"COMMON SENSE AND ASSET MANAGEMENT"

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INTRODUCTION

Many utilities expanded and built new water and wastewater facilities during the late seventies and early eighties to meet new regulatory requirements and increased demands. The federal government funded a large portion of these expansion projects. Now some 25 to 30 years later, utilities are recognizing the need to renew and replace (R&R) their facilities. Presently, the federal government estimates it will fund only half of the anticipated R&R needs in the next five years. This will put significant pressure on utility managers to plan for and fund R&R expenditures. A properly designed and implemented asset management system should provide the utility manager with the tools needed to:

- minimize costly emergency repairs,
- make strategic funding decisions designed to keep rates low and bond ratings high,
- measure the efficiency and effectiveness of their maintenance program,
- defend and protect cash reserves for future asset R&R expenditures, and
- meet new accounting (GASB 34) and environmental (CMOM) regulatory standards.

Concerns about the accounting requirements of GASB 34 and regulatory requirements of the United States Environmental Protection Agency's CMOM program are fueling interest in asset management. Many computer software programs exist that collect, integrate and assist in the analysis of large amounts of inter-related data which is a requirement of an asset management system. Managers recognize that the cost to purchase, install, train, and maintain the data in these programs can be significant but they may have difficulty understanding the value of such systems for their particular utility. This paper will provide the context within which the utility manager can evaluate his or her utility's existing systems and tailor an asset management program that is meaningful and cost-effective.

Good asset management requires taking an asset-centric, life-cycle approach to managing the assets that optimally balances corrective and preventive maintenance with renewal and replacement of assets for cost effectiveness. A key element to this approach is to develop R&R planning that involves both strategic and tactical levels. This paper develops this proactive R&R planning approach by discussing the following topics:

- Asset Life Cycle
- Life of a Utility
- Strategic R&R Planning, and
- Tactical R&R Planning

The discussion of asset life cycle is intended to highlight normal maintenance activity and the opportunity to optimize the asset investment by proactively planning R&R projects. The section on the life of the utility stresses understanding the utility's maturity and character, which is important in strategic, long-range financial planning. In addition, some guidelines for estimating

long-term R&R needs will be presented. The strategic and tactical planning sections will present some basic goals, tools, methods and benefits to be derived from both of these planning phases.

LIFE CYCLE OF AN ASSET

Every asset has a beginning, a useful life and at some point has to be replaced and disposed, as shown in Figure 1. A generalized survival function curve showing the asset condition as a function of time is depicted in Figure 2. The figure shows the gradual deterioration of the ability of the asset to provide its function compared with the straight-line depreciation for that asset. Note that as the asset gets older the rate of deterioration of the asset increases. The effect is to cause the normal maintenance costs of the asset to increase with age. At some point the asset can no longer provide the level of service established for that asset. This is the "design life" or "useful life" of the asset.

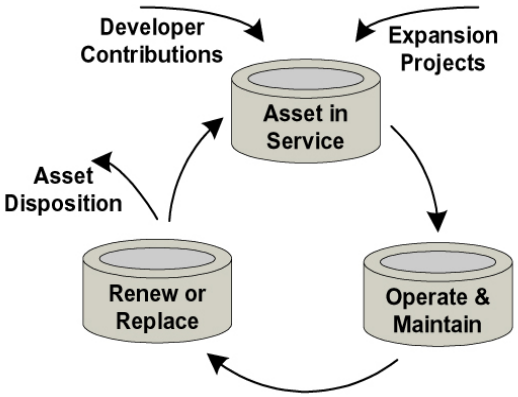

Figure 1. Asset Life Cycle Schematic

"Design life" is defined as the original useful life of the asset as estimated by the design engineer. "Useful Life" is defined as remaining useful life of the asset and changes over time based on levels of maintenance, conditions of service, etc. At the startup of the asset, the useful life is the same as the design life.

The generalized curve in Figure 2 shows the deterioration of the asset including normal maintenance activities. Any work performed on the asset that is not considered normal maintenance, but rather renewal or rehabilitation, will change the shape of the curve and increase the useful life of the asset. At the end of its useful life, the asset will need to be replaced or the service provided by that asset assumed by alternative means.

