Usage-Based Maintenance Programs: Sometimes Less Is More

By Matt Adams, P.E.

There are times when it seems that our industry is too isolated from peer industries. It's clear that institutional facilities management, and educational facilities in particular, represent a unique business. However, it seems that we don't discuss what other asset managers consider best practices as often as we should. One such best practice, usage-based maintenance (UBM), has been around in manufacturing and technology for years. This practice offers benefits for the educational facilities management industry as well.

BASING MAINTENANCE ON USAGE

Let's start with the best news: UBM programs provide all of the benefits of traditional preventive maintenance programs (as most often seen in higher education) but cost less to execute. Given that we are all trying to achieve the Holy Grail of increasing planned maintenance (PM) in place of unplanned maintenance, with little or no additional funding, this benefit is intriguing. The principle is simple, but the implementation is where most of our peers struggle. Contrasting a traditional, calendar-based PM program with a usage-based program at the highest level, the difference lies in the scheduling of maintenance activities.

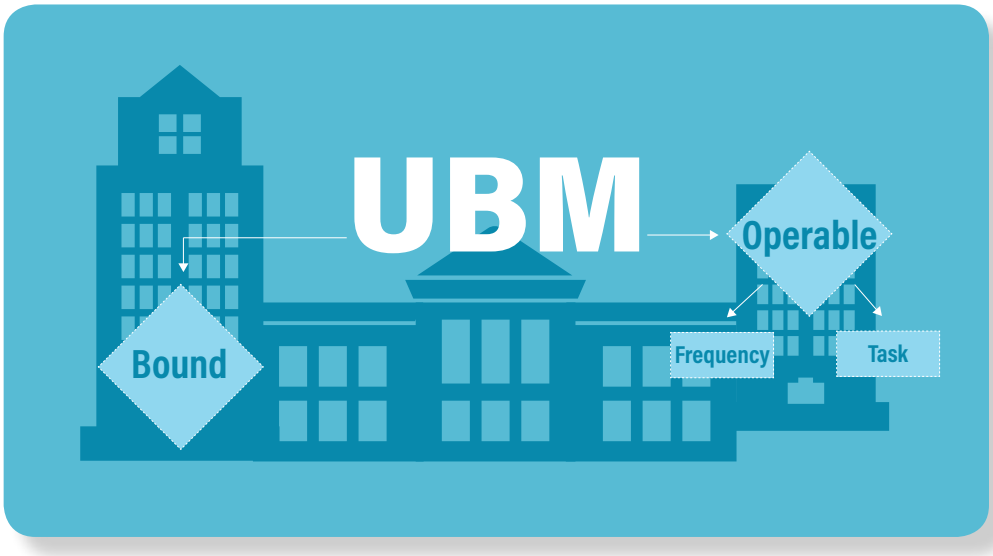
In the calendar-based system we schedule our activities based on calendar dates (computer) that represent weeks, months, quarters, and so on. Each mechanical system is scheduled for a maintenance activity based on the absolute time passed since the last activity.

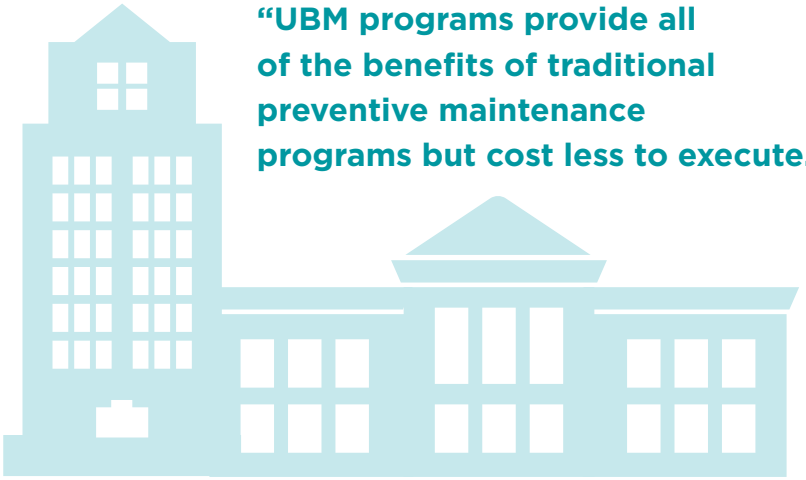
The usage-based system schedules PM based on the actual time a system has been running. Therefore, more usage results in more maintenance. Visualize your car getting its oil changed every three months versus every 5,000 miles. Why would you change the oil if you spent the summer away from home and left your car behind?

