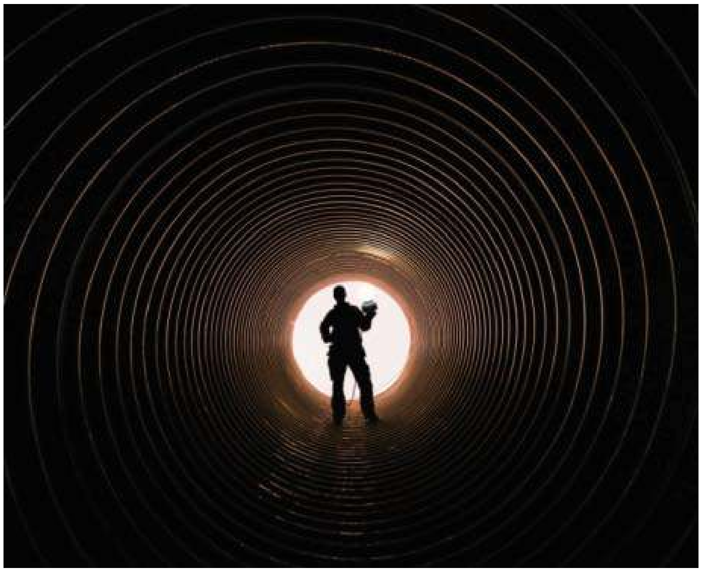
THE UNITED STATES CONFERENCE OF MAYORS

Municipal Procurement



Procurement Process Improvements Yield Cost-Effective Public Benefits

MARCH 2013
WASHINGTON DC

The United States Conference of Mayors

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The Water Finance Research Foundation (WFRF), http://www.waterfinancerf.org/, a non-profit organization which focuses on water delivery and financial practices that are sustainable, efficient, and affordable. WFRF is concerned about the high replacement costs of aging municipal water and wastewater infrastructure and the growing water main break problem which contributes to revenue loss for unaccounted water and the issues of premature failure due to pipe selection, installation, corrosion and maintenance activities. The WFRF supports infrastructure asset management practices, cost and risk evaluations, open procurement and financial transparency, educational outreach, and alternative funding and financing approaches which help utilities maintain financial stability, service delivery sustainability and rate payer affordability.

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INTRODUCTION

Government procurement, the purchase by contract of goods and services, is very big business. Consider this — federal government[1] receipts in 2009 were $2.1 trillion, and expenditures were $3.52 trillion; the federal expenditures (outlays) were 25 percent of Gross Domestic Product (GDP), this includes payroll, pensions and other non-procured goods and services, but generally speaking, federal procurement (minus federal payroll, etc.) ranges from 10 to 15 percent of GDP in any given year. Combined state and local government[2] revenues in 2009 were $2.07 trillion[3], and expenditures were $2.97 trillion. The exact amount of local government procurement is not known but is, nonetheless, a significant amount of taxpayer dollars, and an important sector of the economy. While procurement processes necessarily involve repetitive practices it is no wonder that they can lead to economic inefficiencies, and this paper will cover one such example – how local governments procure water and sewer pipes.

Procurement has always been a cause of consternation in America. John Randolph, counted among the Colonial First Families of Virginia and a Congressman who Chaired the Committee on Ways and Means in the House, oversaw the process of spending federal tax revenues, and it afforded him that rare glimpse of how the government bureaucracy made decisions to spend so much money but achieve so little in public benefit, a process that he so despised - so publicly. In his words, government spending is, ***"That most delicious of all privileges-spending other people's money."*** [4]

Procurement has always been a cause of consternation in America.

Procurement reform, intended to prevent *fraud***, *waste,*** *corruption* or local *protectionism***,** enjoys a long history of effort, some of which has been successful, much of which defies both qualitative and quantitative measurement. Most nations adopt laws to regulate government procurement, and the 'regulations' more or less closely accomplish this objective.[5] At its most basic intention, such regulations require the procuring authority to issue public *tenders* if the value of the procurement exceeds a certain threshold. The critical proposition is that public tenders are subject to great scrutiny, but the critical statement for this report is the qualifying phrase- "more or less closely". And this look at public procurement focuses on the vast and costly underground water infrastructure (pipes), some 1 million miles of it[6] that local government purchases and places in the ground. An equal amount of sewer pipe is also managed by municipal governments. There is also over one million miles of installed water pipe in rural communities across the United States.[7]

No level of government is immune to wasteful spending. Lest the federal agency administrators, those champions of thrusting 'good advice' on local government, especially with unfunded mandates, seize the statement above to hone their sharp criticism of local government, be reminded of the incisive research presented by former Senator William Proxmire (Wisconsin), who established the Golden Fleece Awards highlighting some of the most egregious procurement gems of federal agencies. For example, there was the Federal Aviation Administration who spent "...$57,800 on a study of the physical measurements of 432 airline stewardesses, and, of course, who can forget the Department of Army "...1981 study on how to buy Worcestershire sauce"; the Office of Education funding "...$219,592 in a "curriculum package" to teach college students how to watch television"; and the Department of Defense's "...$3,000 study to determine if people in the military should carry umbrellas in the rain."[8] Not likely that procurement of goods and services of this genre would be approved by the local City Council.

