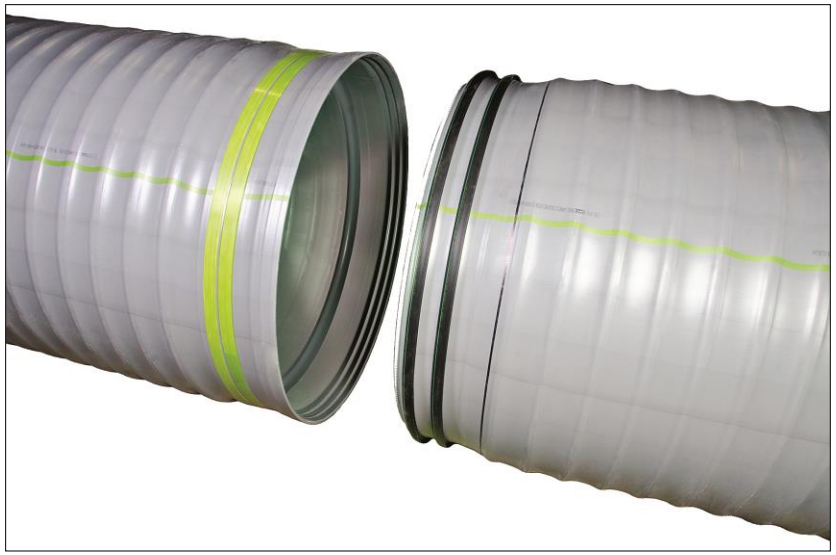
- *Larger sealing area*

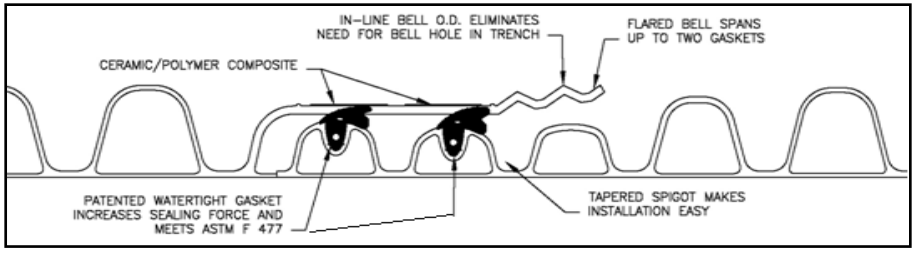
Two Gaskets on Spigot

- *Shipped on pipe & shrink wrapped for protection*
- *Lowers risk for leaks due to construction errors and joint offsets*

