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Innovative HDPE Pipe Solutions Speed Replacement of Storm-Damaged Culvert in Houston



In January 2020, construction workers in Harris County, Texas, installed three 72-inch, 210-foot-long Spirolite culverts featuring tapered ends to fit in better with the natural environment. (Photo courtesy of Plasson USA)



Plasson USA manufactures high-density polyethylene (HDPE) pipes and fittings customized to meet the unique needs of each project. (Photo courtesy of Plasson USA)

ENGINEERING for RESILIENCE

HDPE Pipe, Spirolite, Chosen as Long-term Solution to Replace Storm-Damaged Culvert in Houston

By Erica Bender

Governments, utilities and contractors often rely on conventional products they are familiar with to build, repair, or replace underground pipe infrastructure. However, to keep pace with growing population demands and support resilient building practices, many decision-makers are seeking advanced, forward-thinking solutions to ensure systems run optimally for as long as possible.

One innovative option is high-density polyethylene (HDPE), a flexible plastic material valued for its durability, versatility and longevity. HDPE pipe is normally joined together by heat fusion, making it exceptionally strong yet lightweight and virtually leak-free. This material is also lauded for its corrosion and chemical resistance, weatherability, low maintenance, ease of installation and eco-friendliness.

While HDPE has been on the global market for decades – and utilized by a broad range

of sectors including municipal, industrial, marine, mining and agricultural – certain countries have been slower to adopt this robust solution proven to outperform traditional materials such as concrete, fiberglass, and corrugated metal in large-diameter pipe applications. In the United States, HDPE pipe is commonly used for conduits to transport natural gas and chemicals. Larger HDPE pipes, up to 54 inches, are often seen in high-pressure water pipelines. In recent years the product has gained traction in other markets (e.g., stormwater/wastewater, agricultural, highway construction), and in larger sizes, due to a growing awareness about its unique advantages.

According to spokespersons at Plasson USA, one of the world's largest manufacturers of polyethylene piping systems, factors related to population growth, environmental issues and natural disasters have attributed to the uptick in the usage of large-diameter HDPE

pipe. "The world's continued population growth, along with the pressing need to conserve water and save energy, requires larger infrastructure. Therefore, large-diameter pipe is needed to upgrade and expand these systems," says Iris Jancik, Vice President of Business Development and Sales at Plasson USA.

Alex Perdaen, a Sales Engineer at Plasson USA, agrees. "The aging water infrastructure in the United States has led to an increasing number of failures. Dramatic weather conditions such as hurricanes are adding extraordinary stress to these existing systems. Dry and wet cycles are also creating ground movement, causing many pipes made with conventional materials to break under shear stress. HDPE pipes, including our Spirolite product, stand up particularly well under these conditions," he says.

Spotlight on Plasson USA

Plasson USA, a subsidiary of the inter-

national firm Plasson Group, and headed by CEO and President Philip Ford, offers a full line of standard HDPE pipe fittings ranging in size from a half-inch to 65 inches and with pressures up to 320 psi as well as lower-pressure pipes up to 120 inches in diameter. Larger sizes are available upon request, and any product can be customized to meet an application's unique needs. All products are rigorously tested to meet stringent industry standards and requirements.

The company's largest manufacturing plant is in Corsicana, Texas, which produces Spirolite pipe and fittings above 24 inches. Plasson USA also provides high-end electrofusion fittings from its facility in Israel, which are specifically designed for reliable, high-performance pipe joining and long system life.

The company's signature Spirolite product is a specialized HDPE fluid network conveyance system encompassing pipe, fittings, manholes and structures made from

spirally wound HDPE pipe in open, closed or solid-wall profiles. Other benefits of Spirolite include flexibility, excellent hydraulics/flow, stress-crack resistance, abrasion resistance and high ductility. Also, Spirolite features sophisticated joint configurations – either a bell and spigot gasketed joint or a plain-end, fields-welded joint – that contribute to reduced installation time.

All Spirolite products are created using PE4710, a 100 percent pressure-grade resin approved by both the American Water Works Association and the American National Standards Institute. This state-of-the-art compound optimizes the strength, stiffness, toughness, and long-term reliability of HDPE pipe.

"Spirolite is a leak-free system, in terms of both infiltration and exfiltration, and has a long life span of 100-plus years," Jancik adds. She notes that alternative products made of corrugated metal, fiberglass and concrete are prone to leakage and can cause the surrounding soil to erode from around the pipe. This, in turn, can lead to pipe instability and failure.

HDPE Pipe Offers Originality and Dependability

Recently, HDPE pipe offered an opportunity for innovation on a bridge replacement project in the Riverside Terrace neighborhood of Houston, Texas. The area was significantly impacted by catastrophic flooding caused by Tropical Storm Imelda last September, including damage to a bridge at 209 Holly Street. When the corrugated metal pipe (CMP)

culvert beneath the structure collapsed and threatened the stability of the bridge, Harris County decided to build a new bridge approximately 500 feet from the existing one and replace the two existing CMP lines.

Typically, reinforced concrete pipe (RCP) would have been specified in accordance with Harris County's design standards for a project of this scope and scale. However, the severe weather event required a rapid construction response. With this in mind, along with a desire to rebuild the structure with greater resilience, the engineering department's special projects group opted to use Spirolite. While Harris County has previously used HDPE pipe on driveway culverts and other smaller operations, this was the first time the product was employed on a larger, more complex project.

The culvert replacement activities took place in January 2020 and lasted approximately one week. Angel Brothers performed the installation of the three 72-inch, 210-foot-long Spirolite units, which featured tapered ends to fit in better with the natural environment. According to Jancik, "No other pipe can be cut this way without weakening the structure of the pipe."