PROCUREMENT TRANSPARENCY AND THE IMPACT OF HABITUATION

The number and complexity of multiple reviews of government procurement, and the required transparency and accountability involved has evolved over time. For example, the Federal Acquisition Regulations,[9] (FAR, for short), contains over 1,800 pages of directions, stipulations, specifications, limitations, circumscriptions, and a few opportunities are afforded where procurement officials may exercise common sense and good judgment. And yet, the American public continues to be awestruck by news reports of procurements of hammers and toilet seats purchased at unit prices that rival the cost of an Apple iPad.

While special attention is placed on federal government procurement from several watchdog groups and sometimes Congressional Committees, local procurement wins the prize for enthusiastic scrutiny by the public and the local press. Local elected officials suffer from a general public impression that, when procurement is involved, it appears that local officials are wasting tax dollars by virtue of “spending public money”, and the local ‘investigation’ will, either now or later, ‘out’ them. This argument may have historical credibility, especially where tactics made famous by Tammany Hall may still be practiced, but today the vast majority of local governments exercise sound and ethical practices in procurement transactions.

While special attention is placed on federal government procurement from several watchdog groups and sometimes Congressional Committees, local procurement wins the prize for enthusiastic scrutiny by the public and the local press.

Barring intentional violations of procurement practices, those intended to bestow or beget personal material gain, there is still the prospect of wasteful spending through procurement- even if it is unintentional. In the midst of the ethical exercise of procurement practice there is a certain ***habituation factor*** that renders certain practices in the procurement of goods and services wasteful by virtue of their fundamental, if hidden, flaws. Thus, there is a paradox here, while the procurement process is a highly accountable activity, when executed it is subject to habitual decision making in many instances that result in suboptimal choice of goods and services and their valuation.

Habituation- describes a process where one grows accustomed to certain habits, and the probability of repetition becomes so-called second nature. With regard to government procurement the habituation factor suggests that procurement officials exercise their duty without questioning the fundamental factors that may have guided, perhaps dictated, the choice of, the price of, the size of, the color of a good or service. Habituation tendencies associated with procurement of materials, in particular, can pose a real financial danger because as manufacturing technology and materials science advance the procurement official may be making spending decisions today based on information from yesterday, last year or the last century for that matter.

Thus, municipal procurement processes are redundantly reviewed, highly regulated, proscribed and transparent to the public, a seemingly high degree of accountability all intended to reduce or eliminate waste. But the habitual procurement decisions based on old information can, and sometimes do, lead to wasteful public spending, (***a delicious privilege?***). This creates a situation where economic inefficiencies are baked into (institutionalized) the procurement process: and it is certainly a situation demanding the attention of our elected leaders. The economic statistics presented in the introduction above clearly indicate there is little, if any, slack between local revenue resources and local public expenditures. Indeed, local government in 2010 experienced substantial deficit spending; and the long-term debt for that year, about $1.68 trillion[10], was nearly twice what it was in 2000. In an era of economic hardships from the Great Recession, and as local government is called on to do more, local elected officials are beginning to look more closely at procurement processes and how smart municipal investments can yield greater public benefits. Below we look at how this plays out for the critical function of providing municipal water services.

THE PIPES ARE FAILING

Local government expenditures on municipal water and wastewater infrastructure and services exceeded $111 billion in 2010. Investment was roughly $62.5 billion in 2000. The explosive growth in public spending in this sector is of national importance because water and wastewater services fuels our $16 trillion GDP, protects public health and improves water quality. The ability of cities to continue increasing both capital and operations and maintenance (O&M) investments in this sector is tied to a plethora of economic factors. Thus, in the wake of the Great Recession the pace of increased investment was retarded, but did not hit negative territory. Cities responded to recessionary forces in many ways, and the belt-tightening reflex has reached into the local procurement office. This new economic prospect is causing local officials to seek out greater efficiencies in public works in order to maintain the value proposition of government enterprise creating the conditions for economic success and increased quality of life in their cities.

A survey of US cities conducted by the United States Conference of Mayors (USCM) in 2005 reported over 90 percent of cities made major capital investments in water/wastewater infrastructure; about 80 percent made investments in water distribution pipes and about 70 percent in wastewater collection pipes.[11] In that same report it was noted that 23 percent of cities were making simultaneous major capital investments in above and underground water/wastewater infrastructure between 2000 and 2009.

