

**Stewardship:** We conduct our business in a manner that is reflective and protective of the public trust in us as stewards of the University's facilities.

*Part of the Values at Work Series*

## Building a Legacy: One Piece at a Time

### *The Overview*

*This article provides an overview of The University of Texas at Austin's journey to build and implement a world-class strategy for its comprehensive preventive maintenance program that will move the program forward well into the future. Subsequent articles will follow to provide a more detailed look at the implementation of this major initiative.*

"It's not only what we do now that matters; it's the path we've established for the next generation that will be our legacy," states Darnell Mack, an electrical engineer and project manager with Facilities Operations & Maintenance (FOM), a division of the Facilities Services department at the university. This is her vision, but she is not alone.

Is she talking about the environment? Education? Trust funds? What she is talking about is **being a steward** of the facilities at The University of Texas at Austin.

For nearly 30 years Mack has served in the realm of facilities, providing engineering, project management, and quality control services in the manufacturing and heavy commercial industries. Her passion these days is her work on the **Maintenance Improvement Initiative**, or MI<sup>2</sup>. This initiative is a core strategy for FOM. What does MI<sup>2</sup> mean to the university?

"It is really about a fundamental change to the way we have historically looked at and managed maintenance," explains Dan Clairmont, associate director for FOM. "Performing routine, preventive maintenance (PM) in campus facilities is intended to maximize the useful life, reliability, and efficiency of building systems. However, it is expensive. As good stewards of the university's resources, it is critical for us to validate that it is performed in the most efficient manner and results in value-added benefits."

**"IT IS REALLY ABOUT A FUNDAMENTAL CHANGE TO THE WAY WE HAVE HISTORICALLY LOOKED AT AND MANAGED MAINTENANCE."**

To accomplish this, Clairmont has made MI<sup>2</sup> the division's number one strategic priority. They are breaking down every aspect of their existing maintenance program to the most basic levels and rebuilding it. This is an enormous task, but an essential step in their journey toward becoming a truly world-class maintenance organization—what you would expect at The University of Texas at Austin.



*Technician changes filters on air handler unit.*

FOM currently maintains over 60,000 individual pieces of equipment and devotes around 60 percent of its available worker-hours each year to performing preventive/scheduled maintenance of that equipment—approximately \$6 million per year in direct labor costs alone. Managing this effort is a huge task. Ensuring it is managed efficiently and delivers measurable results was a clear objective of MI<sup>2</sup>. However, there was something more they needed to accomplish with the initiative. They needed to tell their story.

Even before they began developing MI<sup>2</sup>, FOM's hypothesis was that the division was under-resourced to provide world-class maintenance. They knew they were not doing all the maintenance they should do. The questions were, "What would it take to do all the maintenance they should do, and what is the risk to the university's mission?" University leaders would need this information to determine if they could accept that risk. However, before asking leaders to make that decision, FOM would need to show that the division is addressing the highest priority requirements and effectively utilizing their existing resources. This was the story MI<sup>2</sup> needed help to tell, but telling the story would require a major overhaul to FOM business processes. Here is how they did it:

### **1. What resources do you think you need?**

Prior to implementing MI<sup>2</sup>, FOM managers did not know what resources they needed. Business processes were not set up to allow them to determine reliably which maintenance items were currently not being accomplished much less quantify the requirements for enhancing the maintenance program. This had to be step one.

***What Is Not Getting Done?*** Step one began with implementing a business process that would help FOM distinguish between PM work orders that were successfully performed and those that were not completed due to a lack of resources. Previously, all PM work orders were closed, whether they were completed or not. The only distinction between a completed work order and a skipped work order was that skipped work orders had no hours charged. This was a relatively simple fix. Instead of closing skipped work orders, FOM cancelled them. The next obvious question was "Why was it cancelled?" To answer that, they configured their computerized maintenance management system (CMMS) to categorize the reason for cancelling a PM work order. They can now clearly identify the PM work orders cancelled due

to a lack of resources, or for other reasons. They can also easily and reliably show the completion percentage for PM work orders and have confidence that a closed PM work order was actually done.

Now able to identify the PM work orders that were cancelled due to a lack of resources, the next step for FOM was to determine the number of labor hours by trade required to complete the cancelled work.

**How Many Hours Do You Need?** FOM found that the estimated labor hours to perform each PM work order, if recorded at all, were not accurate. Thus, FOM could not accurately predict how many specific craftsmen, such as plumbers or mechanics, were needed to perform the PMs.

