

# Storm Water Culvert Repair Stands Up To Weight Of Railroad Trains And Contaminated Soil



**A 20-foot section of SaniTite® HP pipe being nudged into the culvert. It took the crew just hours to slipline the entire 200 feet of the culvert.**

**T**he town of Durham, New Hampshire found that sliplining with 5-foot diameter polypropylene pipe was the solution to a three-pronged problem be-

ing faced when they repaired a storm water culvert. The 99-year old poured-in-place box culvert runs under an active railroad track through a Brownfield site. This re-

quired the repair to be able to seal out any contamination from above, not inhibit the creek's water flow rate and still be able to withstand the weight of 17 feet of earth

and the multi-ton Amtrak passenger and freight railcars frequently passing overhead every day. Construction costs were originally pegged at \$180,000, but the final tally of \$101,000 was a reduction due to the pipe selection and the project being treated as a design-build undertaking.

“The culvert is under the railroad tracks and a paved remediated area,” Dave Cedarholm, P.E., town engineer, Depart-

match.

The Town of Durham with a full-time residential population of nearly 13,000 is also the location of the University of New Hampshire that has 15,000 students and staff. The town was selected to receive a Brownfield clean up grant for two-acres at Depot Road, which includes the university campus and town land. It abuts the high-speed rail corridor that provides freight and

cleaners in the area between the 1940s and 1989, when it closed.

“The pipe being used to line the culvert had to prevent any possible contaminants from migrating into the brook. This is the reason for the minimum joint pressure rating of 15 psi.” Cedarholm continued. “It was required that the joints satisfy a sanitary condition -- the same as a sanitary sewer.” The security of the joints was also an important factor in the final steps of the installation.

“And we also had to have a pipe that was manageable with just a reasonably sized excavator in a narrow area,” Cedarholm continued. “Some of the pipes we looked at like the steel reinforced pipe would require a crane to lift each section making it quite a challenge to get the pipe up in there. Corrugated metal pipe was not an option because of the joint pressure-rating requirement and it does not last as long. And you really cannot slipline with concrete pipe, and spraying a concrete coating would not have done the job. It became pretty obvious that the SaniTite<sup>®</sup> HP triple wall profile pipe from Advanced Drainage Systems, Inc. (ADS) was our choice because of its material, economical price point, the way it is monolithically extruded and because a standard contractor could easily and quickly install it.”

According to Kevin McCurdy, who has been repairing culverts for more than 20 years and is the manager of the plastic pipe fabrication division of Everett J. Prescott, Inc. (Gardiner, Maine), the local ADS distributor, “Usually, they deteriorate from the base of the stream to the first foot up. Some states are going after them with

aluminum-plate pipe, which means they’ll be facing the same problem within 10 years. The biggest problem for corrugated metal is that it is not going to make it 50 years. And one of the biggest things with concrete is how are you going to push the sections together - - what about the weight of the pipe and the bell end diameter? And just spraying high-strength concrete on the deteriorated



**Contractor easily assembles the field joint together with ratchet straps.**

ment of Public Works, Durham, explained “so there was concern on both the part of EPA and state that contamination from the parking lot area above could potentially seep into the brook. There were some pretty bad cracks in the side of the original culvert which is six foot wide and eight foot tall at the top of the arch and during high groundwater table time you could see water just pour out of those cracks. The state and EPA really wanted to seal that up and together we came up with a couple of options, and the most attractive was to slipline the culvert. Another was just to seal up the cracks but no one felt that would have any longevity.”

The pipe lining is intended to prevent contaminants from migrating into the brook through cracks in the existing concrete cast-in-place culvert. The majority of the project was paid for with a Brownfield grant with the town providing a 25 percent

Amtrak passenger service, the university’s Whittemore arena plus the Memorial athletic field. The \$200,000 grant was used for community involvement activities and remediation of tetrachloroethene (PCE) contamination in the soil and groundwater at the former Craig Supply Company site. The contamination is the result of spills and leaks from an above-ground storage facilities and railroad tanker cars. The company distributed dry cleaning supplies and chemicals to dry

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surface walls of corrugated steel or whatever type of pipe that was used for the culvert literally covers only the surface. Without grouting you haven't done anything about the voids that were created which means you didn't do anything about stopping the infiltration of soil and water over time."