A follow-up survey conducted by the USCM[12] reported that 90 percent of cities have assessed the condition of their water/wastewater pipes, 70 percent are employing partial or full asset management techniques to maintain their pipes, and yet pipe breaks continue to plague cities. The report stated that 65 percent of cities estimate the time necessary to complete full repair and replacement of existing pipes, under current work order and investment plans, exceeds 200 years. The survey findings also report: nearly half of the surveyed cities report annual spending between $400,000 to $15 million per city on water pipe repair and replacement, and nearly half of the cities report annual spending on sewer pipe repair and replacement ranging from $450,000 to $30 million. Other reports from the Congressional Budget Office (CBO) and the EPA corroborate these findings. The US EPA conducts periodic assessments of additional needed investments (referred to as the “Needs Gap”) and estimates an additional $500 to $600 billion is needed in addition to current spending in order for water systems to comply with existing law.[13]

A major symptom of the aging water infrastructure includes 300,000 water main breaks in North America as result of the widespread corrosion problems adding up to a $50.7 billion annual drain on our economy. Leaking pipes are also losing an estimated 2.6 trillion gallons of treated drinking water annually (17 percent of all pumped water in the US), representing $4.1 billion in wasted electricity every year.[14]

Our Need for Infrastructure Repair and Replacement is Great

The U.S. Conference of Mayors (2010) report stated the likely spending requirements for the next 20 years (2009 to 2028) for both water and wastewater including capital, operations and maintenance and growth was $3.8 trillion.[15] The underground pipes, as the EPA points out, are nearly 60 percent of the total costs[16] and as a result are where our open procurement policies and practices should be focused. A business case can be made for challenging traditional pipe procurement habits.

THE BUSINESS CASE FOR PIPE MATERIAL SELECTION AND OPEN PROCUREMENT PRACTICES

The Traditional Approach

The conventional approach to water pipe replacement decision making has been to merely replace the pipe with roughly the same product regardless of price, and based on manufacturer's recommendations. In fact, this replacement ideology and tradition is still heavily imprinted upon the thinking of even modern engineers. Communities in the United States, a century ago, used thick cast iron pipes that are now failing. The majority of these pipes are failing for one basic reason – corrosion. Failure to recognize this systemic performance problem in metallic pipes has allowed traditional procurement practice to make suboptimal materials procurement decisions.

Iron corrosion occurs naturally over time. Simply stated, iron breaks down from water and air exposure and this corrosion is occurring both internally, through a process known as tuberculation where materials adhere to the inner pipe material over time, and externally, where the pipes are in contact with soil and moisture. The thick cast iron pipes have taken a long time to corrode and need to be replaced, but the thick pipes of the past are no longer manufactured. The most commonly used substitute material is ductile iron pipe and it has been widely installed over the last few decades. The walls of ductile iron pipe are made thinner than cast iron, a 76 percent reduction in wall thickness since 1908 -- 1.58 inches to 0.38 inches by 1991 – to reduce cost. Recent reductions thin the pipe wall to 0.21 inches. The simple fact is that thinner metallic pipes, under similar soil and moisture conditions, corrode and fail more quickly than their thicker cast iron predecessors.

In 2007 the Conference of Mayors conducted a survey of over 300 cites representing over 55 million citizens and over 186,149 miles of water distribution mains.[17] A high majority (86.2 percent) of cities use the number of water main breaks per unit length to evaluate drinking water pipe performance. The survey results concluded that water main breaks continue to be a major concern with 45 percent of cities experiencing more than 50 breaks annually. Cities also stated that repair and replacement cycles require a long-term view: 43 percent of city drinking water pipe system repair and replacement cycles extend beyond 50 years; and, 65 percent of city sewer pipe system repair and replacement cycles extend beyond 200 years. Water operation and maintenance managers recognize that older pipe systems may be constructed with multiple materials such as concrete, cast iron, wood (and even lead), and some of these pipes may be over 125 years old. Asset inventory, condition assessment and asset management planning practices provide valuable information to enable utilities to more efficiently replace older pipes constructed with underperforming materials.

Information in the literature provides ample reason to challenge whether or not the current most popular water distribution and wastewater collection pipe materials provide the highest public benefits once in-service. In a 2010 and 2012 pipe survey published in the Trenchless Technologies Pipe Materials Guide (the Guide),[18] the wastewater industry polled that longevity and design life were the most important factors in choosing pipe. Wastewater engineers consider the wastewater pipe to not only be a transport medium, but are also an important public health barrier to possible contamination. Due to the internal corrosive and caustic conditions, the Guide, ranked PVC (polyvinyl chloride) as the most commonly used pipe and the pipe which achieves the longest life cycle over all other pipe materials in this corrosive environment including brick, clay, concrete, fiberglass, polymer concrete, polyethylene, cast iron, ductile iron, and steel. PVC has been around for decades and its material characteristics dealing with corrosion have made it widely accepted in the wastewater industry.