To see it from another perspective, consider a factory. Usage-based maintenance originated in factories where the vast majority of the maintainable assets were critical to the production of "widgets." If these assets failed, the production line was shuttered. In that environment was born the application of reliability-based maintenance driven by usage or run-time. In our industry, one failure will not stop our entire production line of students and research. However, the same application has other important benefits in the form of improved system performance (read, energy savings) and reduced unplanned failures that often require repairs at dramatically increased cost.

CLASSIFYING YOUR ASSETS

The secret of implementing UBM to save money is the fact that unlike a factory, many of our assets do not run 24/7, and many similar assets have varied operating hours per time period. Given this fact,





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we can assemble a decision tree to classify assets and look for application of UBM, and hopefully find some savings in labor. The initial assessment of the maintainable-equipment inventory determines those assets that are bound and those that are operable. A bound asset is one that has no moving parts and is not subject to varied service demands. Operable items that require energy to function are included because they impact energy costs. Items that use resources like water and are operable like bathroom fixtures are included. These assets meet one or more of the following criteria:

- Consume energy
- Are electromechanical and perform a function
- Provide heating or cooling to building occupants
- Internal or external lighting of all kinds

Once the list of UBM candidates is created, we should refer to the manufacturers' suggested maintenance tasks and frequencies. Increasingly, manufacturers are specifying maintenance tasks by operating hours. If so, we can use this data and go right to the next data collection effort: measuring usage. The best option is to exploit the building automation system (BAS) and collection-operating parameters for all of the equipment on our list. This information is used to drive the initiation of PM activities in place of the calendar. Other information such as pressure drops and temperature changes are ideal candidates to drive this form of UBM as well.

A "NORMAL" LOAD

Sometimes the task and frequency hours are not available in a usage format. In this case, we must convert the published standard tasks and frequencies, assuming they are based on what is considered a normal load. "Normal" generally suggests that the systems operate in a typical business environment with normal hours, for example, 8:00 a.m.-5:00 p.m. If this information is unavailable, facilities professionals can estimate the typical usage for each asset class, and this value coupled with the associated tasks and frequencies becomes the baseline. Next, the time- or calendar-based frequencies are converted to usage frequencies by dividing calendar operating days for each suggested PM task and frequency by the actual or estimated nominal operating hours.

In other words, a monthly PM task is converted to operation hours by extrapolating days operated per month to hours. This figure again is the baseline and is unmodified for increased or decreased usage conditions. The manufacturers' or published standard maintenance tasks and frequencies are loaded into the maintenance management system as tasks and operating hours (frequencies).

Some of us will be unable to utilize BAS data to drive our PM activities. The second choice is temporary measurement or even physical observation to create a sample set. Low-cost meters can be installed to monitor operations during various periods to collect a representative sample set. If even this is not possible, observed operating hours can be collected by strategically monitoring the operating assets. This data is then refreshed periodically and loaded into our maintenance system or our paper-based system to drive PM tasks frequencies for varied buildings and associated systems.

USING LESS TO COMPLETE MORE...SOUND FAMILIAR?

Experience shows that while there are many buildings on our campuses having longer operating hours, many have lighter loads. When aggregated, the total PM work load on a typical campus is less by trade using a UBM system than a calendar-based PM program. In addition, this approach allows us to reallocate maintenance resources from those buildings that are not densely populated, and have normal-to-light operating hours, to those very dense facilities like student unions. Thus, by using fewer trade resources to complete a more accurate and effective PM program, we are achieving more with less.

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