

Go with the Flow

ASTM pipe committees make an impact on **water systems and safety.**

By Cicely Enright

While it's not completely clear how much you need to drink each day (eight glasses is an easy but not necessarily final answer), most of us expect that we'll have clean water to drink.

That clean water comes out of the tap because of public infrastructure systems — systems that carry water from lakes, groundwater, and rivers to treatment plants. Following disinfection and filtration, another part of the system distributes water to individuals and companies.

PLASTIC PIPES

Piping is an essential part of that infrastructure, which over the decades has used brick, steel, ductile iron, copper, clay, concrete, and even wood.

More recently, plastic has been an option for drinking water. Since 1973, an ASTM International committee on plastic piping systems (F17) has been developing standards for system components — pipe, fittings, and joints — and installation.

“F17 standards are of central importance in public water,” says Bryan Hauger, Ph.D., president of Bryan Hauger Consulting Inc., and a member of the committee since 2002. He notes that design and specification engineers all over the world use F17 standards, but they are particularly cited across North America. A lack of corrosion and failure resistance make plastic pipes attractive for water infrastructure applications.

Hauger notes that public U.S. utilities rely on American Water Works Association standards and, in turn, “Those standards rely heavily on ASTM standards for all sorts of details, from the dimensional and performance requirements of pipe and fittings to the testing used to demonstrate conformance to those standards.” For example, the AWWA standard for certain sizes of polyethylene pressure pipe and fittings (C906) references more than 20 ASTM standards.

One significant F17 standard specifies poly(vinyl chloride) plastic pipe and its dimensional, performance, and



©iStock.com/ingorthand



This trenchless project uses an ASTM specification (C1208) for jacking pipe.



test requirements (D1785). Another covers crosslinked polyethylene pipe systems (F877). These are just two of the nearly 250 standards that the committee has developed; many more also apply to water, plus other plastic piping purposes such as gas and various materials, whether they are composite, vinyl, or olefin based.

PIPE FOR SANITARY PURPOSES

The other critical part of water infrastructure is sanitary, separating human waste from human contact, drinking water, and public waters.

“Sanitary sewers may not be the most popular topic of discussion, but let a sewer stop functioning for a few hours and you will see just how essential our sanitary sewer systems have become,” wrote Edward Sikora, then president of the National Clay Pipe Institute (U.S.), during the centennial of ASTM International’s committee on vitrified clay pipe (C04).

Both C04 and the committee on concrete pipe (C13), support these materials for sanitary sewers.

The vitrified clay pipe committee organized in 1904 in response to a lack of standard sizes, strength, quality tests, and installation methods. The group’s first standard, updated



One F17 standard specifies poly(vinyl chloride) plastic pipe and its dimensional, performance, and test requirements (D1785). Another covers crosslinked polyethylene pipe systems (F877). These are just two of the nearly 250 standards that the committee has developed.



Another critical part of water infrastructure is sanitary, separating human waste from human contact, drinking water, and public waters.

and still in use today, first appeared in 1915 as C12, Recommended Practice for Laying Sewer Pipe.

Vitrified clay pipe — made from clay and shale that is fired to over 1093 C (2,000°F) — is a centuries-old material for gravity flow municipal sewer pipe. The clay pipe manufactured today now benefits from new technologies and processes. “The essential process to make the pipe hasn’t changed in 6,000 years,” says Jeffrey Boschert, P.E.,

current president of the (U.S.) National Clay Pipe Institute. “But advances in the last 40 or so years have led to stronger bodies and water-tight joints.” He adds that cities are calling for vitrified clay again, citing Seattle, Washington, and Portland, Oregon, in the United States, as two recent examples.

Chemically inert and 100 percent corrosion resistant, vitrified clay pipe meets the challenge of carrying commercial, industrial, and residential sewage to treatment plants. The pipe stands up to rigorous cleaning procedures, including jetting pressures of over 34.5 MPa (5000 psi) as well as most commonly used mechanical cleaning methods. In addition, this pipe “is a product made basically of dirt and lasts forever; so it has unmatched sustainability, both environmentally and fiscally,” Boschert adds.