A Different Approach: Comparing Performance Criteria

Municipal water utilities also have choices when selecting pipe materials in order to make the best decision when comparing cost and performance based on site specific pipe failure data, hydraulic design requirements and corrosive soil conditions.

Soil Conditions

Utah State University's (USU) Buried Structures Laboratory (one of two such facilities in the nation) released a 2012 report[19] concluding that 75 percent of all utilities have some corrosive soil conditions. A corrosion expert qualifies the issue and explains "most people believe that old age is the primary contributor to iron main breaks. However, the problem isn't age it is corrosion."[20] While the USU study suggested the average pipe is failing at 47 years, a 2011 study by the American Water Works Association's Water Research Foundation[21] reported that ductile iron pipes with the thinnest walls (representing the majority of metallic pipes sold) in moderately corrosive soils have a life expectancy of only 11-14 years. Underground infrastructure projects are primarily funded through the issuance of 30 year long-term debt and accounting depreciation schedules assume a 75 to 100 year pipe life. When pipes fail prematurely huge long-term generational financial burdens are placed on the utility unnecessarily increasing user rates. This is akin to having to completely rebuild one's house before the first mortgage is paid off.

There are many types of non-corrosive, non-metallic pipe materials currently widely available in the water and sewer market, including various kinds of PVC (also known as vinyl) and polyethylene. Additionally, some communities rely on pipe materials including: brick, clay, concrete, fiberglass, iron, polymer concrete and steel. Plastic pipes, and especially PVC pipes, are also used in many kinds of industrial capacities and industries including plumbing, irrigation and electrical applications. PVC has a demonstrated history of reliability, and contributes to many community recycling goals.

The 2012 USU survey results identifies that PVC pipe has the lowest overall failure rate among cast iron, ductile iron, concrete, steel, and asbestos cement. PVC's resistance to corrosion seems to be the key factor. Therefore, in corrosive soils plastic pipes demonstrate superior performance by virtue of the elimination of corrosion as a failure mechanism.

Iron pipes in corrosive soil need additional protection, at additional cost over and above the original procurement purchase price. To offset premature iron pipe failure due to corrosion, ductile iron pipe is lined with cement mortar to reduce internal corrosion but also needs cathodic protection against external corrosion as suggested by many NACE (National Association of Corrosion Engineers) engineers, who debate the effectiveness of plastic bags as a wrap for ductile iron pipe due to the tearing throughout the installation process.[22] The recommended installation of polyethylene encasement is not widely followed, but should require blue plastic in order to best identify any tears or folds, constant inspection, cleaning, thorough repair tapings, correct backfill material and additional tape or ties every 2 feet for below water table areas. Corrosion inhibiters may be added to the water supply to reduce the effects of iron pipe corrosion. These types of corrosion control programs require maintenance and monitoring, and are a long-term and ongoing expense for rate payers.

Pipe Design Life and Performance

Corrosion and soil conditions are a major factor in determining the performance of a pipe material. Pipe procurement decisions can be based on pipe material comparisons using side by side evaluations of pipes in corrosive soil and benign (non-corrosive) soil conditions. While PVC dominates the wastewater pipe replacement programs across the US today, ductile iron and PVC are the front runners for water pipe replacements. A 2012 AWWA study[23], a landmark contribution to the drinking water engineering literature, lists PVC with a total average life of 70 years and ductile iron at 56 years in past replacement practices. However, by applying the Water Research Foundations' recent testing results for PVC pipe demonstrating a pipe specific material's estimated performance life, PVC could be compared with ductile iron in non-corrosive soils at 110 years each. In corrosive soil conditions, PVC as a non-corrosive pipe material would remain at 110 years while ductile iron pipe's service life would be reduced back to 56 years or less on average (depending on the degree of corrosivity or reduction of wall thickness). By adding a full corrosion control program the ductile iron pipes' expected service life would increase, but so would the ongoing costs.

Hydraulic Pressure Considerations

Water pressure is an important design criterion for a distribution system and increases the importance of having accurate hydraulic modeling software to understand how the system works. Water pressure must be maintained above 20 psi to avoid contamination. Many systems may be divided up into pressure zones based on water storage and availability and variations in a community's changing elevations.