The weight above was a concern. "When the calculations were done, the design assumption was that the existing culvert would not provide any strength," Cedarholm said. "It was as though the existing culvert was not there and so the new pipe would have to withstand pressures from the 17 feet of soil above the pipe and also the E80 railroad load. This combination required at least a 46-psi pipe stiffness and joint pressure rating of 15-psi that other pipes could not meet and be economical."

An industry sponsored 'real-life' study was completed in 2010 that examined and verified the use of large diameter corrugated pipe made from high-density polyethylene (HDPE) resin. Funded by the Plastics Pipe Institute, Inc. (PPI), the major trade association representing all segments of the plastic pipe industry, it evaluated the successful use the pipe for use under heavy rail car loads with shallow cover. The test was conducted by the Transportation Technology Center, Inc. at the Facility for Accelerated Service Testing (FAST) in Pueblo, Colorado where it operates a test bed for railroad track. The final report is available on-line at website: [www.plasticpipe.org/drainage/cppa\\_technical.html](http://www.plasticpipe.org/drainage/cppa_technical.html). The FAST program has been providing the railroad industry with valuable information since 1976, with the operation of 315,000-pound cars beginning in 1988. The Federal Railroad Administration and the Association of American Railroads jointly fund the FAST program with contributions from individual railroads and the supply industry.

**Installing the Pipe**

While the project started in 2001 with the identification of the Brownfield site, the culvert repair along with construction of the new headwall would need to happen in just six weeks. "We had a small window of time," explained Cedarholm. "We had to wait until the spring semester ended at UNH and had to be done before August 15th, when the sports teams arrive and the University is getting ready for the new school year. The weather held out and

we only had a trickle running through the culvert during installation. I've seen water four feet deep rushing through there. If we had a three inch rain storm, things would have gotten pretty interesting."

Contractor Ted Berry Company, Inc. (Livermore, Maine) won the public bid. "The first thing we did was to go out to the site a few times," stated Matt Timberlake, vice president of the company. "It was a very unique layout due to the two ends of it being on the UNH properties and under a railroad track, which makes any project

that much more complicated, and every little detail becomes more important when you're dealing with anything that has to do with the railroad especially this being the Downeaster high speed passenger rail. We built a plywood mandrel prior to bidding the job that was the same OD as the specified pipe, and actually walked it through the culvert. This let us confirm the true OD of the entire culvert and avoid any complications later on. Sometimes when you get into those large diameters it's kind of hard to judge by eye. You look through



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it and visually it looks fine. We did discover that there was one spot in the middle where the diameter did get a little bit smaller but there was still plenty of room for the pipe.

“Our plan called for putting in 2 x 4 rails on the base of the culvert that we could use to slide the pipe in and would allow water to flow underneath the pipe as we were building our bulkhead,” Timberlake continued.

“On the first day in the field, we set up a simple level and transit and we found that the upstream end was lower than expected. So, we had to make some adjustments to slope of the pipe to create a more consistent flow line. With the rail system, we were able to correct the pitch by raising the inlet

and more than 200 cubic yards was used. “The grout acts two fold,” explained E. J. Prescott’s McCurdy. “First to penetrate through any of the old joints to help fill voids in the soil around the pipe and it also increases the loading ability by filling in annular space between the pipe and the inside surface of the old culvert.

“The material we use is cellulose cement, so it has a very low weight - we get it down to about 60 pounds per cubic foot so it doesn’t have the weight factor involved but is still about a strength 500 psi strength cement mixture. It’s not real thick or self-leveling but can easily go into those soil voids and fill them up.”

According to Timberlake, the grout

they did not leak, no sign of leakage whatsoever. To say the least, we were very satisfied with the joint style, how they physically went together in the field, how easy they were for the crew to deal with and the fact that it was a tight joint. Contractors like to see it work before we really believe it. We’ve used corrugated HDPE pipe before but it’s the first time we used SaniTite HP pipe and we saw it work. My field guys are believers. And if they are, I am.”

