The State of Asset Management

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Overview

I was recently invited to a Mainsaver User Conference to discuss asset management with a group of maintenance managers, engineers and other maintenance professionals. The topic was timely, for there was a big interest in asset management, especially in a current economic environment where most organizations are being asked to do more with fewer resources. After all, asset management is a financial tool where an organization, to ensure their long term viability and productivity, must provide sufficient capital to replace assets, and fund maintenance and preservation activities, to minimize total life cycle cost. Asset management provides an approach that identifies where to focus investment, knowing that there is always more work than time or money to accomplish that work. This paper discusses some of methods available to users of CMMS/EAM software they might consider.

According to the American Society of Civil Engineers (ASCE), the state of the America's infrastructure has a failing grade of D+, and will take an estimated $3.6 trillion investment over the next seven years to achieve a passing grade. The following chart is the ASCE's report card. Also shown is the total investment (in billions of 2010 dollars) needed by segment to achieve a passing grade, and the estimated funding shortfalls during the seven year period.

Segment	GPA	$Needed	$ Shortfall
Aviation	D	134	39
Dams	D	21	15
Drinking Water/Waste Water	D	126	84
Energy	D+	736	107
Inland Waterways/Ports	C-	30	16
Levees/Dams	D-	100	87
Public Parks and Recreation	C-	238	104
Rail	C+	100	11
Schools	D	391	271
Solid Waste	B-	56	46
Transit/Roads/Bridges	D	1723	846
America's Cumulative GPA	D+	3655	1626

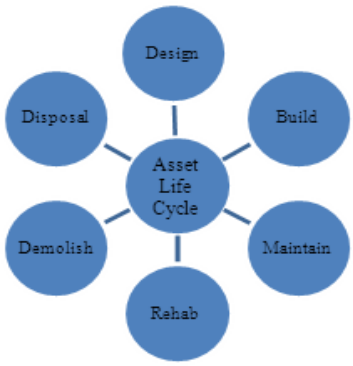
To look at this infrastructure problem from a more personal perspective, Bloomberg estimated the annual per capita cost for repairs to roads, drinking water and airports. These costs range from highs of $1000 per resident for West Virginia, in the $600 per resident range for the Far West States, to approximately $100 for residents of New Jersey, Massachusetts, California and New York. See Bloomberg.com/rank for the complete listing, and the methodology they used to compile the results.

Asset Management Tools

The ability to forecast these cost is the essence of asset management. For the purpose of this article, Asset Management is being defined as:

- the ability to minimize total cost of the asset life cycle
- in a limited resource environment
- while delivering the service levels required
- and, doing so at an acceptable level of risk

Looking at minimizing asset life cycle, the following diagram might be helpful.



Most asset managers would agree that 80% of the life cycle cost of an asset is a known value before the asset is ever put into service. This being the case, the maintenance and preservation cost is what CMMS/EAM managers are left to manage. The types of maintenance typical managed in software like Mainsaver include:

PM Systems

- Time or Calendar based maintenance - Age related
- Run Based Maintenance - Usage related
- Condition Based - Predictive maintenance or health of equipment-related
- Operator Based Maintenance