Utility engineers have traditionally accepted the assumption that metallic pipe has a superior performance profile in the context of pressure capacity. The default assumption is that metallic pipe can handle over 350 psi; this psi level approximates a tensile strength that could withstand upset events and periods of inefficient or sub-optimal operations. There are, however, two fundamental flaws associated with adherence to the hydraulic pressure assumption. First, the assumed 350 psi attribute is based on new pipe and does not account for the effects of corrosion over time.

Second, with the advent of modern system operation technology, pressure release valves and other improvements the underground infrastructure is operated more efficiently and at monitored pressure levels. Thus, the main argument for superior metallic hydraulic pressure capacity may only be credible in some cases, but should not be taken for granted by procurement officials. The Utah State University's Water Main Break Study found that the average water system supply pressure is only 77 psi with pressure fluctuations of less than 20 psi. Well designed and controlled water systems help reduce the stress on pipes which extends pipe life considering high pressure areas are more prone to breaks and leakage which results in water loss wasting rate payer's money and unnecessarily drive up an operation's energy and treatment costs. High pressure areas may exist for larger diameter transmission lines, but not for all residential and commercial water distribution systems. Procurement practices should accommodate the selection and design needs for pipe materials which satisfy pressure requirements without "over-building" at a higher price, the underground infrastructure. The use of non-corrosive materials can help reduce the overall costs of maintenance, operations and expensive capital replacement plans.

Cost Considerations

Accurate information on the extent of corrosion and its impact on future expenditures are limited. The AWWA's Buried No Longer report, focusing on underground drinking water systems states an estimated cost to maintain our current level of service including growth over the next 25 years is $1 trillion. The study assumes a pay-as-you-go cash approach which can avoid debt interest costs that ordinarily add significant cost to the estimated trillion dollars. Even without incurring additional debt the massive investment required to maintain existing underground inventory is estimated to triple household water bills.

The AWWA's estimated $1 trillion investment for drinking water infrastructure assumes that pipe replacement costs are based on an average cost per linear foot; but the study did not consider the individual costs for the various pipe materials discussed. The model employed did not make any assumptions about pipe type selection for replacement pipes (as normally completed as part of an asset management funding strategy); therefore, pipe selection based on cost and performance in corrosive soils could potentially reduce this estimate substantially.

Open procurement policies can actually help reduce the staggering cost. If the lion's share of system investment is in the pipes (60 percent), then focusing on pipe material selection is the first step in reducing system capital cost, and, subsequently, operations and maintenance costs (O&M). Likewise, on a smaller scale a local utility could do a similar cost comparison analysis in order to reduce the estimated costs of a large water main replacement program.

Pipe cost comparisons can and should be made based on both benign and corrosive soil conditions. When corrosive soils are considered the comparison should include the added cost of corrosion control measures for ductile iron and other corrosion prone materials. This type of comparison is not common practice. Indeed, the habituation factor is at full play here. By not considering comparative costs of pipe-type in corrosive soils with additional corrosion control costs included, the common practice of choosing metallic pipes without a full financial evaluation continues to dominate procurement decision making. A financial calculation would suggest that the unit cost of pipe used in the AWWA study could decrease a replacement capital plan budget if an actual unit cost amount was applied. For example, using a PVC unit cost (which can range from 30 to 70 percent less expensive than ductile iron pipe) depending on diameter would decrease the overall project cost significantly.

Non-corrosive pipes can also save on O&M costs. A Water Environment Research Federation (WERF) report stated,[24] "*If a utility has primarily PVC pipes it would be pointless to invest in an inspection system designed to measure the amount of wall loss due to corrosion.*" Likewise, when a metallic pipe's true unit cost is used the total price tag would increase for both the capital cost and the operations and maintenance expenditures side if corrosion control program costs were added. Pipe selection will drive the cost either up or down for a local community.

CITIES TAKE A LEAD ROLE IN INFRASTRUCTURE PROCUREMENT MODERNIZATION

Open Procurement Can Achieve Substantial Public Cost-Savings

An important step in effectively managing assets is to create an open procurement and selection process which allows for all appropriate materials to be considered and accurately and fairly compared. Any improvement in this area can represent a huge cost savings for rate payers considering the perpetual high cost of underground infrastructure replacement. Procurement habituation in pipe material consideration combined with a failure to take advantage of the open bidding process impedes competitive cost savings. Closed procurement processes lead to unnecessary costs, and may diminish public confidence in a local government's ability to provide cost effective services.

Mayors Are Proactive in Managing Costs through Open and Fair Competition

The experience of nearly a century of habitual procurement of water and wastewater pipes has had a costly impact on local repair and replacement programs. While this tradition is difficult to change, several proactive cities have broken with tradition and have reformed their procurement processes. Recognizing the growing record of success of alternative, corrosion-proof pipe materials, these cities have performed open procurement analyses to make procurement decisions on water and wastewater pipe material selection. Cities that have reviewed their pipe material options and performed objective analyses have chosen more cost-effective and better performing pipe materials for their water systems. As a result, alternative pipe materials are gaining wider acceptance and providing a cost effective method to address failing pipe issues. The procurement reform efforts of some leading cities are briefly described below.