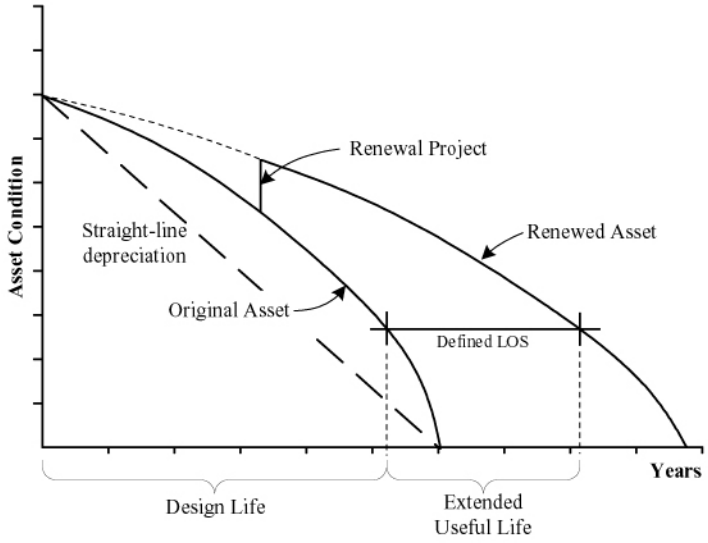

Figure 2. Asset Condition vs. Time

The top curve in Figure 2 depicts a possible curve resulting from a renewal and replacement alternative compared to just replacing the asset at the end of its useful life. It is possible that the overall life cycle cost of an asset can be lower if renewed, thus increasing the asset's useful life, as

compared to just replacing the asset at the end of its design life. Part of the common sense approach is to anticipate when an asset will need to be replaced and to anticipate it far enough in advance to be able to analyze alternatives to replacement. The useful life of an asset is affected by many variables. Assumptions made during the planning and design of the original asset may not actually prove true. Equipment quality may not be as specified; process conditions may dramatically change; or funding and budget constraints may require changes in maintenance levels. A good asset management system will help managers track the actual condition of the asset, anticipate the need for renewal and replacement, and evaluate which course of action is most cost-effective.

LIFE OF A UTILITY

An important aspect of proactive R&R planning is to understand the overall life of the utility. This concept includes having a general estimate of how old the utility is and the composite, useful life cycle of the utility. Understanding the shape of a utility's life cycle curve and where the utility is on that curve is the underpinning of strategic R&R planning.

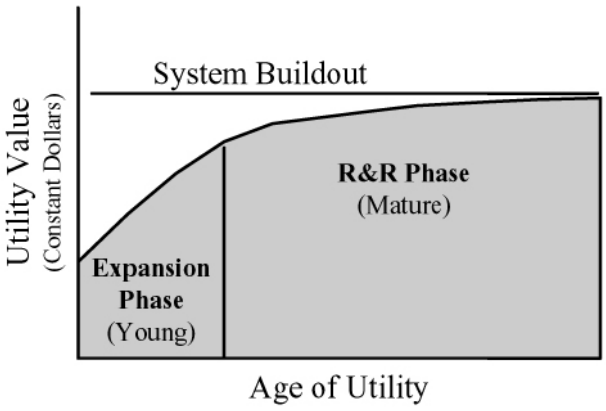

Figure 3. Life of a Utility

Each utility consists of a large number of individual assets, each having its own value, function and useful life. Assets are added to the utility over time to meet growth, changing technology and regulatory requirements. Every asset has a unique life cycle curve that, added together, creates a composite life cycle curve for the utility. An idealized life cycle curve of a utility, based on the fixed asset value (in constant dollars) of the utility over time, is shown in Figure 3. Initially, the utility capital improvement program, or CIP, is primarily comprised of expansion projects that add new value to the utility. As the utility matures, more and more of the assets will require renewal and eventually replacement. As the utility approaches buildout, most of the capital expenditures will be devoted to R&R projects, as shown in Figure 4. The shift to more R&R expenditures requires a shift in strategy and planning focus.