Corrective Maintenance

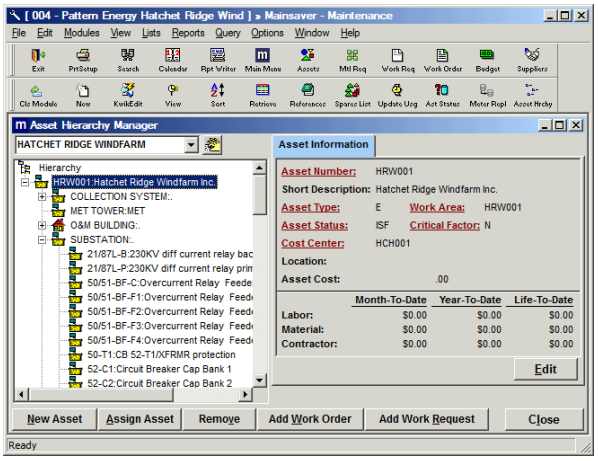
- Failure Repairs - Reactive/breakdown

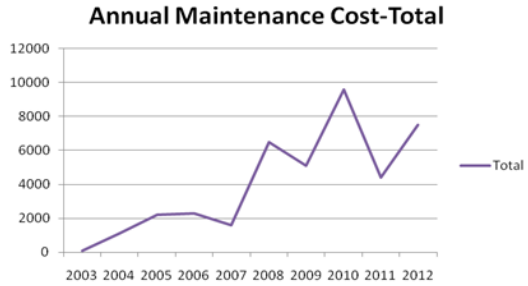
Run to Failure

- Consequence based

Asset Hierarchy

The asset hierarchy is one of the tools that permit the asset and CMMS managers to have the maintenance and preservation cost displayed for an asset, or system of assets. Typically the hierarchy represents all of the managed maintenance items (MMI) in a plant or facility, and provides the ability to roll up and display the maintenance cost of the assets in the systems and subsystems. This kind of representation of cost data is an after-the-fact or lagging indicator of effective asset management.

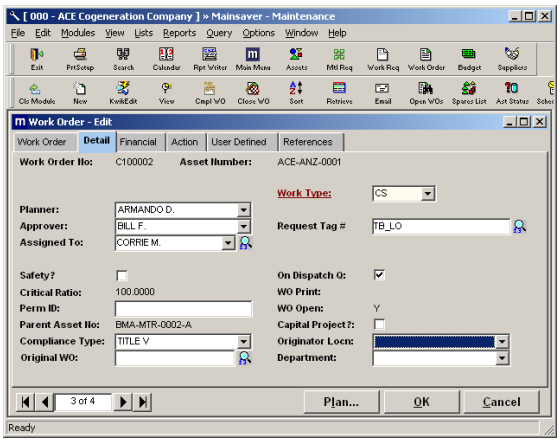


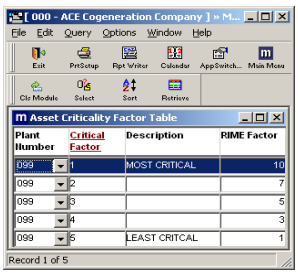


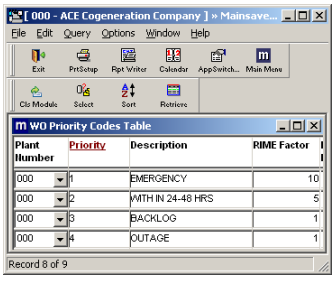
Ranking Index for Maintenance Expenditures (RIME)

A tool provided to help focus the maintenance efforts in a more proactive manner would be the use of the Ranking Index for Maintenance Expenditures (RIME). The concept of RIME is simple. It uses a calculated value called the critical ratio, and is expressed as the product of how important an asset is, and how important is the work. Using scales of 10, where 10 is the highest asset criticality factor, and 10 is the highest priority work, the critical ratio of a particular work order requirement would be 100. Every work order gets this calculation and it is typically used as a scheduling tool to ensure that the highest value work orders are actually executed at the expense of lower value work orders.

(Critical Ratio = Asset Criticality x Work Order Priority)