Finding a Balance

Pleasanton, CA, wanted to establish a balance between increased repair and replacement cost while looking to expand the water system to accommodate an influx of population growth from the Bay Area. In order to achieve affordable water rates and maintain a competitive economic development strategy for developers the options for cost effective pipe materials were reviewed and performance evaluations for different pipe materials were applied to the procurement decision. The Mayor of Pleasanton, at that time, was Mayor Jennifer Hosterman who stated that using PVC pipe is about 70 percent more economical to use and less labor-intensive than metallic pipe. According to the Mayor, *"Giving taxpayers the best bang for the buck should be the chief goal for mayors and elected officials across the country"*.[25]

Looking for Strategic Alternatives

Indianapolis was experiencing a high percentage of water loss, an increasing amount of water main breaks, the need to increase rates to stem water loss, and increasing rates for wastewater services due to wet weather overflow issues. Mayor Gregory Ballard adopted an administrative effort to require strategic procurement practices that involved reviewing alternative designs. In a 2012 article, Mayor Ballard explained how water main breaks declined 2.5 times compared to traditional pipe materials in his city through the use of green, durable and cost-effective PVC pipe, realizing significant savings for ratepayers. *"Using a non-corrosive material is critical to keeping long-term maintenance costs down and minimizing capital replacement budgets. As we explored repair and replacement options we found that alternative pipe materials like PVC pipes have demonstrated superior performance…We also learned through life cycle analysis that PVC pipe has both a longer useful life than traditional pipe materials, and has a lower cost to both install and maintain,"* explains Mayor Ballard.[26]

Rejecting Traditional Pipe Selection Habits

Former Schenectady, NY Mayor Brian U. Stratton faced millions of dollars of underground infrastructure replacement costs. Stratton directed staff to conduct research, and carefully review the available pipe material alternatives. He then made the mayoral decision to direct the city engineers to change the traditional practices which excluded PVC in a closed bidding process. Affordability was a major concern. His demonstrated leadership drastically reduced the cost of capital plans and the long-term projections of maintenance costs.

Federal Practices with Rural Utilities

The U.S. Department of Agriculture (USDA) has long supported competitive bidding. The Department's Rural Utilities Service (RUS) funding program specifies in an internal memorandum dated March 16, 2002, *"All procurement transactions regardless whether by sealed bid or negotiation and without regard to dollar value, shall be conducted in a manner that provides maximum open and free competition."* [27] Many rural utilities may have over 3,000 miles of pipe - the equivalent of many of our largest municipalities. The National Rural Water Association members confirm that rural utilities use PVC for 95 percent of their extensive pipe networks.

ASSOCIATED PUBLIC BENEFITS

The direct cost benefits of procuring the right pipe materials, based on a performance evaluation analysis can be considerable. There are several important indirect cost benefits that provide collateral benefits as well. Some of these are briefly identified below.

Health Risk Management

The combination of acidic gas and corrosion in sewer pipes is correlated with a high incidence of pipe failure that can lead to water contamination. There is a similar level of concern with pipes conveying drinking water. A major health care issue which has been raised for several years deals with the rusty pipes. Timothy Ford, a microbiologist and water research scientist with Montana State University stated, "If you clean up water and then put it into a dirty pipe, there's not much point."[28] Ford considers the distribution system to be the highest risk and the greatest problem we are going to be facing in the future. He argues, as the iron pipes corrode and break, not only does water escape, but also diseases get in. A National Research Council study reported that, "Investigations conducted in the last five years suggest that a substantial proportion of waterborne disease outbreaks are attributable to problems within distribution systems".[29]

Energy Use and Carbon Footprint

Life Cycle Assessment (LCA) analysis is a readily available tool to aid pipe selection in the procurement process. LCA is used to quantify and compare the environmental impacts associated with underground pipe systems by accounting for the impacts from all phases of the pipe life cycle - raw material extraction and processing, manufacturing, transportation, installation, use, and disposal. LCA is important to understanding the different impacts that one pipe material may have compared to other materials in terms of overall sustainability. For example, the energy required for manufacturing pipe systems and the resulting carbon footprint is an important consideration in the life cycle. Pipe which requires less energy to produce has a lower carbon footprint. Similarly, it is important to factor in whether or not pipe materials are recyclable at the end of service life. The recyclability factor has implications for energy consumption, and a recyclable material may provide benefits of carbon footprint reduction if the life cycle attributes are favorable.

