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Sanitary sewer construction with polypropylene pipe

Award-winning overflow-abatement project uses a new type of plastic pipe.

PROJECT DETAILS:

PROJECT: Combined sewer separation

OWNER: City of Portland, Maine

ENGINEERING AND DESIGN: Woodard & Curran, Portland

LOGISTICS AND SYSTEM DESIGN SUPPORT: E.J. Prescott Inc.; Gardiner, Maine

CONSTRUCTION MONITORING: Gorrill-Palmer Consulting Engineers Inc.; Gray, Maine

CONTRACTOR: R.J. Grondin & Sons Inc.; Gorham, Maine

INSTALLATION: June through October 2010

COST: \$4 million

In June, sewer managers for Maine's largest city received a regional American Public Works Association award for a project that involved one of the nation's first and largest installations of polypropylene pipe for combined sewer overflow remediation.

In 2007, when Portland began exploring how to eliminate overflows and keep untreated wastewater from flowing into an estuary, such a product wasn't commercially available. But the next year, a pipe that provided a watertight joint and met the city's required stiffness standard of 46 pii was introduced, and added to the list of options — which included epoxy-coated, reinforced concrete and centrifugally-cast glass fiber reinforced polymer — con-

tractors could choose from to meet an extremely tight installation deadline.

Developed specifically for the gravity-flow sanitary sewer market, SaniTite HP (for "high-performance") pipe is made from an enhanced grade of polypropylene resin: an engineered, impact-modified, co-polymer compound that's chemically resistant to the hydrogen sulfide gas and sulfuric acid concentrations typical of sanitary sewers. Developer and manufacturer Advanced Drainage Systems Inc. is the world's largest producer of corrugated high-density polyethylene (HDPE) pipe.

SaniTite HP 30- to 60-inch-diameters meet ASTM F2764.

The 60-inch pipe has a triple-wall construction that provides a smooth interior and exterior wall design, sup-

ported by a corrugated structural core for improved stiffness and greater beam strength to minimize deflection and enhance long-term performance. It's available in 16.3- and 20-foot lengths.

The 30-inch pipe is available with either dual- or triple-wall construction and, like the 48-inch pipe, comes in 13- and 20-foot lengths to accommodate various trench box dimensions.

Pipe 12 to 30 inches in diameter meets ASTM F2736 and is made with dual-wall construction to provide performance ratings that exceed many industry standards for gravity-flow sanitary sewers.

With dual gaskets and banded reinforced bell and spigots, all are watertight, exceeding the requirements of ASTM D3212.

Consulting firm Woodard & Curran and city engineers had spent several years exploring design alternatives for replacing hundred-year-old 24- and 30-inch vitrified clay pipelines with a single, larger-diameter pipe and separating a parallel, 10-foot-diameter pipe to convey only stormwater.

They wanted a system designed around data from actual storms, not a predicted 25- or 100-year-event model. Monitoring equipment installed



Five months from start to finish: The interceptor project replaced 24- and 30-inch vitrified clay pipelines with 5,600 feet of 60-inch polypropylene pipe. Buried 8 to 22 feet down, the pipe — Advanced Drainage Systems' SaniTite HP — has maintained shape regardless of depth. Photos: Advanced Drainage Systems

Safety, environmental pressures

Part of the mile-long installation was under high-tension electrical transmission wires.

Thanks to Maine's tough bedrock, some blasting was required.

Finally, the last half of the installation occurred in an area identified by the Maine Department of Inland Fisheries and Wildlife and state EPA as an inland wading waterfowl habitat, which limited construction to between Aug. 1 and Oct. 15. The travel corridor for reaching the area to install the new pipe in depths to 22 feet was only 30 feet wide.

"We went with the ADS pipe because we could set it in place simply with our backhoes and wouldn't need cranes," says Ken Grondin of R. J. Grondin & Sons Inc., which was awarded the installation contract. "Plus, there were logistic issues.

"If we used concrete pipe that comes just in 8-foot lengths, we'd have had nearly 200 truckloads to coordinate to the holding site and then have to move again piece by piece to the trench. That's a lot of extra handling and traffic control. There were essentially three times fewer trucks required with the 20-foot lengths of the ADS pipe."

Another benefit of choosing the pipe was that ADS had recently acquired the Inserta Tee line of fittings, which can be used to connect corrugated, solid wall, profile wall, and concrete pipe regardless of manufacturer to provide a watertight lateral service connection for wastewater and stormwater systems. About 200 feet of the ADS pipe in diameters ranging from 24 to 48 inches was used for laterals that were

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in the existing line collected flow data from September 2007 to September 2008, supplementing data the city had collected from monitoring sites within the project area in 2004 and 2005. The largest storm occurred Sept. 6-7, 2008, when 5.46 inches of rain fell with a maximum intensity of 0.94 inches in one hour.