Tapered Bell-n-Spigot Design

- *No need to excavate for bell holes*





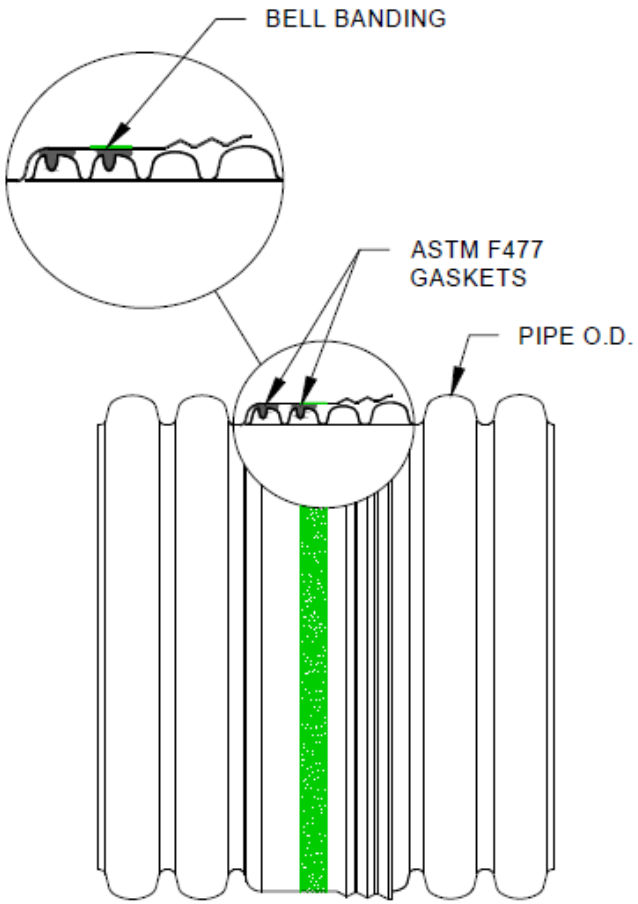
Joint Integrity

Deeper Joint = Better Seal

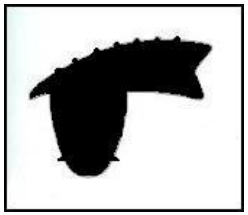
VS

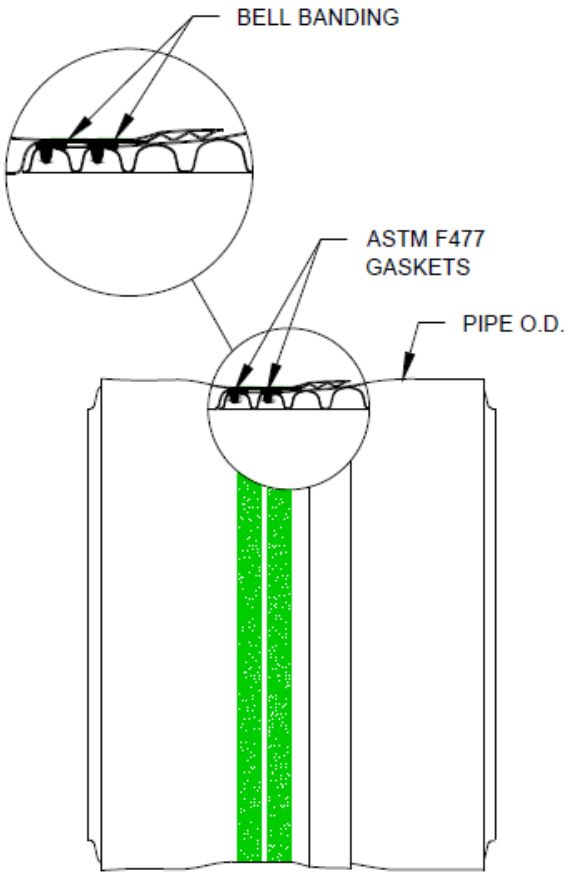
Joint Integrity

High Performance Joints



ASTM F 477 Gasket

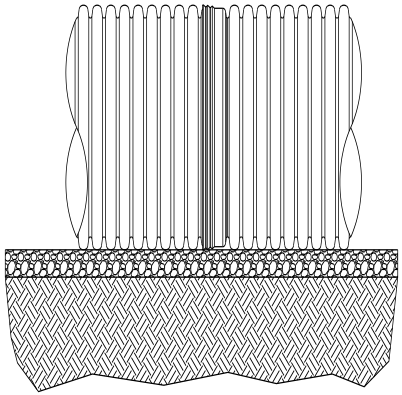




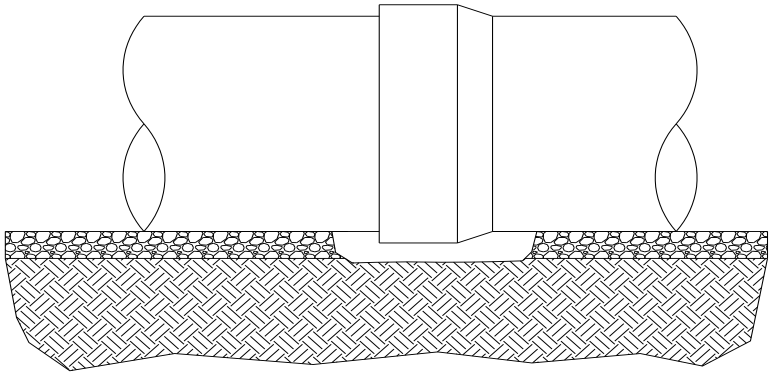
Installation

Joint Installation

HP Pipe Inline Bell



RCP & PVC Oversized Bell



Joint Installation

Joint Installation

Field Repairs

Easy to Cut

Emergency Repairs

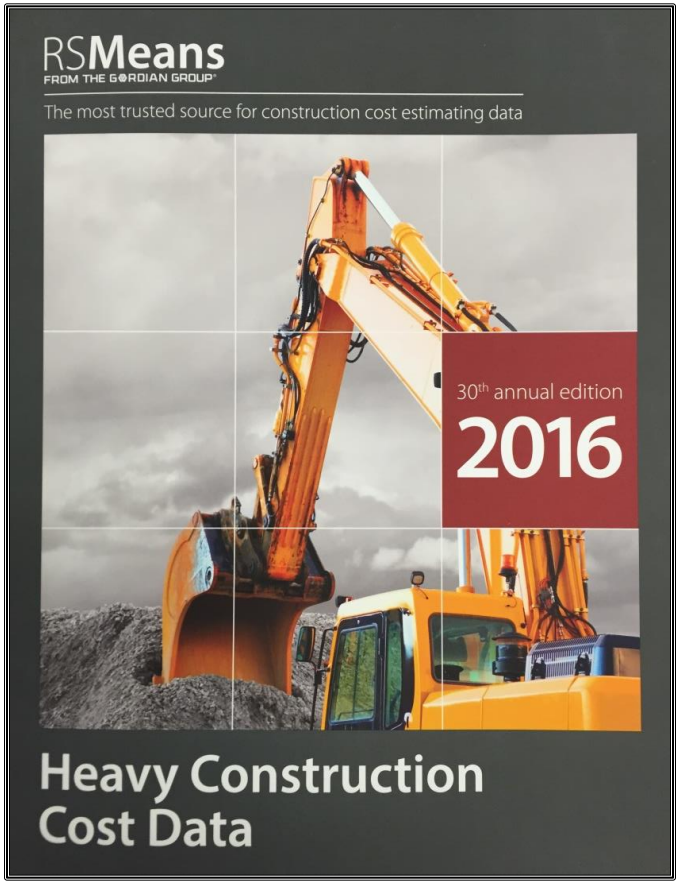
HP Repair Couplers

Mission Rubber with Stainless Steel Collar

Dissimilar Materials

Installation Rate Savings

DIAMETER	HDPE (PP) Daily Output [LF]	RCP Daily Output [LF]
12”	340	150
15”	300	150
18”	275	132
24”	250	100
30”	200	88
36”	180	72
42”	175	72
48”	170	64
60”	150	48



***Outputs based on equivalent backfill; RCP 8’ L vs. HDPE (PP) 20’ L

Approvals

FAA Approved

Storm Drain and Culvert Applications per ASTM F2764 & F2881

HP pipe is now allowed under airfield pavements per Item D-701, Pipe for Storm Drains and Culverts in AC 150/5370-10, Standards for Specifying Construction of Airports.

AREMA Approved

AREMA added Corrugated HDPE pipe in 2012 to their Manual for Railway Engineering

AREMA®
American Railway Engineering and Maintenance-of-Way Association

2013

- **Polypropylene Pipe added for slip lining**

