SANITITE HP Advanced drainage systems



Presentation Outline

- Product Snapshot
- Polypropylene Material
- Design
- Manufacturing
- Testing
- Practical Application
- Project Case Studies







Product Snapshot







Dual Wall Design



Dual Wall: 12" - 30"

Exclusive Triple Wall Design



Triple Wall: 30" - 60"



SaniTite HP Application

Sanitary Sewer Market

• Trunk line manhole to manhole





Storm Sewer Market

- Native-fill applications
- Rigid-pipe-required installations





SaniTite HP Polypropylene Material



Polypropylene (PP) Material

Advanced Resin Technology

DS

- Impact modified copolymer PP material provides unique balance between PE & PVC
 - Excellent pipe stiffness
 - Increased longitudinal beam strength
 - Outstanding durability
- PP pipe used in Europe since the 1970's



IABLE: Co	mparison (of Physical	Properties	of <i>Iypical</i>	I hermoplastics
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Properties	Units	PE	PP	PVC
Density	g/cm ³	0.95	0.90	1.42
Tensile Strength	psi	3,000	3,000 4,000	
Tensile Modulus	ksi	110	200	400
Elongation at Break	%	100 – 1000	50 – 800	20 – 30
Gardner Impact (75°F)	J	330	350	250





Polyethylene

• Applications: milk jugs, detergent bottles, drums, pipe

ethylene monomer ····C-C-C-C-C-C-C-C-C-C-H H H H H H H H H

Polypropylene

• Applications - Automotive panels, yogurt containers, battery boxes, trays, etc.







PP-b (block)





SaniTite HP Raw Material

HP Pipe Color

- Raw material is opaque
- Add grey color concentrate with titanium dioxide to...
 - Provide UV protection
 - Enhance post installation visual inspection
 - Differentiate from HDPE & other thermoplastic pipes







Durability





When selecting a storm or sanitary sewer pipe, the following environmental properties should be considered:

- Possible <u>abrasion</u> to the invert of the pipe due to bed loads, scouring velocities, etc.
- <u>pH</u> of effluent & water table
- **Sulfate** concentration of soil, effluent & water table
- **<u>Chloride</u>** concentration of soil, effluent & water table.
- <u>Dissolved Oxygen</u>
- <u>Bacteria</u>







Chemical resistance of PP is much the same as HDPE





Saskatchewan Research Council Abrasion Tests



Quartz slurry in pipe with capped ends attached to rocker and rotated for 400,000 cycles.





Saskatchewan Research Council Abrasion Tests







Taber Abrasion Study







Taber Abrasion Study

4/14/09

PDI I.D.	ADVANCED DRAINAGE SYSTEMS
PDI-044-067-1	New PP1 Gray
PDI-044-067-2	New PP2 Gray
PDI-044-067-3	New HDPE w/5% Black
PDI-044-067-4	RIGID PVC A 2000 White
PDI-044-067-5	RIGID VYLON PVC Light GRAY

Sample ID	Wheel Type	V Force(g)	Revolutions	Start Mass(g)	End Mass(g)	Mass Loss	/Rev (mg)
67-1	CS-10	250.00	500.00	30.6036	30.6034	0.0004	PP
67-2	CS-10	250.00	500.00	30.6868	30.6866	0.0004	
67-3	CS-10	250.00	500.00	31.6658	31.6655	0.0006	
67-4	CS-10	250.00	500.00	50.8776	50.8759	0.0034	PVC
67-5	CS-10	250.00	500.00	50.4187	50.4176	0.0022	





Manufacturing





SaniTite HP 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-25 & HS-25) load bearing capability with minimal cover:

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





LRFD Introduction

Load and Resistance Factor Design

This Design Method Uses Load factors and Resistance factors instead of direct safety factors.

- Safety Factor = Load Factor (γ) ÷ Resistance Factor (ϕ)
- Load Factor is related to ultimate loaded condition where structural failure occurs
- Resistance Factor is related to material performance





LRFD Design Specifications

$\sum \eta_i \gamma_i Q_i \leq \phi R_n = R_r$

- η = Load Modifiers
- γ = Load Factor

Load factors/modifiers INCREASE the actual load

• Q = Applied Load

Resistance factors REDUCE the resistance from the pipe profile

- Φ = Resistance Factor
- R = Resistance





Product / Design Testing



- Utah State
 University
- Ohio University
- Timothy J McGrath,
 Ph.D

Simpson, Gumpertz & Heger





SaniTite HP Manufacturing

- Extrusion Process
- Seamless & Monolithic
- 13' and 20' Lengths
 - Minimum 16' for 60"









