Projects and Plans for the Water Utilities in the City of Austin

Aldo Ranzani, P.E.
Public Works and Engineering Department City of Austin,
Austin, Texas

Executive Summary

Across the United States, municipal operators face the problems of an aging pipe network: leaks, infiltration, low pressure, tuberculation and even collapse. This is made even more challenging by the fact that older pipe often runs under crowded, well-developed, sometimes historic neighborhoods, necessitating careful planning for repairs and replacement.

By 2020, the average age of the 1.6 million miles of water and sewer pipes in the United States will hit 45 years. Cast iron pipes in at least 600 towns and counties are more than a century old, according to industry estimates. And though Congress banned lead water pipes three decades ago, more than 10 million older ones remain, ready to leach lead and other contaminants into drinking water from something as simple as a change in water source.

The U.S. Environmental Protection Agency recently began collecting information for its second Drinking Water Infrastructure Needs Survey, as required by the Safe Drinking Water Act. During the first survey, the single largest category of infrastructure need was for the installation and rehabilitation of transmission and distribution systems. The survey found that municipalities expected to spend some $77.2 billion over the next 20 years to satisfy that need.

In a similar survey conducted on the wastewater side of the industry, the Clean Water Needs Survey found that over the next 20 years cities need to spend $10 billion on upgrading existing wastewater collection systems, nearly $22 billion for new sewer construction and $45 billion for controlling combined sewer overflows. Another $7 billion is needed to control municipal stormwater.

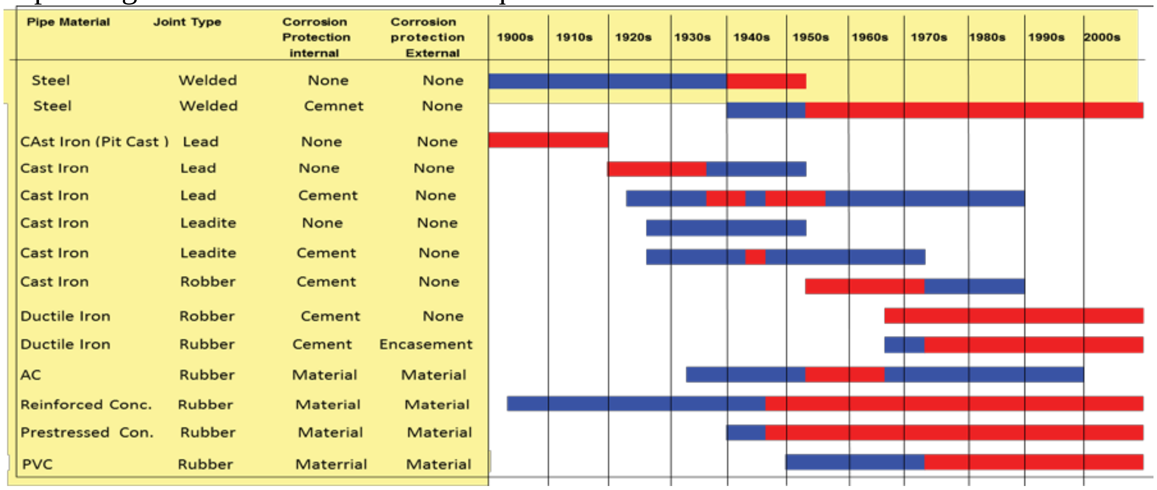
Small communities have a large need in proportion to their size, according to the survey. New collector sewers account for only 6 percent of the total Clean Water Needs for larger communities, but represent 29 percent for small communities. This reflects, in part, the continuing effort to extend wastewater collection and treatment to the smaller communities.

According to EPAs surveys, corrosion is one of the major culprits in pipe failure, causing some materials to fail in as little as 10 years. An EPA survey of 89 cities showed that 32 of them had reported sewer collapses, most from hydrogen sulfide corrosion.

Site visits from the EPA revealed that corrosion problems are not limited to warm climates. Severe corrosion was observed in Seattle, Wash.; Milwaukee, Wis.; Boise, Idaho; Casper, Wyo.; Albuquerque, N.M.; Baton Rouge, La.; Fort Worth, Texas; Los Angeles County, Calif.; and Tampa, Fla.