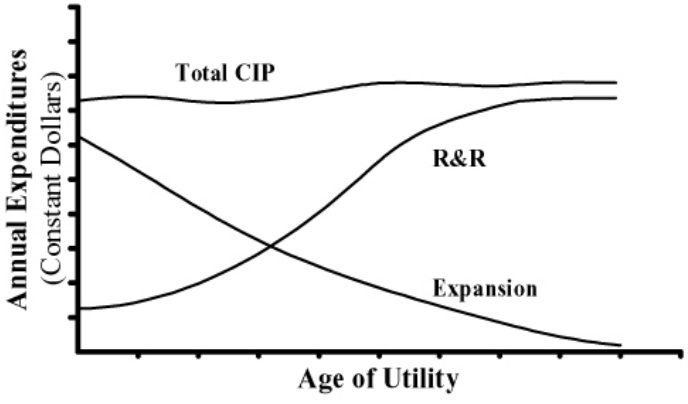

Figure 4. Comparison of Expansion vs. R&R Expenditures over time

RENEWAL AND REPLACEMENT (R&R) PLANNING

Common sense suggests effective R&R planning as those activities necessary to anticipate R&R needs in time to maintain the defined level of service cost-effectively. Cost-effective projects require time to evaluate alternatives, plan, design and construct, typically from one to three years. Reactively delivering R&R projects usually does not allow time to evaluate less costly alternatives. Thus, good R&R planning should proactively identify assets that need some level of renewal and replacement at least one to three years prior to reaching their useful lives. Proactive R&R planning is more than this however. Proactive R&R planning starts during the conception and design of the original assets and identification of the service to be provided. Decisions related to operations and normal maintenance activities versus renewal and replacement activities should be made at that time. Ideally, the manufacturer or design engineer should define the operating and maintenance activities for the asset in the O&M manual. The quality of the O&M manual and the "plan" for operating and maintaining the individual asset is fundamental. A financial plan that adequately funds R&R projects extending as much as 20 to 40 years into the future is also needed. In addition, methods for project delivery must be considered.

Detailing all of the management activities required to properly and cost-effectively plan for R&R projects is too broad a subject for this paper. The approach here will be to deal with some basic elements that require the most attention from utility management in order to refocus its resources toward planning for R&R projects and realize the benefits of a good asset management system.

R&R planning can be divided into three phases: reactive R&R, tactical R&R planning and strategic R&R planning. Each phase requires a certain mind-set or planning philosophy in addition to certain tools to properly perform the planning function. Most utilities are familiar with the philosophy and requirements of reactive R&R so this paper will not focus on the reactive phase of R&R planning, except to emphasize that it is difficult to "guess" long-term annual expenditure needs and how to fund them using reactive R&R history. This paper will focus on the strategic and tactical phases of R&R planning. A time frame and a summary of characteristics of each planning phase are depicted in Figure 5.

Figure 5. R&R Planning Time Frame – Phases & Characteristics

Reactive R&R
- Emergency
- Unplanned
- Up to 20% more expensive
- No time to evaluate alternatives

Tactical Phase
- Short-term plan
- Generates specific projects
- 2 to 10 year window
- Update annually
- Verify rate sufficiency

Strategic Phase
- Long-term plan
- Generates R&R funding strategies
- 10 to 40 year window
- Update every 5 years
- Establishes rates

STRATEGIC R&R PLANNING

The term strategic implies a high level of thought and a broad view of what needs to be accomplished. The strategic approach should create the future conditions most favorable to implement the utility's plan. Relating to utility asset management, this means having a general understanding of growth and replacement needs, a plan for providing the resources, both money and people, at the time they are needed, and communicating the plan to the governing authorities.

The R&R strategic plan should be a component of the utility's strategic business plan or guiding document. The most significant aspects of the strategic R&R plan are the financial projection to deliver R&R projects and the subsequent funding plan for those financial needs. The funding plan must consider the impact to user rates. Other elements of a strategic R&R plan include establishment of appropriate levels of service, performance measures and auditing practices. It is recommended that the utility update its strategic R&R plan at least every five years. The strategic plan should provide a clear philosophy for distinguishing maintenance versus R&R activities to cost-effectively extend the life of an asset. This philosophy should be used by all entities that plan, design and construct assets that will be added to the system.