SaniTite HP

12"- 30" Dual Wall Polypropylene Pipe

- Extended Ceramic Polymer Reinforced Bell
- Double Gasket on Spigot
- Thicker wall cross-section



Exclusive Triple Wall Design

30" – 60" Triple Wall Polypropylene Pipe

- Extended Ceramic Polymer Reinforced Bell
- Double Gasket on Spigot





SPECIFICATIONS

- ASTM F2736 PP Sewer Pipe 12 30"
- ASTM F2764 PP Sewer Pipe 30 60"
- AASHTO MP21-11 (all diameters)

- Material-specific specs

- ASTM D2412 Pipe Stiffness Test
- ASTM F477 Elastomer Gasket (Natural rubber)
- ASTM D3212 Water-tight Joint
- ASTM F2467 Water-tight Field Test
- ASTM F1417 Air-tight Field Test
- ASTM D2321 Installation Methods

- Thermoplastic industry standard specs





Stiff & Light Weight









Pipe Stiffness

SaniTite HP

Meets / Exceeds Minimum 46 pii as Required by ASTM F2736 & F2764







Joints





SaniTite HP Joints

Competitor's Inline Bell



SaniTite HP Pipe Inline Bell







SaniTite HP Joints





SaniTite HP Joints (ASTM D3212)

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





FOPPE TECHNICAL GROU

Lawrence E. Foppe, P.E. President

2140 Waycross Road, Suite 100 / Cincinnati, Ohio 45240 / 513-671-8144 / Fax 513-671-8150 / www.foppe.com

JOINT PERFORMANCE

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

🕼 F2764 – 10

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 timetemperature 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 timetemperature 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



SaniTite HP Field Testing Joints

Standard field test methods:

- ASTM F1417 Field Test
 - Air Test
 - Stabilize 3.5 psi compressed air
 - Clock the time take to drop 1.0psi to 2.5psi
- Joint isolation testing







Joint Assembly







Field Repairs




Easy to Cut













SaniTite HP Repair Couplers





Dissimilar Materials









Splice & Repair Couplings



Slip Repair Coupler. Used to connect two pieces of pipe



SaniTite HP Repair Coupler





SaniTite HP Repair Coupler











Mar Mac Coupling













SaniTite HP Repair

• NPC Internal Joint Seal: 18-60"

• Link Pipe Grouting Sleeve: 12-60"

• (External) PP Welding









Installation





Pipe Delivery









Standard Installation

National Specification	State / Provincial / Local Specifications	
ASTM D2321 - Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications	Site Specific	
AASHTO Section 30 - Thermoplastic Pipe		
CSA B1800 Standards - Thermoplastic Pipe		







Trench Detail – SaniTite HP Installation



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

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

	CLASS I	CLASS II		
PIPE DIAM.	COMPACTED	95%	90%	
12" (300mm)	40 (12.2m)	28 (8.5m)	21 (6.4m)	
15" (375mm)	42 (12.8m)	29 (8.8m)	22 (6.7m)	
18" (450mm)	37 (11.3m)	26 (7.9m)	19 (5.8m)	
24" (600mm)	32 (9.8m)	23 (7.0m)	17 (5.2m)	
30" (750mm)	32 (9.8m)	23 (7.0m)	17 (5.2m)	
36" (900mm)	29 (8.8m)	21 (6.4m)	15 (4.6m)	
48" (1200mm)	24 (7.3m)	18 (5.5m)	14 (4.3m)	
60" (1500mm)	30 (9.1m)	22 (6.7m)	16 (4.9m)	

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 (ys) = 120 PCF

TABLE 3, MAX MUM COVER



Maximum Burial Depth Based on Groundwater Elevation 12" Dual Wall Pipe

Groundwater Burial Depth to Invert

NOTES:

- Soil and groundwater heights are measured to the invert of the pipe.
- Calculations based on LRFD Section 12.
- Cover heights only applicable for pipe backfilled with compacted Class 1 stone