Pipe History

The average life span of pipe depends on a wide variety of factors including the type of pipe, soil and air characteristics and installation. Network designers often use 50 years as the average life expectancy for most pipe types. That estimate may be too conservative, depending on the materials and techniques used.



Average Estimated Service Lives By Pipe Materials

Derived Current Service Lives (Years)	CI	CICL (LSL)	CICL (SSL)	DI (LSL)	DI (SSL)	AC (LSL)	AC (SSL)	PVC	Steel	Conc & PCCP
Northeast Large	130	120	100	110	50	80	80	100	100	100
Midwest Large	125	120	85	110	50	100	85	55	80	105
South Large	110	100	100	105	55	100	80	55	70	105
West Large	115	100	75	110	60	105	75	70	95	75
Northeast Medium & Small	115	120	100	110	55	100	85	100	100	100
Midwest Medium & Small	125	120	85	110	50	70	70	55	80	105
South Medium & Small	105	100	100	105	55	100	80	55	70	105
West Medium & Small	105	100	75	110	60	105	75	70	95	75
Northeast Very Small	115	120	100	120	60	100	85	100	100	100
Midwest Very Small	135	120	85	110	60	80	75	55	80	105
South Very Small	130	110	100	105	55	100	80	55	70	105
West Very Small	130	100	75	110	60	105	65	70	95	75

LSL indicates a relatively long service life for the material resulting from some combination of benign ground conditions and evolved laying practices etc.
SSL indicates a relatively short service life for the material resulting from some combination of harsh ground conditions and early laying practices, etc.

Soils

The soil in which a pipe is buried can have a variety of deleterious effects on it. The longer the pipe stays buried there, the greater the deterioration it may suffer. It is possible that many incidents of breakage are a result of the effects and movement of the soil in combination with the pipe age and material.

The greatest number of repeat pipe breaks occurred in clays (primarily fat clays) and urban areas. The Austin area soils are largely clay, many of them fat clays, so this is not a surprise. However, Houston black clay figures prominently in the numbers of the repeat pipe breaks. Per 2002 study, from July 1997 to October 2002 , 1267 repeat pipe breaks happened with 29% of the repeat pipe breaks in Houston black clay and urban areas on Houston black clay (fig. 14), even though only 11% of the water system is laid in Houston black clay. So 369 of the 1267 repeat pipe breaks happened in only 222 miles of the water system. However, it should be noted that 94% of these pipes were installed before 1978 and are aging. (Houston black clay is a fat clay with an AASHTO (American Association of State Highway and Transportation Officials) soil classification of A-7. Soil classifications of A-6, A-7, or a combination of these two are silty clayey soils.)

According to the study 19% of the pipe breaks occurred in urban lands and Austin (silty clay) soils. Approximately 14% of the water system is laid in these soils

Water Main Breaks

Generally between 75 and 100 years old, the country's drinking water infrastructure is approaching, if not extending beyond, the end of its functional life. The ASCE estimates there are approximately 240,000 water main breaks every year in the U.S–meaning our pipes are wasting 2.1 trillion gallons of water a year. This is both expensive and inefficient. Despite the fact that our overall drinking water quality remains "high"–particularly in relation to other parts of the world–much of the nation's drinking water system requires a large scale investment. Cities like Flint, Michigan demonstrate just how urgent the issue is, as aging pipes can quickly lead to dangerous health problems when not properly managed (Source :ASCE 1017 report)

