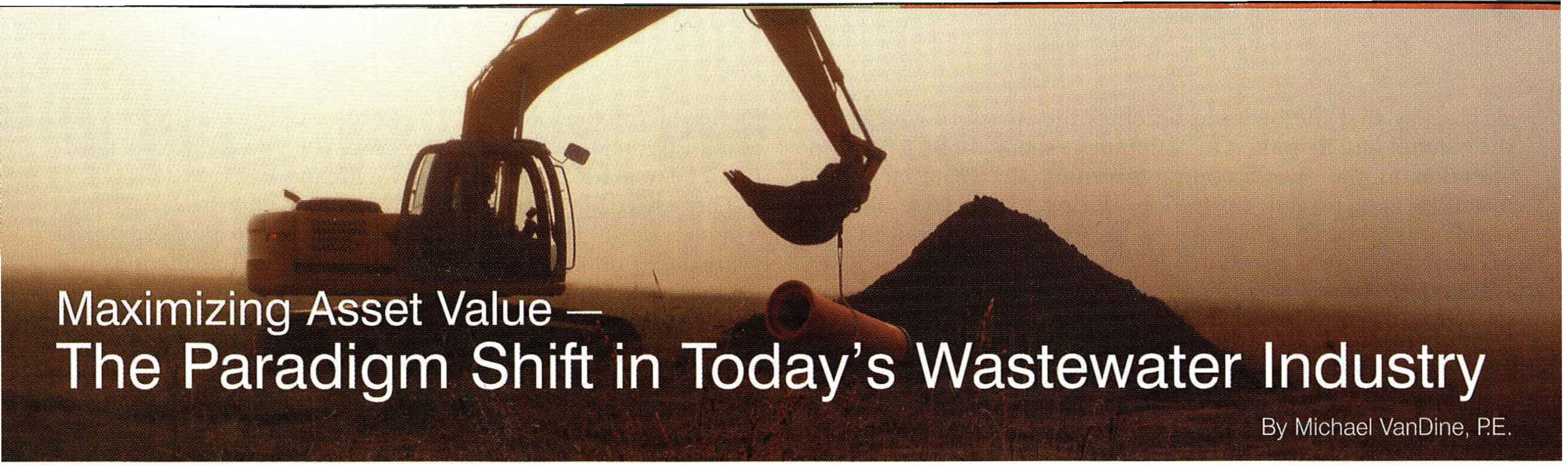

Maximizing Asset Value — The Paradigm Shift in Today's Wastewater Industry

By Michael VanDine, P.E.

We have all purchased something new that we thought was a good value. We were assured that it would work just like the more expensive model. Over time, we found that our purchase failed to meet our expectations and we had to buy the more expensive model to be sure we received value for the money we spent. What we thought was an asset became a liability. We bought cheap and we paid the price.

It is not easy to spend more up front for anything, and even more difficult for municipalities to evaluate infrastructure purchases with long-term value in mind. Budgets are tighter than ever, and there is less funding available for the projects that are necessary to keep our communities growing and thriving. After all, buried assets are out of sight and out of mind until there is an overflow, a backup or a road cave-in. Today, we are required to evaluate our decisions based on long-term performance — not just initial cost.

In today's tight financial climate, it is imperative that municipalities look long and hard at the benefit accrued from the project dollars we invest in our communities. Decision-making philosophy has changed considerably in the past 100 years, and dramatically in the last 10. We must begin to evaluate our decisions on a life-cycle cost basis rather than on what is least expensive based solely on a short-term perspective.

A Historical Perspective

In the early days of sewer construction, we did not always know what we were getting at the end of a project. There were no real standards for the manufacture of pipe; there were very few standards for designing a system or installing pipe, and little real ability to test the lines that were installed. The mentality of the day was "bury it and forget it." The primary function of the sewer system was conveyance. From the early sewer practices in England and the United States, it is obvious that leakage was not only expected, it was desirable.