Trench Detail – HP Storm Installation



TABLE 3, MAXIMUM COVER I								
	CLASS	CLASS		CLASS III		I	CLASS IV	
PIPE DIAM	COMPACTED	95%	90%	85%	95%	90%	85%	85%
12"	40 (12.2m)	28	21	16	21	17	15	14
(300mm)		(8.5m)	(6.4m)	(4.9m)	(6.4m)	(5.2m)	(4.6m)	(4.3m)
15"	42 (12.8m)	29	22	17	22	17	16	15
(375mm)		(8.8m)	(6.7m)	(5.2m)	(6.7m)	(5.2m)	(4.9m)	(4.6m)
18"	37 (11.3m)	26	19	14	20	15	14	13
(450mm)		(7.9m)	(5.8m)	(4.3m)	(6.1m)	(4.6m)	(4.3m)	(4.0m)
24"	32 (9.8m)	23	17	13	17	13	12	11
(600mm)		(7.0m)	(5.2m)	(4.0m)	(5.2m)	(4.0m)	(3.7m)	(3.4m)
30"	32 (9.8m)	23	17	13	18	14	12	12
(750mm)		(7.0m)	(5.2m)	(4.0m)	(5.5m)	(4.3m)	(3.7m)	(3.7m)
36"	29 (8.8m)	21	15	11	16	12	11	10
(900mm)		(6.4m)	(4.6m)	(3.4m)	(4.9m)	(3.7m)	(3.4m)	(3.0m)
48"	24 (7.3m)	18	14	10	14	11	10	9
(1200mm)		(5.5m)	(4.3m)	(3.0m)	(4.3m)	(3.4m)	(3.0m)	(2.7m)
60"	30 (9.1m)	22	16	12	17	13	11	8
(1500mm)		(6.7m)	(4.9m)	(3.7m)	(5.2m)	(4.0m)	(3.4m)	(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 (ys) = 120 PCF





N-12[®] HP Storm Installation

Backfill Materials

Unified	AASHTO	ASTM	RCP Soil Group	Soil Type
GW	A-1-a	Class I	Group 1	Well graded gravel
GP	A-1-a	Class I	Group 1	Poorly graded gravel
GM	A-1-b	Class III	Group 2	Silty gravel
GC	A-2-6, A-2-7	Class II & III	Group 2	Clayey gravel < 20% pass 200 sieve
SW	A-1-b	Class II	Group 1	Well graded sand
SP	A-3	Class II	Group 1	Poorly graded sand
SM	A-2-4, A-2-5	Class II & III	Group 2	Silty sand
SC	A-2-6, A-2-7	Class III	Group 3	Clayey sand < 20% pass 200 sieve
ML	A-4	Class IVA	Group 2	Sandy silt
CL	A-6	Class IVA	Group 3	Silty clay
OL	A-4	Class V	N/A	Organic silt
МН	A-5	Class IVB	Group 3	Inorganic silt
СН	A-7	Class IVB	Group 4	Inorganic clay
ОН	A-7	Class V	N/A	Organic clay
PT	N/A	Class V	N/A	Peat





N-12[®] HP Flotation

Table 2 Minimum Recommended Cover¹ to Prevent Flotation of ADS Thermoplastic Pipe²

Nominal Diameter	Minimum Cover
in. (mm)	in. (mm)
4 (100)	3 (77)
6 (150)	4 (102)
8 (200)	5 (127)
10 (250)	7 (178)
12 (300)	9 (368)
15 (375)	11 (457)
18 (450)	13 (559)

Nominal Diameter	Minimum Cover
in. (mm)	in. (mm)
24	17 (711)
30	22 (914)
36	25 (1067)
42	29 (1219)
48	33 (1372)
60	40 (1702)

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

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





Connections at Structures





On Structure



A-Lok Compression Adapter <u>Cast</u> into structure



NPC KOR-N-SEAL Compression fit to structure





Triple-Wall Connection







Triple-Wall Connection





























TIGHTEN BOOT TO SLEEVE







Dual-Wall Connection



Corrugated pipe adapter





Dual-Wall Connection

Put valley gasket on pipe



Pipe inserted and secured with stainless steel straps



Lubricate Boot & Gasket



Place backfill under pipe at manhole to eliminate shearing


















Fittings



IIIIIIZ DS

Fittings

12" - 30"

- PVC SDR 35 Nyloplast
- Manufactured fittings
- Vacuum tested to 4 psi
- On-Site Welding Capability Made in Ohio & PA
- Made in Ohio & PA



- Manufactured fittings
- Vacuum tested to 4 psi
- On-Site Welding Capability









Jefferson Ave. Sports Complex UC Football Field













Jefferson Ave. Sports Complex UC Football Field







Service Laterals – Inserta-Tee



12 inch Hole Saw



Coring 48" HP Pipe



Deburring the Hole



Completed 12" Tap into 48" HP

MANCE



NEW FATBOY® SEWER TAP

FOR SANITARY APPLICATIONS THESE PARTS ARE WATERTIGHT AND AIR-TESTABLE

INSERTA Fitting PVC Hub

360 degree stop on pipe surface THE STRONGEST INSERTA FITTING EVER!