More standards for the pipe have been developed over the years. For example, standard C700 specifies standard- and extra-strength vitrified clay pipe and fittings — their materials, manufacture, physical properties, fittings, and more. Test methods for the pipe contained in standard C301 address its resistance to acid solutions, earth loads, hydrostatic forces, and absorption. A third standard (C1208/C1208M) governs vitrified clay jacking pipes typically used for trenchless installation methods.

Another pipe type for sanitary and storm sewer applications is concrete. According to the American Concrete Pipe Association, it can be designed to resist any required load and is not as installation-sensitive as many other buried pipe options. In addition, concrete pipe lasts a long time — many installations have been in place for over 100 years.

“Standards have been the backbone of the concrete pipe industry,” says Josh Beakley, P.E., vice president of engineering at the American Concrete Pipe Association. “Without standards, we don’t really have an industry.”

One standard for reinforced concrete culvert, storm drain, and sewer pipe (C76) provides engineers with the ability to specify five strength classes of concrete pipe according to the specification. “C76 is the bread-and-butter specification,” Beakley says. “It’s the one most people tend to use.”

DURABILITY, RESISTANCE, INNOVATION

In keeping potable water separate from sewer and other water, and conserving water in general, ASTM International committees have also developed standards related to pipe joints and stormwater. They’re also working on trenchless applications as well as looking at new materials.

Keeping water out of pipe highlights the importance of system joints. And, according to the 2017 Infrastructure Report Card from the American Society of Civil Engineers, nearly 23 billion liters (six billion gallons) are lost every day through leaking pipes, much of which was laid in the 19th and 20th centuries. Each pipe committee has developed resilient joint-related standards to prevent leakage from the pipe and keep outside water from getting in. The ASTM International subcommittee on joints for precast concrete structures (C13.08) specifies the joints used in pipe, manholes, and box sections. The vitrified clay pipe committee specifies factory-applied compression joints (C425), which assures both watertightness and joint flexibility. And for plastic pipe, standards such as the practices for installing rubber gaskets (D2321) and heat fusion joining of polyolefin pipe and fittings (D2657) support leak-free systems.





“Standards have been the backbone of the concrete pipe industry. Without standards, we don’t really have an industry.”

Josh Beakley
American Concrete Pipe
Association



With increased variability in weather patterns, stormwater management has become more critical to help reduce flooding potential. In the United States, the Environmental Protection Agency released a draft guide, “Community Solutions for Stormwater Management: A Guide for Voluntary Long-Term Planning,” last year. The guide is intended to help states and local governments manage stormwater, which can be a source of pollution and a threat to public health.

A subcommittee of the ASTM International committee on precast concrete products (C27) has developed three standard methods that support this effort. One describes hydrodynamic stormwater separator device performance under a wide range of conditions (C1745/C1745M); another provides details about the flow, viscosity, and particle size distribution of underground separators and settling devices (C1746/C1746M); and a third addresses the hydraulic capacity of the stormwater device’s filtration (C1814/C1814M).

The clay pipe manufactured today now benefits from new technologies and processes.

And, as technologies develop in innovative areas such as trenchless applications, standards from these and other committees will continue to be developed. For example, the plastic piping systems committee has developed a number of standards for placing plastic liners into existing pipe through forming in-place or pull-through linings. The vitrified clay pipe committee has a standard for jacking pipe, which involves placing pipe as the tunnel is bored. And the concrete pipe committee has jacking pipe standards in development.

The concrete pipe industry has been considering the addition of fibers to the material for possible additional strength and ductility as well as products with thinner walls. “We think we have a really sustainable product,” says Beakley. “The challenge is moving forward with an even better one.”

That’s true of all the infrastructure areas covered by ASTM International standards.