2016

- **Polypropylene Pipe added for culverts and storm drain applications under tracks**

NYSDOT Approved

STORM SEWERS
KIND OF MATERIAL PERMITTED AND STRENGTH REQUIRED
FOR A GIVEN PIPE DIAMETERS AND FILL HEIGHTS OVER THE TOP OF THE PIPE

Nominal Diameter in.	Type 1 — Fill Height: 3' and less With 1' minimum cover								Type 2 — Fill Height: Greater than 3' not exceeding 10'							
	RCCP	CSP	ESCP	PVC	CPVC	PE	CPE	CPP	RCCP	CSP	ESCP	PVC	CPVC	PE	CPE	CPP
10	NA	3	X	X	X	X	X	NA	NA	1	*X	X	X	X	X	NA
12	IV	NA	X	X	X	X	X	X	II	1	*X	X	X	X	X	X
15	IV	NA	NA	X	X	NA	X	X	II	1	*X	X	X	NA	X	X
18	IV	NA	NA	X	X	X	X	X	II	2	X	X	X	X	X	X
21	III	NA	NA	X	X	NA	NA	NA	II	2	X	X	X	NA	NA	NA
24	III	NA	NA	X	X	X	X	X	II	2	X	X	X	X	X	X
27	III	NA	NA	NA	NA	NA	NA	NA	II	3	X	NA	NA	NA	NA	NA
30	IV	NA	NA	X	X	X	X	X	II	3	X	X	X	X	X	X
33	III	NA	NA	NA	NA	NA	NA	NA	II	NA	X	NA	NA	NA	NA	NA
36	III	NA														
42	II	NA														
48	II	NA														
54	II	NA														
60	II	NA														
66	II	NA														
72	II	NA														
78	II	NA														
84	II	NA														
90	II	NA														
96	II	NA														
102	II	NA														
108	II	NA														

RCCP Reinforced Concrete Culver
CSP Concrete Sewer, Storm dra
PVC Polyvin
CPVC Corrug
ESCP Extra S
PE Polyeth
CPE Corrug
CPP Corrug
X This m
NA This m
* May al

STORM SEWERS
KIND OF MATERIAL PERMITTED AND STRENGTH REQUIRED
FOR A GIVEN PIPE DIAMETERS AND FILL HEIGHTS OVER THE TOP OF THE PIPE