"Constructability efficiency was another key factor in our decision to use Spirolite," says Harris County Chief Engineer Brock Crenek, PE. "Spirolite is much faster and easier to install compared to RCP and other products, which normally take two to three weeks to place. The ease of installation also allowed us to use smaller and lighter con-

struction equipment, which was essential due to the confined space of the right of way area. This approach also mitigated noise and air pollution on the project."

A Go-To Solution for Highway Improvements

In addition to municipal water/wastewater applications, Spirolite is a go-to solution for highway work in numerous states, including Indiana, Iowa, Michigan, Illinois, Utah, Arizona and Nevada. The Indiana Department of Transportation (INDOT), for example, has utilized Spirolite to reline its highway culverts for the last decade. Over the next few years, the state agency plans to replace hundreds of damaged culverts.

"INDOT prefers to reline its failing culverts versus digging up and replacing the culverts, which is more costly and requires shutting down or bypassing the highway," Jancik shares. "When comparing relining options, using Spirolite for these culverts (which are 60 to 120 inches in diameter) is the fastest, easiest and most cost-effective option."

When pushing lightweight and flexible Spirolite pipes inside of these existing culverts, many of which are made of CMP, the new pipe is strong enough to act independently as a large culvert underneath the highways. Comparatively, a heavy and rigid concrete pipe cannot be slid easily across the uneven surfaces within an existing culvert, and can potentially fracture or break during the process.

Shifting Paradigms in Building Responsibly

The Alliance for PE Pipe, headquartered in Tulsa, Oklahoma, is a trade association dedicated to educating infrastructure decision-makers about the advantages and applications of HDPE pipe. According to Executive Director Peter Dyke, the use of HDPE pipe can be a real game changer in conserving natural resources and lowering infrastructure maintenance or improvement costs.

He defines HDPE as a "responsible infrastructure" solution given the material's exceptional durability and performance. "HDPE has solved for the two most common failure mechanisms in today's legacy pipes: failure at the pipe joint and tuberculation," Dyke says. He further describes HDPE pipe as a fully monolithic system (aka a seamless pipeline with no joints) better capable of withstanding impacts caused by ground movement versus PVC, cast iron and ductile iron materials. He notes that stray currents, corrosive soils, water and moisture have zero impact on HDPE pipe.

The product's longevity and low life-cycle costs are other major selling points. "If you want to keep a system running as long as possible, why not put in a pipe that will last over a hundred years? Other pipes typically fail in the 40- to 80-year range," Dyke comments. "Also, when installed using trenchless methods, HDPE is 40 percent to 60 percent less expensive than ductile iron and PVC. When installed using open-cut, HDPE is still less expensive, but not as much as with trenchless."



Resiliency and constructability efficiency were key factors in Harris County's decision to use Plasson USA's Spirolite product to replace culverts damaged by a tropical storm. Left to right: Amanda Jones, Harris County; Iris Jancik, Plasson USA; Marco Montes, Harris County; Masih Mujadidi, Harris County; Jose Araguz, Harris County; Adrian Garcia, Harris County Precinct 2 Commissioner; John Blount, Harris County Engineer; Enrique Sanchez, Harris County; Omar Rodriguez-Arellano, Harris County; Paul Fries, Harris County; Ross Moomaw, Angel Brothers; and Ross Hosket, Harris County. (Photo courtesy of Harris County Engineering Department)

Dyke cites other advantages and considerations in employing HDPE, which are too numerous to list in this article. “When one considers the importance of system resilience, nothing performs like HDPE,” he asserts. While the product holds great promise in a variety of markets, he says many people are unaware of the product’s inherent value and ability to meet a broad range of needs. Hence, many advocates of HDPE – including Plasson USA – strive to educate contractors, civil engineers, city managers, county officials and others on how its usage can save time, money and other critical resources.

According to Crenek, the positive experience with Spirolite in Harris County will likely shape specification standards for future endeavors involving large-diameter pipe. “HDPE pipe is an outside-of-the-box solution that pairs well with the Envision initiative embraced by our county, which aims to benefit the environment by reducing construction’s carbon footprint, among other things. Spirolite is definitely something we will consider using for similar applications moving forward,” he confirms.

For the team at Plasson USA, continued innovation in areas such as electrofusion will advance the performance and longevity of its HDPE products – and further bolster HDPE’s reputation. Recently, the company introduced its Spirolite Electrofusion Pipe System, which features an even more robust bell and spigot joint thanks to electrofusion.

“Many companies use electrofusion in their HDPE technologies; it’s the approach that differs,” Jancik reveals. “What is unique and patented to Plasson USA is how we place the copper wiring inside the joints of our large-diameter pipes. When everything is fused together, this makes the joints so strong that the pipe can withstand up to 50 psi.”

HDPE and steel are the only materials that can be fused together in such a manner. “There is no other product on the market that can compete with the performance of our large-diameter pipe, specifically the leak-free joints, with the exception of steel, which is more expensive than HDPE and time-intensive to fuse together,” Jancik explains. Perdaen adds, “Whether in the factory or in the field, the fusion of large-diameter HDPE pipe takes one to two hours. But welding steel takes hours upon hours, and multiple passes along the perimeter of the pipe, due to the thickness of the material.” When a leak-free system is crucial and the pressure does not require steel piping, the Spirolite Electrofusion Pipe System provides for a time-saving, cost-effective alternative.

Jancik notes her appreciation for the many years of experience that engineers have accumulated while using traditional piping materials such as steel and concrete. However, she believes that today’s construction world is hungry for value engineering – and HDPE must become the new standard.

Spirolite, a specialized HDPE fluid network conveyance system, is a go-to solution for highway improvements nationwide. (Photo courtesy of Plasson USA)