Pipe material

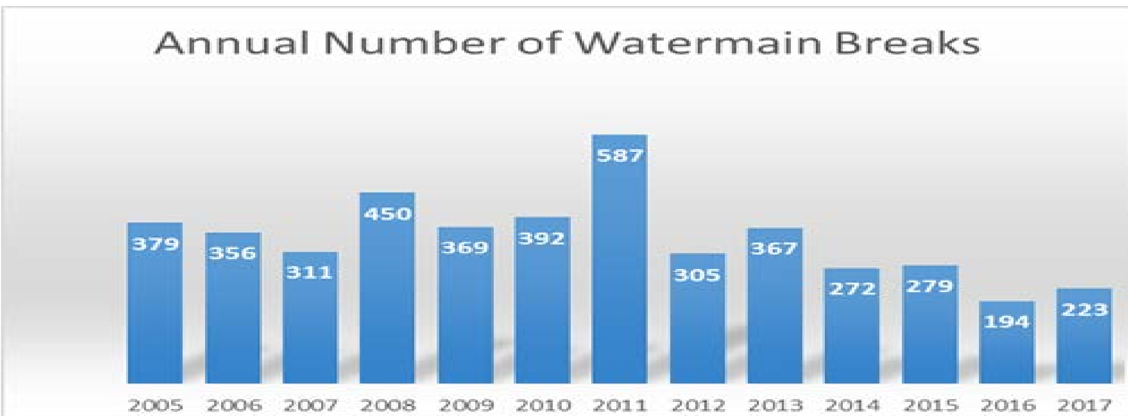
A look at the pipe material most often involved with the repeated pipe breaks reveals cast iron (CI) to be a material of considerable interest. In Austin since 2012 nearly 79.77% of the pipe breaks occurred in cast iron pipe while only 30.40 % of the entire water system is cast iron. AC pipe was involved with 10.72% and DI pipe with 2.79 % of the pipe breaks studied.

Ductile iron (DI) pipe, the current alternative to cast iron pipe, is 25.89% of the distribution system. PVC pipe is 17.92% of the distribution system.

Pipe Type	**Total Number of Mains by Pipe Type**	**Total Miles of Mains by Pipe Type**	**% Of Water System by Length**
Ductile Iron (DI)	45,111	900	25.89%
Cast Iron (CI)	31,525	1,057	30.40%
Polyvinyl Chloride (PVC)	23,700	623	17.92%
Asbestos Cement (AC)	16,918	622	17.89%
Concrete Steel Cylinder (CSC)	3,441	261	7.50%
Galvanized (GALV)	231	8	0.22%
High Density Polyethylene	111	3	0.09%
Steel	10	3	0.08%

An initial breakdown of the data revealed that repeat pipe breaks rose sharply in August and again, almost as sharply, in December. A contributing factor to the tendency to break pipe in the months with higher temperatures might be seasonal increases in water usage. During such months when the temperature rises and the precipitation decreases or ceases entirely, water usage and pumpage increases. Besides the soil condition, pipe breaks appear to rise similarly to the pumpage increases, which might suggest that the added water being sent through the already stressed pipes may stress them further.

Austin of Water Main Break Data before and after 2012 Establishing of Renewing Austin Program Asset Management to replace deteriorated water mains.



Conclusion:
Because pipe assets last a long time, water systems that were built in the latter part of the 19th century and throughout much of the 20th century have, for the most part, never experienced the need for pipe replacement on a large scale. The dawn of the era in which these assets will need to be replaced puts a growing financial stress on communities that will continually increase for decades to come. It adds large and hitherto unknown expenses to the more apparent above-ground spending required to meet regulatory standards and address other pressing needs It is important to reemphasize that there are significant differences in the timing and magnitude of the challenges facing different regions of the country and different sizes of water systems. But the needed investments is real, The United States is reaching across roads and faces a difficult choice. We can incur the haphazard and growing costs of living with aging and failing drinking water infrastructure Or, we can carefully prioritize and undertake drinking water infrastructure renewal investments to ensure that our water utilities can continue to reliably and cost-effectively support the public health, safety, and economic vitality of our communities.

Index to data sources:

Water pipe data:
Austin Water Utility (Systems Analysis/GIS).
Water Pipe Break data or Repeated Pipe Break data:
Austin Water Utility's Facilities Maintenance System (also referred to as CMMS or Hansen)
Soil Data:
United States Department of Agriculture (www.usda.gov). The soil survey for each particular county and state must be consulted for in depth explanations as to the soil types in the data and their characteristics. Some of the soil surveys for Texas are available in pdf format online at http://www.tx.nrcs.usda.gov/soil/soil_surveys.html. However, the only current reference for Travis County Soils is the "Soil Survey of Travis County, Texas" from 1974.
AWWA and ASCE