Nominal Diameter in.	Type 3 — Fill Height: Greater than 10' not exceeding 15'								Type 4 — Fill Height: Greater than 15' not exceeding 20'						
	RCCP	CSP	ESCP	PVC	CPVC	PE	CPE	CPP	RCCP	CSP	ESCP	PVC	CPVC	PE	CPP
10	NA	2	X	X	X	X	X	NA	NA	3	X	X	X	X	NA
12	III	2	X	X	X	X	NA	X	IV	NA	NA	X	X	X	NA
15	III	3	X	X	X	NA	NA	X	IV	NA	NA	X	X	NA	X
18	III	NA	X	X	X	X	NA	X	IV	NA	NA	X	X	X	NA
21	III	NA	NA	X	X	NA	NA	NA	IV	NA	NA	X	X	NA	NA
							NA	N							
							NA	X							
							NA	N							
							NA	N							
							NA	N							
							NA	N							
							NA	N							
							NA	N							
							NA	N							
							NA	N							
							NA	N							
							NA	N							
							NA	N							
							NA	N							

ght.
l height.
ed according

Standard Specifications for Road and Bridge Construction

Adopted January 1, 2012

Department of Transportation

Art. 550.03 Storm Sewers

Note 1. The class of elliptical and arch pipe used for various storm sewer sizes and heights of fill shall conform to the requirements for circular pipe.

Note 2. The fine aggregate shall be moist.

Note 3. The coarse aggregate shall be wet.

550.03 Kinds of Material Permitted. When a Class of storm sewer is specified, the material shall be selected from the following table. When a particular material is specified, no other kind of material will be permitted.

Class	Materials
A	Rigid Pipes: Clay Sewer Pipe Extra Strength Clay Pipe Concrete Sewer, Storm Drain, and Culvert Pipe Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe Reinforced Concrete Elliptical Culvert, Storm Drain, and Sewer Pipe Reinforced Concrete Arch Culvert, Storm Drain, and Sewer Pipe
B	Rigid Pipes: Clay Sewer Pipe Extra Strength Clay Pipe Concrete Sewer, Storm Drain, and Culvert Pipe Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe Reinforced Concrete Elliptical Culvert, Storm Drain, and Sewer Pipe Reinforced Concrete Arch Culvert, Storm Drain, and Sewer Pipe Flexible Pipes: Polyvinyl Chloride (PVC) Pipe Corrugated Polyvinyl Chloride (PVC) Pipe with a Smooth Interior Polyvinyl Chloride (PVC) Profile Wall Pipe-794 Polyvinyl Chloride (PVC) Profile Wall Pipe-304 Polyethylene (PE) Pipe with a Smooth Interior Corrugated Polyethylene (PE) Pipe with a Smooth Interior Polyethylene (PE) Profile Wall Pipe

When a storm sewer diameter is specified, only a circular pipe will be permitted. When a round size equivalent is specified, only a reinforced concrete arch pipe or reinforced concrete elliptical pipe will be permitted.

When metric sizes are specified on the plans, the next larger available manufactured English pipe may be substituted at no additional cost to the Department.

The Contractor may, at no additional cost to the Department, substitute a stronger pipe of the same kind of material specified.

The kind of material and thickness or thickness class required for the various types of storm sewers shall be according to the following tables.

468

; Department of Transportation

andum

To: All Regional Engineers

From: Omer M. Osman, P.E. 7/14/14

Subject: Special Provision for LRFD Storm Sewer Burial Tables

Date: July 25, 2014

This special provision was developed by the Bureau of Bridges and Structures as a result of updating the storm sewer pipe burial tables to be compliant with the AASHTO LRFD Design Code along with updating the pipe materials available.

Highlights of the changes include:

- LRFD compliance for all tables and materials.
- Upgraded to 75 year design life.
- Added CPP flexible pipe material.
- Removed profile wall PVC and profile wall PE flexible pipe materials.
- Added D loads for special design concrete pipe to the storm sewer tables.

This special provision has been revised to correct a few minor rounding errors for various RCCP and CPE storm sewer options.

This special provision should be inserted into contracts involving storm sewer installation.

The districts should include the BDE Check Sheet marked with the applicable special provisions for the November 7, 2014 and subsequent lettings. The Project Development and Implementation Section will include a copy in the contract.

This special provision will be available on the transfer directory July 25, 2014.

80325m

Pipe Catalogs For Civil 3D

Click to Download the ADS Pipes Catalog .zip File

Thank You!

Justin C Piccillo, P.E.

Engineered Product Manager

Phone: (917) 716-6420

Justin.piccillo@ads-pipe.com

SaniTite® HP HIGH PERFORMANCE

HP Storm HIGH PERFORMANCE