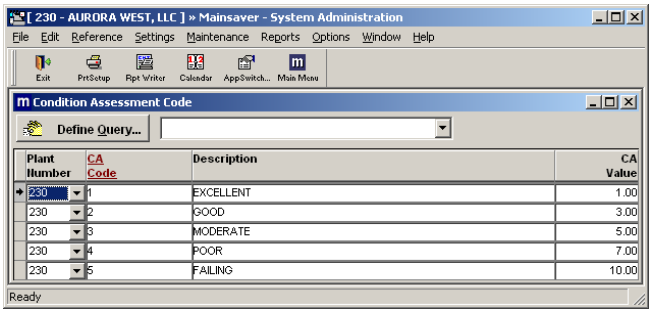




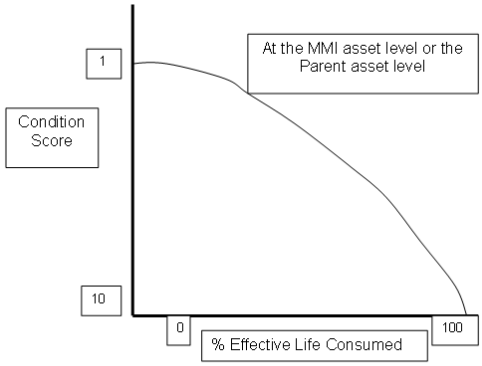
Asset Condition Assessment

More commonly performed today is an asset condition assessment. Condition assessment is of value if it is used to the extent that it helps assess the nature and timing of possible failure, and should be focused on remaining useful life rather than just condition. Condition assessment requires well defined and written protocols, consistently applied over time. A condition assessment matrix might look like these:

	Physical Condition Code Rating Guide
1 Excellent	Asset is like new, fully operational, well maintained, and performs above standard. Little wear and no action necessary.
3 Good	
5 Moderate	Asset is functionally sound, showing normal signs of wear relative to use and age. May have minor failures or diminished efficiency and some performance deterioration. Likely modest increased maintenance and operating cost. Minor to moderate rehab may be needed in near term.
7 Poor	
9 Very Poor	
10 Failing	Effective life exceeded and excessive maintenance cost incurred. A high risk of breakdown – imminent failure with serious impact on performance. No additional life expectancy, immediate replacement is needed.



Condition assessment might be performed each time a technician services an asset, or more likely is performed every few years to satisfy other requirements such as capital planning systems or financial audit requirements. Again, what is important about condition assessment is that it be performed consistently over time. The outcome is to predict when an asset is likely to fail; it produces a decay curve (illustrated below) that assists the asset manager with a financial forecast for asset replacement.



Measurement of Risk

Still another tool that is available is the measurement of risk. Risk is used to evaluate and consider the exposure of the organization to the effects of failure of an asset to perform its intended service level. Risk is a calculated value represented by the product of the consequence of failure (COF) and the probability of failure (POF).

A typical COF scale would be:

		Health and Safety	Regulatory Environmental Impact	Community Impact	3rd Party	Cost of Repair	COF Score
Asset	Wt	.3	.3	3	.05	.15	-
2212-M	-	2	3	1	1	3	2.20
2212-E	-	2	4	1	1	4	2.65

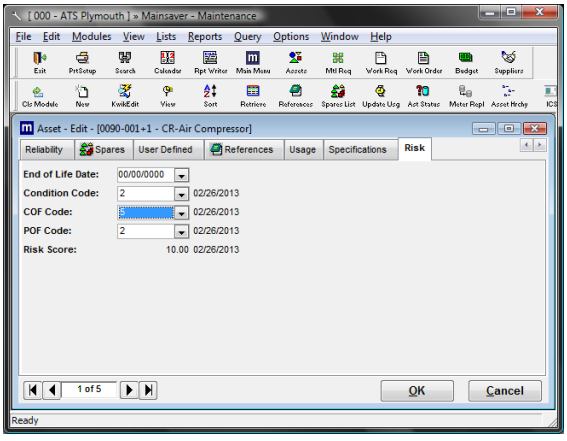
A typical POF scale based on condition (since condition relates to remaining useful life) would be:

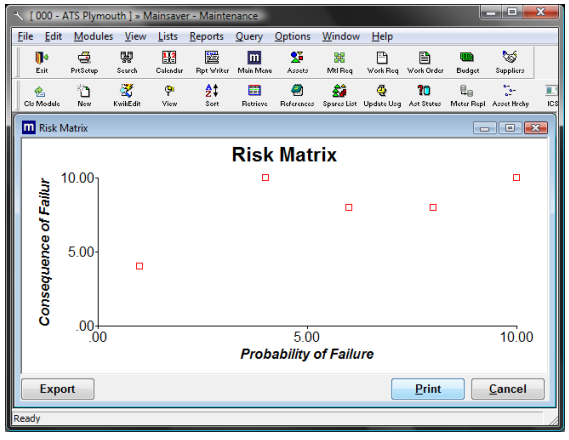
	Condition Score	Description	POF Score
2212-M	3	Moderate	3
2212-E	4	Poor	4

(Risk = COF x POF)

