

CONCRETE PRESSURE PIPE IN SEWER INSTALLATIONS



Plastic liner protects Concrete Pressure Pipe lining from acid generated from sewer gas.

As migrating population trends force our surroundings to expand and evolve into larger and more populated communities, the public utilities are constantly being challenged to meet the needs and demands imposed on the area's infrastructure. The conveyance of sewage is a critical and integral part of a community's growing infrastructure.

Laws enacted by environmental authorities such as the Environmental Protection Agency have mandated and enforced more stringent water quality standards. As public utility systems come under closer scrutiny and more restrictive regulations, an economic decision must be made. Compliance might require a new system, or upgrading existing facilities. "Tie-in" to a regional water reclamation district may also be an opportunity. More often, a previously-constructed regional sewer system can be extended to accommodate the new demands.

In addition, environmental concerns and increased treatment costs are requiring the public utilities and their civil engineers to design conveyance systems with low infiltration/exfiltration characteristics. The design must meet present and future needs, as well as comply with all federal and regional standards. Systems such as sewer outfalls and wastewater treatment plant effluent lines that terminate in rivers and oceans must also comply with environmental regulations.



Installation of large-diameter force main with restrained joint.

DESIGN CONSIDERATIONS

System performance is dependent on a pipe product that will convey the sewage with tight joints to limit infiltration and exfiltration. Concrete Pressure Pipe services the needs for the initial collection and transmission phases of a sewer system. It also serves as the yard and process piping in the treatment facilities. Pipeline systems can be designed to flow by gravity or pressure, although it is sometimes more economical to design a hybrid system.

Site conditions and design characteristics can vary considerably from project to project. The data from subsurface exploration might indicate areas having a high water table, a low compression organic soil, or a rock stratum that must be accommodated.

Long reaches of gravity sewer systems may require progressively deeper trench excavations and wider embankment installations. Such conditions might

also require that the pipeline be elevated, pumped under pressure or both. The operation and maintenance costs of pumping may be easily offset through reduced construction costs from shallower excavation, transport, and placement of select bedding material.

PERFORMANCE REQUIREMENTS

The joints of Concrete Pressure Pipe for sewer force mains provide the same performance characteristics as those on water main pipe, ensuring the owner and engineer of a watertight sewer system. The interior of the steel joints are protected from corrosion with either mortar or epoxy and zinc coatings for diameters under 30", and mortar pointing for larger pipe.



Concrete Pressure Pipe in sewage treatment plant.



Concrete Pressure Pipe in sewage treatment plant.

The installation of both sanitary sewers and sewer force mains may need to be conducted in environmentally sensitive areas. For example, sewer lines might need to be laid adjacent to, through, under, or over natural waterways, aquifers, or water mains. Many engineers, when addressing these conditions, recommend that gravity sewers be designed and constructed to AWWA pressure pipe standards. The watertight joint and barrel performance of Concrete Pressure Pipe helps to protect wetlands and environmentally sensitive areas.

ENGINEERED PRODUCTS

To complement Concrete Pressure Pipe, an assortment of special pipe fittings are available. These include integral base-tee manholes and riser sections. The manholes can incorporate drops and deflections, or elbows can be used in lieu of manhole sections when access is not necessary.

A sewer force main operating under pressure might utilize restrained joints. Wherever an unbalanced force is anticipated due to dead-ends such as bulkheads or

tees, or changes in alignment such as elbows, the pipe joints can be restrained, allowing for a completely integral thrust restraint system and avoiding the use of thrust blocks.

In areas that have very poor soil, pile supported pipe is a viable alternative. Continuous beam or simple span pile supports can be used. The types of supports can vary and be designed with chocks or concrete pile cap supports.

Transient conditions are common and can be severe in sewer force mains, primarily because of cyclical pumping. Concrete Pressure Pipe is designed for such conditions and is capable of handling either negative or positive pressure surges.

Concrete Pressure Pipe is a more rigid pipe structure designed to resist not only the internal pressure, but also applied external loads. The reinforcing steel is protected by the highly alkaline environment which passivates the steel in Concrete Pressure Pipe. Portland cement is an excellent corrosion inhibitor for most soil types.



90° wye outlet fitting for 132" sewer pipe, with plastic liner.

INTERIOR ENVIRONMENT

Under certain conditions, hydrogen sulfide gas may form in sewer pipes. Sulfate-reducing bacteria can convert the gas and condensate on the pipe wall above the flow line into concentrated sulfuric acid, which damages the pipe wall. Conversion of gas to sulfuric acid requires an aerobic or oxygen-supplied condition. The sulfuric acid is corrosive to mortar or concrete linings of any piping material, but becomes diluted in the sewer effluent such that damage to the concrete pipe lining below the flowline is not a concern. However, hydrogen sulfide gas will attack bare steel or iron surfaces either above or below the water line, so these materials must be protected by mortar or a suitable coating regardless of their location relative to the fluid surface.

Force mains are normally designed to flow full, which prevents sulfuric acid formation. Force mains should be laid with some gradient to better assure air pockets are contained at air release valves so the air can be expelled. For sections of the force main that do not flow full and for gravity sewers, the use of recognized and approved lining systems can prevent the attack of sulfuric acid on cementitious materials.

Concrete Pressure Pipe continues to be the product of choice. It has given excellent service and has an incomparable performance record throughout the world.

LEARN MORE

For more information about using Concrete Pressure Pipe in sewer installations, speak with your Concrete Pressure Pipe supplier, or contact the American Concrete Pressure Pipe Association at **714.801.0298** or **www.acppa.org**.

References

Sulfide and Corrosion Prediction and Control Design Manual, American Concrete Pipe Association.

Concrete Pipe Handbook, American Concrete Pipe Association, 1988.

Design Manual, Odor and Corrosion Control in Sanitary Sewage Systems and Treatment Plants, Center for Environmental Research Information, U.S. Environmental Protection Agency, EPA/625/185/018, October, 1985.



ACPPA Headquarters
T 714.801.0298
email: support@acppa.org
www.acppa.org