In preparing a strategic financial plan, the utility manager will need to estimate the following:

- the value of the system or group of assets (typically expressed as replacement cost new),
- a composite, cost-weighted useful life of the system or group of assets,
- an "in-service" date for the system or group of assets, and
- a funding strategy.

A strategic R&R financial plan considers the system or group of assets as a single, combined asset and estimates annual R&R expenditures. An initial projection of annual R&R expenditures is based on an estimate of replacement cost new (value of the system) and a cost-weighted, composite useful life of the system or group of assets. Determining funding strategies to meet the R&R needs as well as all other utility funding needs completes the financial plan. The funding strategy may be modified to make the accumulation of reserves more defensible to the utility's governing body depending on the composite age of the group of assets. Modifying the funding strategy would involve using the estimated "in-service" date of the group of assets.

Value of the System

The utility may already have an asset record that fairly approximates the value of the system. The utility manager should determine the appropriate level of detail needed to make a defensible case for financial planning. In the event that an adequate asset record is not available, then an asset valuation task can be performed. The level of detail of the valuation can vary depending on the size and complexity of the groups of assets. The goal is not to create a precise estimate of the value of the system but to create an approximate estimate. The assumptions and values that are

used to formulate the financial plan can be validated and updated later with more detailed information as it becomes available.

Cost-Weighted, Composite Useful Life and In-Service Date

The composite useful life should be weighted by cost using the values obtained in the valuation described above or from the existing asset record depending on the manager's confidence in the asset record. Typical useful lives for groups of assets can be obtained from various published sources such as the Uniform System of Accounts series for water and wastewater utilities published by the National Association of Regulatory Utility Commissioners (NARUC) and Section 25-30.140 of the Florida Administrative Code. As with the estimated value of the groups of assets, the goal is to determine a reasonably accurate estimate of the composite useful life that can be modified later based on improved information.

An estimate of the composite "in-service" date for the group of assets should also be determined at this time. This estimate can be the most difficult to obtain. As before, if the existing asset record is adequate then a composite in-service date is easy to derive. For the general, strategic planning time frame, it is appropriate to make an estimate of in-service date for a group of assets based on personal or anecdotal experience. Again, the assumptions should be modified as necessary as new information becomes available. The in-service date and the shape of the life cycle curve for the utility will allow the modification of the projections of R&R expenditures and thus the funding strategy.

Initial Projection of Annual R&R Expenditures

This section presents some guidelines that a utility manager can use to develop an initial projection of annual R&R expenditures for the 10 to 40 year strategic time frame. This initial estimate can then be modified as necessary to help the utility manager establish or defend a funding strategy.

In a fully mature, ideal system, annual R&R expenditures would theoretically be equal to the weighted annual depreciation expense for all fixed assets, as adjusted for inflation. Because of the variability in expenditures, however, to meet a high percentage of the annual needs, deposits should be set at some value in excess of this theoretical value, say 10 percent to 50 percent. The excess percentage used should be influenced by both historical variability of actual R&R expenditures as well as predicted future R&R needs. Interest earnings on the R&R fund, if retained in the fund, can effectively provide a portion of the excess percentage. Planning for R&R expenditures at these relatively constant levels over time is very important for estimating revenue requirements from the standpoint of determining required rates or sufficiency of existing rates.

Let's consider an example. We will do an initial estimate of annual R&R expenditures needs for a utility that has an estimated overall replacement cost new value of $100 million and a composite, cost-weighted useful life of 25 years. We will keep the example simple by

considering the entire utility rather than grouping assets and assuming that the retained interest earnings will be enough to fund the expenditure spikes. An estimate of the annual depreciation expense is therefore 1/25th or 4% of $100 million, or approximately $4 million per year on average needed for R&R expenditures. This method estimates a worst-case, baseline projection of annual R&R expenditures based on replacing the entire utility once every 25 years. If needed, the projections can be modified using this baseline as a starting point.