Risk Matrix Plot

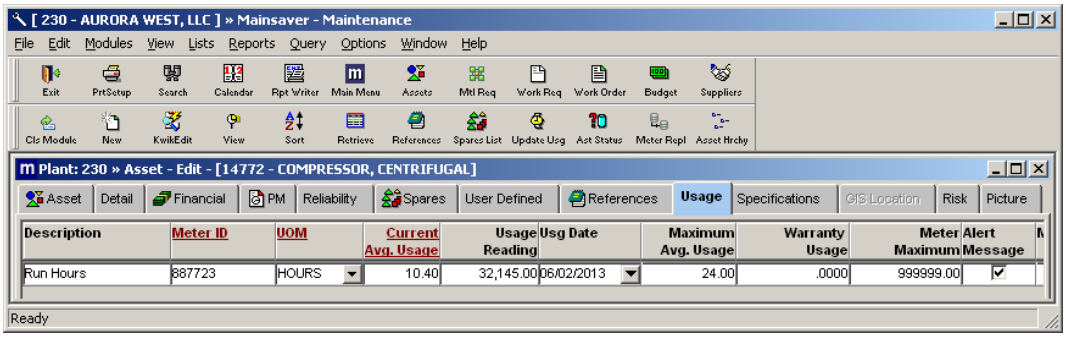
As the risk assessment program evaluates all managed maintenance items, the calculated value for each asset is stored. A plotter on a scatter plot identifies those assets that are at highest risk of failure and must be addressed.

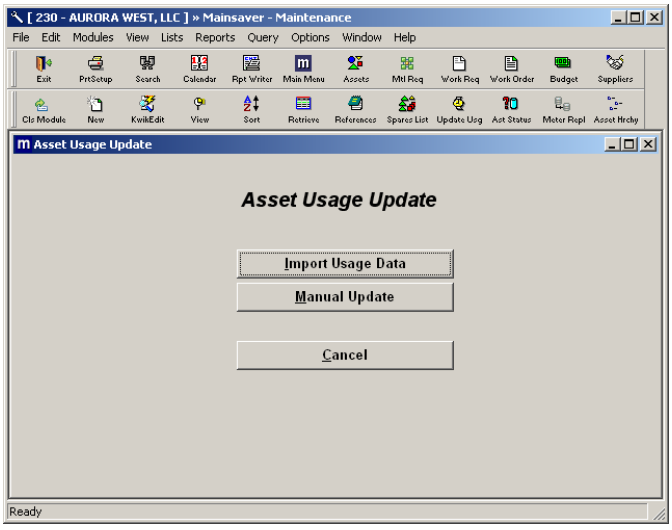




OSIsoft PI and SCADA Systems

Another common tool is the use of imported data from systems such as the OSIsoft PI system or other SCADA systems, where anything that can be measured and reported can be used as a trigger for work order creation. Historically, usage based PMs used asset run hours, odometer readings, or production cycles as the more common criteria. The process requires assets to have a “meter” defined, where the meter represents the hours, mileage, or production cycle; and then the meter is periodically updated – either manually or by an import utility. Other asset performance criteria can also be used as trigger points for work order creation such as pressure differentials, temperature, and vibration.





Summary

In the era of big data analytics and smart metering system integrations, the triggering of events has evolved to the point where it can impact the management of up to 20% of the asset life cycle cost that can be influenced by asset managers - on a real time basis. Operational attributes such as boiler efficiency, emissions, and discharges can be monitored on real time basis.

Biography

Mr. Grassi has been involved in CMMS implementations since 1984; he is the principal of Grassi & Associates, a specialized CMMS implementation firm that provides a broad range of management and technical services. His experience includes needs assessment and gap analysis, project planning, implementation and management, system audits, asset surveys, PM/PDM program development and implementation, storeroom organization and automation and MRO purchasing. Mr. Grassi has been involved in over 400 CMMS implementations in the last 30 years in a variety of roles, including project manager, project consultant, coach and trainer. He also served as the Managing Director of MECCA (Maintenance Engineering Council and Consulting Association) from 1987 – 1990. Mr. Grassi holds technical and business degrees from The City College of New York and Pepperdine University.