In the 1935 book American Sewerage Practice by Metcalf and Eddy, we see that dilution became the earliest, most economical, most efficient and the most commonly used method of treating sewage. Metcalf and Eddy reported that 99.3 percent of the U.S. cities having a population of 100,000 or more in 1930 used dilution as the primary method of effluent treatment.

As cities grew and nearby lakes, rivers and streams became threatened with contamination, treatment plants and facilities were built to handle the wastewater being generated. As costs for treating this material began to increase, engineers began to look for ways to reduce or eliminate extraneous flow from the collection system. Compression joints were developed by the clay pipe industry in the late 1950s and are now the standard for most of the pipe used in the construction of today's sanitary sewers. With factory-applied compression joints that were designed to eliminate leakage, a simple test for the integrity of the installed system could be developed. The low-pressure air test was developed for testing sewer lines by the Bay Area Committee on Air Testing. Several other methods are now available for acceptance testing of new construction, as well as for lines already in service. Thorough inspection during the construction phase of a project is crucial to the long-term performance of any collection system.

With few exceptions, current design practices commonly use a life expectancy of 50 years for most products. One notable exception is the city of Atlanta, Ga. The mayor and her staff have required a 100-year life certification on all materials used in that city's sewer system. Los Angeles also uses a 100-year life criteria for design for lateral sewers smaller than 18 in. in diameter, and 60 to 100 years for trunk sewers larger than 18 in., depending on the pipe materials chosen. In Europe, the requirements are even more stringent. Sweden requires 200-year life while Germany is designing for a 300-year life.

Life-Cycle Cost Considerations

It is our responsibility to ensure that the decisions we make today provide the greatest value for the project dollars invested. Every effort must be made to educate ourselves on the real, demonstrated capabilities of the materials and designs we apply to our systems.

"With so much to learn about life-cycle cost considerations for sewer lines, one message is clear — picking the low bidder isn't going to cut it any longer. If you're not thinking in terms of life cycle cost, you're behind the curve." — Phillip R. Snyder, CE News, August, 2001

CMOM and GASB 34 have begun to push more municipalities into a long-term analysis of their projects. While construction costs may vary from project to project, pipe material selection plays a small part in the real cost of installing a system, but a critical part in the overall life-cycle cost analysis. When specifying a sewer pipe material, the easiest and most direct approach is to consider the initial cost alone. But this simplistic decision-making process is no longer viable today.

The material selected and the system design significantly affect the long-term efficiency and financial impact of a sewer system installation. When comparing only initial project costs, one material or design may appear to have an advantage over another. But the more important issue is the reduction of overall life-cycle costs through superior, long-term performance. Several things affect the long-term performance of a collection system installation. Three of these are: system construction, chemical attack and corrosion resistance.

System Construction: Constructability of the pipe and bedding system will affect the long-term performance of any pipe material installed today. All products require that a firm foundation be provided in the trench. Bedding practices specific to the material being installed need to be closely followed to ensure the long-term viability of the system. Rigid products are designed to be a structure that carries the trench load with the help of the bedding materials. Flexible conduits need to be constructed in such a way that the bedding becomes the structure containing the conduit and helping it to maintain its shape. Without careful attention to the specifications governing the material to be installed and careful inspection during the course of the installation, the life expectancy of the pipe will be reduced and premature failure may result.

Chemical Attack: In some environments, it is impractical to use products that may be affected by fuels in underground storage tanks or industrial waste in the soils of a brownfield. Hydrocarbon waste products in the effluent can also seriously compromise the structural integrity and physical properties of many pipe materials. These chemicals will reduce the life expectancy of some products and premature failure will almost certainly result.

Corrosion Resistance: Corrosion resistance is probably the single most significant influence on pipeline longevity.

"Inherent corrosion resistance often provides an extended pipe life resulting in the following benefits:

- No liners or coatings to inspect, maintain, refurbish or replace
- No rehabilitation costs because of corrosion deterioration
- Hydraulic characteristics are unchanged, delaying relief line construction costs
- Costs for premature replacement are avoided completely."

(Source: CE News, "Life Cycle Cost Considerations for Sewer Pipe," August 2001.)