Recio et. al.,[30] investigated carbon footprint related to energy consumption involving pipe materials. He reports that among the pipe materials used to convey drinking water, PVC pipe is the one with the least energy consumption, and least CO2 emissions. With respect to pipe recycling, ductile iron pipe yielded the highest level of energy consumption and the highest level of CO2 emissions. If recycled material is used in manufacture of the ductile iron pipe, the energy consumption is still 26 percent higher than for the PVC pipe. Ductile iron pipes without recycled material compare even more unfavorably because energy consumption is in the region of 56 percent higher than PVC. Ductile iron pipe that is cement lined poses more difficult recycling efforts and will impact an LCA and many times utilities simply leave the failed iron pipe in the ground.

Information should be used in the pipe selection process to ensure maximum environmental and economic sustainability of water and sewer infrastructure. Australia, based on LCA testing and evaluation of the benefits of PVC, now offers Green credits through its Green-Star building program for PVC pipe.[31]

MODERNIZING PROCUREMENT – MAXIMIZING PUBLIC BENEFITS: WHAT CAN MAYORS DO?

Mayors can play an important role in curbing wasteful spending through habituation and blind acceptance of traditional procurement practices. Promoting improvement of municipal procurement does not necessarily invoke a climactic clash pitting wasteful spenders against frugal savers. It is more akin to consciously addressing an infection that triggers chronic budget inflammation requiring repeated spending on the same materials, and the spending is compounded by cost inflation. The symptoms are in front of all of us all the time – pipes bursting on Main Street in every city. The response, however, is invariably centered on fixing the pipe break (the symptom), an appropriate response to a potential emergency situation, but does little if anything to address the causative factors creating the problem. Devoting a percentage of the time, effort and money to addressing the procurement habituation factor could yield quite remarkable public benefits.

What practical steps can mayors take to ensure that local procurement in their cities is performed in a manner that minimizes waste? In the realm of - easy to suggest, hard to accomplish - mayors can pursue several lines of inquiry in the city administration. Some of them are at the 30,000 feet level, and some are in the weeds of procurement.

Review and Update Local Procurement Operations Manual

A utility procurement manual or standard operating practice can simply be updated allowing open competition for pipe materials. AWWA establishes standards for pipe materials such as PVC. Once this occurs, design and financial analysis can take place to select the best value pipe for a particular project and the results can be demonstrated as part of the review package for the public.

Know What Procurement Methods are Available

The Water and Wastewater Equipment Manufacturer's Association (WWEMA) and the National Association of Clean Water Companies (NACWA) assert, in their report on public procurement, "If the primary focus is on procuring goods and services in a way that ensures the lowest total cost of ownership to the public agency and its customers, then an examination of the full range of available procurement methods is essential."[32] These two organizations identify 9 distinct procurement methods available to local government in the report: base bid, competitive sealed bidding, cooperative purchasing base bidding, incentive contracting, leasing, pre-purchase base bid, prequalification of bidders (RFQ), request for proposals (RFP), sole source procurement. According to WWEMA many municipal governments are unaware that the several procurement methods are available for employment. Or, some municipal governments are under the impression that state procurement laws prohibit them from using such methods. NACWA reports results of a survey of state procurement by EPA Region that identifies acceptable methods in relation to procurement for goods and services where the Clean Water Act State Revolving Fund loan program money is used for investment.[33]

Know What Evaluation Methods can be Applied

In addition to a variety of procurement methods available for use by local government, the joint NACWA/WWEMA report identifies several “elements of value” that should be considered for most purchases:[34] purchase price, internal costs of procurement, time-value of money, after purchase support, reliability, operating costs, and manufacturer’s experience. Additionally, it may make sense to ask procurement staff the questions listed below to better understand how updated the process is.

- who wrote the bid specification and when
- do the conditions supporting the process continue to hold true
- has new information surfaced that has not been incorporated into the book
- is change addressed in the training of procurement officials
- what is the method of local evaluation, whether based on qualitative criterion or specific metrics employed to continuously improve local procurement practices
- do state procurement laws hinder the incorporation of change and improvement, if yes, can waivers be obtained

As pipe material information becomes more widely available it is recommended that Mayors urge their procurement officials to update their materials data base and consider how the new information might result in superior performance and lower cost. This recommendation does not imply that procurement officials should simply choose the low cost material; nor should they settle for underperforming pipe materials. Table A is provided as a template for utilities to evaluate PVC as an alternative to ductile iron. The table enables utility personnel to accurately balance their pipe costs and their performance needs. Completion of the table simply requires the utility to contact a local water works distributor to gather the necessary pipe data.