Funding Strategies and Modifying the R&R Needs Projections

A number of utilities will find themselves in the situation where they are a fairly young utility, in which their composite service age is midway on the life cycle curve. Their capital expenditures are still primarily for expansion projects and their accumulated reserves would appear inordinately high for the next several years because R&R spending has not caught up to the set asides as determined in the initial estimate described above. Because of the nature of the estimating methodology, the utility manager can modify projected R&R needs so that he forecasts less needs in early years ramping up to the steady state level of the annual depreciation level. This modification can only occur if the utility is still relatively young. The modification is based on the deterioration characteristics of all physical assets and the composite nature of the calculation. The annual depreciation method is good for a mature utility that has reached or soon will reach buildout. This number can also be used to estimate ultimate R&R needs. The modified method is good for a young utility that is still growing. In order to properly apply the modification, the average startup date for the system or group of assets must be estimated to be able to locate where on the curve the utility currently exists.

The modified method will show smaller R&R needs in the shorter planning time frame thereby freeing up the revenues generated by existing rates to be used for some other need. It can also help to defer rate increases. Obviously, a higher level of effort is required to modify the initial R&R needs projections. In the event that an accurate asset record exists or is created and accurately maintained then these calculations are very easy to obtain. This method can help the utility develop a strategy to transition from a debt-financed to a pay-as-you-go funding strategy by minimizing R&R deposits during the term of the bonded indebtedness. The portion of the utility's revenues allocated to pay the debt-service can be reallocated to deposits to meet R&R needs once debt has been retired.

As a reminder, it is important to plan for and set aside monies for emergency R&R expenditures. There is typically a bond covenant requirement for annual R&R deposits of five percent of annual gross revenues. This level may meet emergency R&R needs but the ultimate-buildout, annual R&R deposit requirements may be as high as 20 percent of annual gross revenues.

For the strategic approach we recommend dividing the utility into two major groups of assets: short-lived and long-lived. Short-lived assets would generally include pumps, mechanical and electrical equipment and other assets that have useful lives less than 15 to 20 years. Long-lived assets generally include structures, pipes, and other assets that have useful lives greater than 15 to 20 years. If the utility provides more than one service, then we would recommend further dividing the groups of assets based on utility service as well.

TACTICAL R&R PLANNING

Tactical R&R planning should proactively identify specific assets needing R&R, evaluate R&R alternatives, and initiate R&R projects for inclusion in the utility's CIP. The ultimate goal for an R&R planning group would be to identify R&R projects two to 10 years ahead of the asset reaching the end of its useful life. Depending on the utility's resources and the accuracy of the asset record, a realistic initial time frame may only be from one to five years. Tactical R&R planning activities also should include a process to gradually improve the accuracy of the asset record.

Basic Elements of Tactical R&R Planning

The basic elements needed for tactical R&R planning are relatively simple and are easily understood. They are:

- an accurate asset record,
- an annual R&R planning process,
- methodologies for delivering R&R projects,
- R&R project closeout procedures for updating the asset record, which leads to
- an accurate asset record.

Accurate Asset Record

An accurate asset record is essential to effective proactive planning of R&R projects during the tactical phase. An accurate and sufficiently detailed record will meet the recording requirements of GASB 34 and provide information to the utility manager for both the tactical phase planning and the strategic planning discussed above. The minimum requirements of an asset record are:

- asset name and classifications,
- asset install and in-use dates,
- design useful life, and
- original cost.

Classification information that increases the effectiveness of the asset management system include:

- asset location,
- asset function,
- political district,
- service type, and
- service area or district

Other pertinent information may be collected and recorded as determined by the utility. Obviously, the more information in the record, the higher the cost to maintain the record and the higher the risk of inaccuracies in the record. The asset maintenance history is an essential part of the asset record and is not mentioned here since the concepts are discussed in greater detail in other presentations on computerized maintenance management systems.