### Function, Performance and Aesthetics

The final touch was the repair of the existing headwall. “It’s fantastic,” said Cedarholm, “with the stone work. The University’s Whittenmore Center faces that outlet

end where we had the masonry headwall built. So they wanted something that looked pretty nice, not just a slab of concrete. We had a standard DOT detail for the shape of the headwall, but we hired a local stonemason Rob Burnham of Millstone Stone Masonry who took that to another level and really made it fit into the topography.

“The old concrete headwall also had some real structural issues. It had a very large crack and a large portion was tipping forward. In addition, the slope above the headwall was steeper than 1:1. So the pipe actually stuck out beyond the old pipe by

about 10 feet which allowed us to build the new headwall in front of the old one,” he said. “There’s compacted fill between the two that now supports the old failing headwall. We didn’t disturb any of the area above the old headwall and that was a key to the project because the soils are potentially contaminated and the vegetation is currently stable so we didn’t want to destabilize that slope. Now the new headwall supports both the slope and that old headwall. And I just love the way it came out. It has a nice clean cut face on it and



**The final headwall and the 60-inch diameter pipe blends in with the surrounding area.**

end by 8-10 inches. We shot the invert, slipped in the new pipe and had it perfect. The entire pipe system with just a little less than 200 feet of pipe was put together by a crew of four guys in a couple of hours.”

After the pipe was installed, the Ted Berry Company crew started the grouting process to fill in any cracks in the walls of the old culvert and to fill in the annulus between the pipe and the surface of the old box culvert.

The grout was a critical component of the installation as it would fill in all around

could have posed a real problem if the pipe did not perform as required. “One of the concerns about any segmental pipe is the pipe joint, especially when you’re doing grouting. One of the hesitations with grouting is always if the joints leak you’ll have grout inside of your new pipe. And if that happens from a contractor’s end, that’s the most risk I have in the entire project. If I grout and the joints leak, either I ruin the new pipe or have to go in and clean concrete out of the new pipe and that’s all bad. We grouted and all the joints were tight...

the end of the pipe blends in real nice with the stonework.”

“As contractors, one of the things we understand is that we go in and put pipes underground, under roads, under railroads, under all these things,” reflected Timberlake. “Nobody sees that. But what they do see is what you leave behind especially on storm drain projects is that in the ends, it must be pitched the right way so there’s no puddle on the end, and our crew takes a lot pride in that. After this job, we took a look back and the guys said it will be fun to take their kids to a hockey game at UNH and show them what we did and tell them I did

it. You don’t hear that everyday...pride of craftsmanship.” **L&W**

by *Steve Cooper*

For more information call ADS at (800)821-6710, go to [www.ads-pipe.com](http://www.ads-pipe.com) or contact any local ADS office.

**Putting it all together...**

The process the Town of Durham followed saved it time and money.

“It’s sort of unheard of for a municipality doing its own design-build project. A lot of it has to do with purchasing policies and state regulations,” offered the town’s Dave Cedarholm. “When we’re doing a sewer or a water project with a grant, we are required to hire an engineer to design and oversee the construction of the project and then we have to bid the project out. That higher level of engineering and the bidding process adds significant cost to the project. You also typically get a small grant from the state to do the project that way, which is not a bad thing, but it stretches out the project schedule and adds a lot of cost.”

Ted Berry’s Matt Timberlake said, “One of the unique things about the job was the way it was put together. As part of the grant the town received, they were required to do a certain percentage of the work on their own. And so they had a set of plans put together with the work that was required for the sliplining contact and the work that was required that the city was going to do. It was all on their own and detailed that work by the contractor and work by the city.

“What we figured there was work that was happening on the downstream end of the culvert rebuilding the headwall and in doing some of the erosion control that was a significant part of the project. I think they put together a project with a very good bid from us...just under \$100,000. If we had been responsible for all the work on the end, it would have obviously added significant cost to it. I think they got the best bang for their buck by putting it together as we come in sliplining and grouting and they took it from there.”

“The grant required that we, the town, provide a 25% match,” Cedarholm continued. “So we wanted to do some significant components of the project ourselves in order to satisfy that match. And so we identified a few areas that would enable us to turn this into a simple pipe project with outside contractors to help with the pipe and a mason for the headwall, and the town would do the site work.” **L&W**



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