TABLE A: PIPE MATERIALS COMPARISON FACTORS
PIPE MATERIALS AND CORROSION COST COMPARISON WORKSHEET

				MATERIAL COST			LABOR & EQUIPMENT COST		BACKFILL COST *		INSPECTION COST **		TOTAL INSTALLED COST	
SOIL TYPE	PIPE MATERIAL	PIPE SIZE (IN)	TOTAL LENGTH (LF)	($/ LF)	(TOTAL $)	INSTALL RATE (LF / HR)	($ / LF)	(TOTAL $)	($ / LF)	(TOTAL $)	($ / LF)	(TOTAL $)	($ / LF)	(TOTAL $)
ALL TYPES	PVC DR18													

				MATERIAL COST			LABOR & EQUIPMENT COST		BACKFILL COST *		INSPECTION COST **		TOTAL INSTALLED COST	
		PIPE SIZE (IN)	TOTAL LENGTH (LF)	($/ LF)	(TOTAL $)	INSTALL RATE (LF / HR)	($ / LF)	(TOTAL $)	($ / LF)	(TOTAL $)	($ / LF)	(TOTAL $)	($ / LF)	(TOTAL $)
LOW CORROSIVE SOIL	DI PC 250 CEMENT LINED *****													

				MATERIAL COST			LABOR & EQUIPMENT COST		BACKFILL COST *		INSPECTION COST **		TOTAL INSTALLED COST	
		PIPE SIZE (IN)	TOTAL LENGTH (LF)	($/ LF)	(TOTAL $)	INSTALL RATE (LF / HR)	($ / LF)	(TOTAL $)	($ / LF)	(TOTAL $)	($ / LF)	(TOTAL $)	($ / LF)	(TOTAL $)
MODERATE CORROSIVE SOIL	DI CL 52 CEMENT LINED *****													
	THICKNESS	INCREASE												
	POLYWRAP ***	SINGLE WRAP												
	CATHODIC PROTECTION OR COATED	APPLY												

				MATERIAL COST			LABOR & EQUIPMENT COST		BACKFILL COST *		INSPECTION COST **		TOTAL INSTALLED COST	
		PIPE SIZE (IN)	TOTAL LENGTH (LF)	($/ LF)	(TOTAL $)	INSTALL RATE (LF / HR)	($ / LF)	(TOTAL $)	($ / LF)	(TOTAL $)	($ / LF)	(TOTAL $)	($ / LF)	(TOTAL $)
HIGH CORROSIVE SOIL	DI CL 56 CEMENT LINED *****													
	THICKNESS	INCREASE												
	POLYWRAP ***	DOUBLE WRAP												
	CATHODIC PROTECTION	INSTALL												

COST COMPARISON SUMMARY

	PVC	DUCTILE IRON	CAPITOL COST SAVINGS
MATERIAL COST			
LABOR & EQUIPMENT			
BACKFILL COST			
INSPECTION COST			
CORROSION CONTROL COST			
TOTAL INSTALLED COST			

DI ONLY -ONGOING O & M COSTS ****	ANNUAL OPERATIONS & MAINTENENCE COSTS
INHIBITOR CHEMICALS	
CHORLAMINE DECAY	
CEMENT LINING	
CATHODIC PROTECTION MAINT.	
OTHER	
TOTAL ANNUAL COST	

*Proper installation for longest life/leak avoidance includes backfill for all pipes. PVC and DI use the same backfill. See AWWA C605 installation standard for PVC pipe and AWWA C600 installation standard for DI pipe

**Proper installation requires inspections for all pipes to protect against risk transfer to utility

***"Polywrap Encasement" requires proper installation, bedding, and inspection to reduce PE damage and tears (Recommended blue color for water)

****O & M increase with DI, corrosion inhibitor chemicals, increased cholamine decay rate, cement lining and cathodic protection maintenence

***** Consider double thickness cement lining

Class of pipe to meet 250 psi minimum operating pressure requirements

Soil types as defined by the National Soil Survey Center

Footnotes

1. Source: U.S. Office of Management and Budget, Budget of the United States Government, Historical Tables, annual.
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Footnotes

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33. See #32 above.

34. See #32 above

Notes

Mayors Water Council

The Mayors Water Council (MWC) provides a forum for Mayors to discuss issues impacting how they provide safe, adequate and affordable water and wastewater services and infrastructure in America's Principal Cities in the 21st Century. It is open to all Mayors, focusing on water resource issues, including: watershed management; water supply planning; surface and sub-surface water infrastructure financing and rehabilitation; water conservation, Public-Private Partnerships; and asset management.

The MWC helps Mayors develop local government policy objectives and facilitates dissemination of information on innovative technology, and cost-effective best practices. The MWC acts through the USCM Environment Committee by proposing and reviewing policies on water related matters that benefits the nation's cities.

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