Fatboy[®] design available in **4**" & **6**" to fit SDR 35, SDR 28, and SDR 26 laterals. PVC hub made from **SDR 26** material Exceeds **ASTM F 1336 Sec. 10.3** Pipe Stop Load Support Test















Additional Projects / Installations





Sanitary Interceptor

Location: Syracuse, NY LF: 1000LF Diameters: 48" &60" CDM Smith JJ Lane







Slip Line Culvert Application

Location: Marcy, NY LF: 100 LF Diameters: 48"







Slip Line Culvert Application

Location: Bethelhem, NY LF: 1500 LF Diameters: 30"





Sanitary Replacement

Location: Troy, NY LF: 400 LF Diameters: 30" Engineer: CHA









Falls Creek Tunnel Sanitary



Location: Niagra Falls, NY LF: 180LF Diameters: 48" URS & Yarussi Constructio September 2011 / Max burial 60'





City of Middletown Sanitary

Location: Middletown, NY LF: ~4000LF Diameter: 30" & 36" McGoey Hauser Edsall Sullivan County Paving & Construction









City of Beacon Sanitary



Location: Beacon, NY LF: 620LF Diameter: 30" Lanc & Tully Engineering Sun Up





SaniTite City of Weymouth Ma







Public Street Storm Sewer

Location: Pelham Manor, NY LF: 520LF Diameters: 48" Dolph Rotfeld Engineering Joken Development





HIGH PERFORMANCE



Slipline

Location: Clifton Park, NY LF: 60LF Diameters: 60" (72" CMP Replaced)







Slipline

- Location: Town of Carroll, NH
- Slip-Lined deteriorated steel culvert:
 - Utilized 80-ft. of 48-in. dia. SaniTite HP
 - Deteriorated steel culvert
 - All voids pressure-grouted to stabilize deteriorated culvert system









West Side Interceptor Portland, ME 5,600 LF 60" SaniTite HP Pipe









Crum Creek Trunk Sewer



Location: Media, PA

28,440LF of 18" - 42"

Engineer: Catania Eng.

Installed by: Metra Industries



ANTIETAM INTERCEPTOR

Location: Exeter, PA 3,800LF of 12" – 18" Engineer: Gannett Fleming Installed by: R3 Construction Services





3rd & Boas Street Repl.



Location: Harrisburg, PA 220LF of 36" Engineer: HRG Installed by: E.K. Services



Newark, OH CSO 1006 & 1013 Modifications



1800 LF of 48" 40 LF of 30"

48" Jack & Bore @ 130' & 240'

Burial up to 27 FT

In Service 2010

Engineer: Malcolm Pirnie

Contractor:

Complete General Construction

Status: In Service



HIGH PERFORMANCE



CSO Disinfection Pilot System Ft Madison, IA 12"–60" SaniTite HP Pipe







Olds Lift Station Wenatchee, WA Twin Barrel Run 60" SaniTite HP Pipe









Billy Creek Sewer Interceptor 8600 LF 15"-24" Diameters

Location: Elizabethtown, KY

Installed: Summer 2009

Engineer: Clemons & Associates, Elizabethtown, KY

Contractor: Jeff Robards Const., Brooks, KY













Owasso Sanitary Sewer 10,000 LF 24" Diameter Pipe

Location: Owasso, OK Installed: Spring/Summer 2010 Engineer: Greely & Hansen Contractor: Paragon Cont, Tulsa, OK











St. Louis MSD Mason Valley (Lower) Sanitary Project 3,100 LF 15" and 24" Diameter

Location: St. Louis, MO Installed: Summer 2010 Engineer: Crawford, Murphy & Tilly Contractor: Essex Contracting, St. Louis











Manitowoc Sanitary 24" Diameter Pipe

Location: Manitowoc, WI

Installed: Fall 2009

Engineer: City of Manitowoc

Contractor: Minton Construction







Fly Ash Landfill / Maryland

- 12,500 LF 15"–48" SaniTite HP For "Storm" Application
- Contaminated Soils
- Alternative to "Coated" Class IV RCP with Premium Joint





Slip Lining









Port Columbus International Airport Columbus, OH

- 18,000 LF 30"-60" SaniTite HP For "Storm" Application
- Alternative to Class IV RCP with Premium Joint








Summary

- ADS: a conservative experienced company
- PP: an international pipe material
- 13', 16', 20' lay lengths
- Rigid and high impact
- Lightweight & quick installation
- Deep cover, high load bearing capacity
- Plug & play:
 - Fernco
 - Inserta-Tee
 - A-lok
 - Press Seal, NPC, etc.
 - Air, water, and mandrel testing
 - Repairs
- Customer support



QUESTIONS?