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Risky Business

Print

Physical asset management tactics reduce costs

- By Roderick Lovely

Water and wastewater managers make decisions every day that are aimed at reducing the risk of costly failures. But as time goes on, systems change, people retire, the knowledge base is lost and the probability of costly failures increases as our infrastructure ages.

Against this backdrop, a new generation of managers is finding that old tactics to replace aging assets in broad strokes or fixing them after they break are not cost-effective solutions. In order to address these issues, today's managers seek a more strategic approach that uses and improves their knowledge base as it instills confidence that the decisions made are the most cost-effective.

What they are discovering is that tactics in physical asset management (PAM) can be applied to resolve these issues. Fundamental to PAM is prioritization of assets based on risk. The following discussion summarizes what information is required and how it can be applied to assess risk.

In PAM, risk is defined as the product of the probability of failure (PoF) and consequence of failure (CoF): Risk = PoF x CoF.

Probability of Failure

To determine the PoF, first determine how an asset may fail in terms of failure modes. There are at least four failure modes common to all assets to consider:

- Condition—Can be quantified by the number and extents of defects, or by direct measures such as a vibration analysis.
- Age—Measured against life expectancy to determine the percent of life remaining.
- Capacity—Most often measured as percent of capacity utilized.
- Level of Service—Any performance measure that can be reliably quantified is a candidate for a level of service failure mode. Standards for issues such as noise, odor, safety, efficiency and costs may be considered level of service measures.

A manager's actual list of failure modes will vary depending on the asset types being rated, but they should all fall into one of these four categories. As you develop criteria, take into account that failure does not always mean a catastrophic failure, but it does mean that continuing to operate the asset without taking action will be more costly than taking action.

Consequences of Failure

CoFs reflect the values of stakeholders and what they want to protect. For instance, the public places a high value on the environment; therefore, a sanitary sewer overflow that spills into a water body would be highly consequential.

Some CoF examples include:

- Threat to life and health;
- Environmental damage;
- Regulatory compliance;
- Disruption of service;
- Property damage;
- Cost to repair;
- Loss of revenue; and
- Public relations.

To develop CoF ratings for the types of assets you manage, develop a list of consequences that could occur if an asset fails, rank the priority of each consequence relative to other consequences in the list and develop criteria for determining a CoF rating for each asset.

The Risk Model

Once you have determined failure modes, PoFs, consequences and CoF ratings, you can combine this information to calculate risk in a matrix for each asset. Above is an example of this calculation.

In this example, the consequences along with their relative priority are listed on the left. The asset is then rated according to the potential for each consequence to occur if the asset were to fail. The CoF score is calculated by

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multiplying the priority by the rating and adjusting to an arbitrary scale of 10, where 10 signifies the highest consequence. PoFs are developed from measures on the asset and entered into the table for each failure mode. Each CoF score is then multiplied by each PoF to generate risk scores. The highest risk score for each consequence is highlighted in red. The highest risk value falls out of the table as the risk factor—in this case 5.25 on an arbitrary scale of 10.

From this example, we can say that the most concerning consequence for this pipe is property damage due to a failure in capacity. The probability of this occurring in any year is 75%, and the consequence factor is 7 out of 10.

Developing the risk model requires this same analysis to be performed on each asset. If dealing with just a few assets, you could perform the calculation by hand; however, if dealing with hundreds or thousands of assets, you should seek a computer application to develop the model. Once the model is developed, patterns should emerge. The map below was generated using VUEWorks software with GIS data and illustrates how high-risk sewer pipes fall in the denser business sectors in this municipality.

Analyzing Risk

Managers have always been conducting studies to gather information about their systems for decision-making purposes; however, with the advent of PAM, we now have a structure to utilize this information qualitatively in a risk model as a basis for strategic decision making.

When dealing with a large number of assets, the use of asset management software can help you develop a risk model and assist in prioritizing operations and maintenance as well as capital project activities. Although risk assessment should be central to any asset management program, there are many tactics in PAM, such as cost/benefit analysis, triple bottom line analysis, optimized budget forecasting and reliability centered maintenance, which use the same information pool generated from the risk model.

To learn more about physical asset management, a good place to start is the U.S. Environmental Protection Agency website at http://epa.gov/owm/assetmanage/index.htm.

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Source: *Water & Wastes Digest* November 2008 Volume: 48 Number: 11

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