Annual R&R Planning Process

We recommend a the utility have a formalized, annual R&R planning process. This annual planning process should be coordinated with the utility's CIP budget process. The activities described below are the real heart of the tactical R&R planning approach, and are generally in sequential order:

- generation of a list of assets within a defined percentage of their design useful life,
- solicitation of feedback from the utility's O&M staff to add to or modify asset list,
- inspection to verify and observe condition of assets,
- preliminary evaluation of R&R alternatives,
- preparation of proposed R&R project list,
- prioritization of proposed R&R project list,
- determination of project delivery methodology, and
- preparation of preliminary budget and schedule.

The list of assets that are within a defined percentage, but no less than two years, of the end of their design lives can be reported to the planning engineer from the asset record. Depending on the amount of information in the record, the planning engineer may be able to analyze the maintenance history and make decisions regarding renewal and replacement needs. The planning engineer should solicit feedback from the O&M personnel regarding the list of assets to verify that the data are accurate and information regarding the condition of the asset is current. The O&M staff should recommend additions or modifications to the proposed asset list. Based on the list and feedback from the O&M staff, the planning engineer should inspection the assets remaining on the list. The inspections should help determine the current condition and relative urgency to rehabilitate or replace the asset. Also, the engineer should evaluate renewal alternatives to replacement. A list of R&R projects can then be generated or modified from the previous year, and relative priorities established based on cost and risk factors. At that time the utility management staff can decide on the project delivery methodology, either by O&M forces or by the utility's CIP. The final step in the annual planning process is to create or update a project's schedule and budget. The utility's CIP budget process will determine sufficiency of funds, but if the strategic R&R planning and the tactical R&R planning phases are working properly, then funding should be available.

Project Delivery Methodologies

Project delivery is not necessarily a planning activity but an implementation activity. However, deciding how to deliver an R&R project can affect the tactical planning process, in particular the budgeting needs of the tactical plan. Some R&R projects will be small and can be delivered in

the O&M budget. The decision to deliver the project as a CIP project or as an O&M project depends on the organization of the utility. Generally, most utilities have O&M staff that are capable of handling normal maintenance and small R&R type projects. A reasonable guide for determining project delivery methodology is that if it is greater than $200,000 in cost it would usually be delivered by the CIP, if less than $5,000 to $10,000 it would usually be delivered by the O&M forces. There is a master project delivery concept that can be used to budget and deliver the $10,000 to $200,000 range of projects. This concept creates a CIP master project at some predetermined funding rate, say $1,000,000 annually, that is approved by the governing agency. Smaller R&R projects that qualify to be included in the master project can be added and implemented by the CIP staff in relatively short period of time. This mechanism can deliver the mid-sized projects within the zero to two-year budget time frame as well. These master projects can work well for delivering the unavoidable, unplanned R&R projects that will always crop up.

R&R Project Closeout Activities

The R&R project closeout activities are not really a planning activity but an implementation activity. Whenever any project is completed either by the utility's forces or contributed by a developer, the R&R project closeout activities will add the appropriate asset information to the utility's asset record. In the case of an R&R project, these activities would include a step to account for retiring the existing asset. The asset acquisition activities are the most crucial step in the maintaining an accurate asset record. It is also the key to gradually populating a new asset record for the database.

CONCLUSION

We have outlined a proven, proactive approach for planning R&R projects that provides the utility manager with the information needed to: minimize costly emergency repairs, make strategic funding decisions to keep rates low and bond ratings high, provide a measure of efficiency and effectiveness, and meet anticipated accounting and environmental regulatory standards. The approach is centered on the concepts of strategic and tactical planning, the life cycle of the asset and the life cycle of a utility. The need for an accurate asset record was presented in several elements of the R&R planning phases that provides the utility manager with an idea of what an asset record should contain and how it will be used. In the absence of an accurate asset record, the utility manager can still derive information necessary to develop a strategic R&R plan.

With the maturing of many utilities, the focus of management should now properly include more emphasis on the planning and delivery of R&R projects. The concepts, tools and practical techniques for implementing a cost-effective and comprehensive R&R program are applicable to all environmental utilities, regardless of size. It is likely that in the future, utility management will be judged by how well and efficiently they are able to plan and deliver their R&R projects.