"Our analysis determined the main line would require a 60-inch pipe to handle the peak flow rate anticipated for the system of 70 million gallons

a day along its 1-mile length," says Woodard & Curran Project Manager Dave Senus, PE. "The ADS pipe with its Manning's 'n' value of 0.012 met this requirement."

So it was added to the city's request for proposals.

Service laterals and all but four manholes were fabricated from the same material as the replacement pipe: polypropylene.



Instead of precast concrete, ADS used the 60-inch pipe to fabricate manholes with H-20 load rating and fill heights. Once in place, each was encapsulated in concrete with a field-placed steel reinforcing cage.

could use a larger backhoe for a wider and longer trench, we went back to the standard 20-foot lengths. Then when we got into the deeper areas, we asked for some more 16-foot lengths even though we were using the big backhoes and didn't have any overhead hazards.

"ADS did a wonderful job on fabricating the fittings. They went through pain-staking efforts to make sure we got what we needed, such as special tees and bells; and everything was made very accurately and fit perfectly."

Manholes made from the same material as the pipe also helped the contractor meet deadline.

The original design called for concrete structures. But instead of heavy, 8-foot precast concrete manholes that

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connected to the main trunk using In-serta Tee fittings and fabricated fittings.

"What I like about the pipe as well as the company is that ADS was open-minded and provided a good product and good service," Grondin says. "They offered us options to make the pipe at

the length we required and T-bases.

"So, for instance, in the shallower areas where we needed to use smaller equipment under the power lines, we used 16-foot lengths with a smaller backhoe and smaller trench box. But in the more accessible areas where we



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would've been cumbersome to move, each of the 21 manholes were individually designed for H-20 load rating and fill heights at the ADS factory. Once in place on the jobsite, each T-base was encapsulated in concrete with a field-placed steel reinforcing cage.

"We saw the benefit of making them out of the SaniTite pipe instead of concrete and worked with the city to gain

approval," says Robbie Chadwick of E.J. Prescott Inc., which provided logistics and system design support for the project. "In the past you'd have the pipe from ADS, then the concrete structures from another company, etc. Instead, this is a turnkey operation. We live here, so we want what's best for our community. This interceptor will probably last for more than 100 years."



About 200 feet of pipe in diameters ranging from 24 to 48 inches was used for laterals that were connected to the main trunk using Inserta Tee and fabricated fittings.

The T-bases made the contractor's job easier as well.

"They were ideal because essentially you plug them in and at the end of every night you can open up the line installed that day and go home, not worry about flows or your bypass pump as opposed to a precast concrete structure," Grondin says. "We did have four precast concrete manholes on the job for various reasons. But for those you end up having a space underneath the inlet and outlet of the manhole that requires a brick channel. You have to get back in there and do that brickwork."

"The T-base is superior in 90% of applications because it's a plug-and-go solution with no brickwork. They're lighter, so you can use smaller equipment to set them. The concrete would've required a crane, and we were working under high-voltage power transmission lines. It was just safer all around."

Gorrill-Palmer Consulting Engineers Inc. monitored construction and provided continuity between the engineering design firm, the city, and the contractor.

"We kept track of quantities, payments to the contractor, and were also the go-between for Grondin & Sons

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and Woodard & Curran,” says Paul Ostrowski, PE. “If the contractor had a question I’d try to answer it first. But if it was too technical, I’d go back to Woodard & Curran. Our goal was to simplify and keep the project moving because we had a tight timeline.”

In fact, the contractor brought in another crew as the construction deadline loomed to split the park segment of the installation in half: one crew started upstream, the other downstream, and they met in the middle.

“It was pretty much a perfect fit,” Ostrowski says. “They hit it right on grade. The Grondin crew had to be a little creative in making the connection because it was a tight fit. They picked up both pipe sections, let them touch, and then lowered both into place. They used a steel band coupler and did a concrete collar around it.

“The ADS pipe definitely increased productivity. Once, they put in about 320 feet in one day.”

To backfill the trench most of the material used was existing native soil. Crushed stone was laid as a bed for the pipe and about 1 foot of cover directly over the top the pipe.

Post-installation assessment: positive

A Mandrel test was performed several months after installation to determine to what degree, if any, the pipe had deflected.

Grondin & Sons pulled the mandrel through the pipe using ropes, hauling it from manhole to manhole without any issues. The pipe, which had been buried in depths ranging from 8 to more than 20 feet, maintained shape regardless of the depth. **PW**

—Cooper (steve@scacommunications.com) is a free-lance writer based in New York City.

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