All of the coatings, linings and special design criteria that must be used to combat corrosion add to the long-term cost of pipe materials that are subject to this type of deterioration. Often these "safeguards" only delay the inevitable onset of corrosion. Selection of a material that is inherently corrosion resistant will negate these concerns and future costs.

An Economic Approach to Sewer Pipe Selection

"Agencies that plan to operate their own facilities must adopt a new mindset, which gives equal consideration to the operation, maintenance, repair and replacement expenses along with the installed cost," adds CE News' Snyder. "Long-term planning is the order of the day, and life-cycle cost analysis is being adopted across the nation. When evaluated by a life-cycle cost comparison, which assesses the sum of all costs, pipe materials with the longest projected service life are generally the winner."

In most cases in today's engineering community, 50 years is the typical life expectancy for a sanitary sewer system. But in today's regulatory environment, shouldn't your sanitary sewer system be expected to last at least 100 years? When one considers that sanitary sewers are usually the most expensive utilities to replace because they are laid beneath water and gas lines, telephone cables, electric services, sidewalks, curbs, gutters and paved roads, selection of pipe material must be based upon a carefully calculated long-term least-cost analysis, and not solely on the initial bid price.

Engineers have used least-cost analysis for many years to determine the present worth of a project, or Total Effective Cost in current dollars. Comparing two different pipe products with the Least-Cost method will yield an advantage in the form of a differential between the two products. This method also helps the engineer to calculate the amount of money that would need to be set aside at current interest rates to provide for the replacement of the limited-life product at the end of its service life.

For example, a project is specified using 7,963 ft of 15-in. sanitary sewer. Project service life is 100 years. Depth of cover is approximately 18 ft. A 100-year service life product and a 50-year service life product are bid. The bid price plus engineering and administration totals $1,409,322 for the100-year service life product. The total for the 50-year service life product is $1,269,174.

The service life of 100-years is based on demonstrated service. The service life of the limited-life pipe is extrapolated to 50 years based on current engineering practices. Calculations will be performed using "The NCPI Toolbox" computer program "Least-Cost."

For the purposes of this comparison, we will assume that the project is funded by the state/ local government.

Base-Line Project Cost $1,409,322 Service Life: 100 yrs
Limited-Life Project Cost $1,269,174 Service Life: 50 yrs

If one were to look only at the initial project cost, the limited-life material would show a cost advantage of $140,148. Using the Least-cost model and calculating all the costs based on 100-year service life shows the following result:

Total Effective (Life Cycle) Cost of a 100 Year Product = $1,409,322
Total Effective (Life Cycle) Cost of a 50 Year Product = $1,830,044
Cost Advantage of the Longer Life Product = $ 420,722

Since the 100-year service life product would not need to be replaced during the time period calculated, the project cost does not change and it is considered the base-line cost.

Since the limited-life product would need to be replaced after 50 years, the cost of replacement must be added to the initial project cost, making the final cost of the limited-life product cost higher than the initial low-bid cost.

This gives a net advantage to the long-life product of $420,722. In other words, the owner would have to invest $560,870 today to allow for replacement of the limited-life product at the end of its anticipated life cycle.

These calculations are based on the initial reported project bids. There is no allowance made for the potential increases in design or construction costs for the second installation of the 50-year product. The long-term interest of the community is best served by using a life-cycle cost approach.

Hindsight Is 20/20

As the American engineering community begins to evaluate past practices and take a more serious look at life-cycle cost analysis, it is imperative that a long-term paradigm take firm hold as we struggle to put our shrinking project dollars to work repairing our aging infrastructure. The temptation will always be strong to do as much as you can as cheaply as possible, but we must remember that it pays to invest in quality, performance, proper installation and extended service life. We must specify materials that have a proven track record of performance and a history of quality improvement to provide us with the long-term benefits that will give us the most value for every project dollar invested.

Pat Choate said it best in his book, America in Ruins: The Deteriorating Infrastructure, "In an era of tight budgets, public officials making investment decisions must ask themselves a fundamental question: If we can't afford to do it right, can we afford to do it again?"

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