To provide a means for estimating the needed resources, they are mapping the PMs to the equipment to be maintained. They are breaking down the PMs and indexing them by class of equipment, maintenance objective, and the tasks involved, as shown below:

Class of equipment – Such as a fan or pump

Objective – Which PMs should be done to best prevent failure?

Tasks – What needs to be done to carry out the objective? Examples include lubricate the bearing and perform a visual inspection

The steps vary, based on specific equipment details, but the objective(s) should remain the same. This analysis provides a strong basis for estimating hours needed to complete the PMs. FOM is currently in the stage of identifying objectives. Drilling down to the details is still on the table for this team in order to make the full-scale improvements they want to make. Yet, a strong maintenance team knows that while estimating the hours needed is important, the long-term value to accurate estimates is to help manage the program by comparing estimated with actual hours and providing the ability to project resource requirements.



*Technician inspects rooftop fan at the Union Building.*

**Align actual hours with estimates.**

Evaluating estimated hours and developing metrics ensures that the actual hours align with the estimates. “When you have confidence that the estimated hours are accurate, you will also be able to compare them to the actual hours charged to give an indicator that the work is being done efficiently and completely,” Mack explains. The managers can spot the outliers and then research the reason for the discrepancy, which they can document for future reference.

When the actual and estimated hours are closely aligned, this is an indicator that the job was done properly. Mack states, “Our focus has to be on the quality of the work to ensure our buildings and equipment operate safely and efficiently. Our goal is to stress to our technicians that the quality of work is most important, not the quantity.” With clearly written instructions and the expected amount of time

required to do the work, technicians have the freedom to do the job right the first time without the stress of being told to work faster, which ultimately has a negative impact on quality.

## 2. How can you prove you are effectively using the resources you have?

According to the MI<sup>2</sup> team, there were two imperatives to ensure FOM was effectively applying its resources to the most critical maintenance items: setting priorities for the PMs and implementing a process to schedule individual technicians for specific work orders.

**Set priorities.** Before MI<sup>2</sup>, all PM tasks were assigned the same priority. If there were over 1,000 work orders for a week, there was no way to prioritize those work orders. FOM now categorizes PMs based on four priorities and has established clear completion goals for each priority (Table 1). Unlike client requested work, known in FOM as Trouble Calls, where priorities drive a certain response time, PM priorities drive a completion rate. Clairmont explains, “It does not matter, within reason, how quickly we accomplish a priority 1 PM; it matters that it is completed in a quality manner.” This allows employees to work on the most important tasks first. Then, they proceed with lower priority requirements until they run out of available hours to complete them.

PREVENTIVE MAINTENANCE				
Priority	Description	Comments	Examples	Goal/Band
1	LIFE SAFETY / CODE	Life safety or code required PMs.	<ol style="list-style-type: none"> <li>1. Fire suppression systems</li> <li>2. Eye wash stations and safety showers</li> <li>3. Backflow preventers</li> <li>4. Emergency egress, signage and lighting</li> <li>5. Chemical fume hoods</li> </ol>	98% - 100%
2	REQUIRED	Minimum maintenance.	Annual preventive maintenance activities and other essential maintenance tasks: <ul style="list-style-type: none"> <li>• HVAC systems</li> <li>• Steam generators and piping systems</li> </ul>	95% - 100%
3	MFR RECOMMENDED	Manufacturer's recommended maintenance level.	All OEM recommended PMs (weekly, monthly, quarterly and semiannually)	85% - 95%
4	TOP TIER	Top tier maintenance activities.	All of the above items plus: <ul style="list-style-type: none"> <li>• Exercising rarely used valves</li> <li>• Predictive maintenance program development</li> <li>• Structured failure analysis program</li> </ul>	

Table 1: Preventive Maintenance Decision Matrix

**Schedule the work orders.** Work order scheduling was a critical process change necessary to support the overall MI<sup>2</sup> effort. Previously, PM and trouble work orders were generated and given to technicians to accomplish. Technicians carried around a stack of printed work orders they needed to complete, but FOM managers did not know how many days, or weeks, of work each technician had nor did they know which work orders a technician would decide to do on any given day. FOM's CMMS had the capability to schedule work but it had never been utilized. The MI<sup>2</sup> team tested this capability extensively and developed procedures for maintenance supervisors and planners to produce a daily schedule for each technician. With better estimates of the time it takes to complete a given work order, the technician's availability, and the priorities of open work, supervisors now know exactly which work orders technicians will address on a given day and, barring unforeseen



*Technicians work on sump pump at the Texas Swim Center.*

emergencies, is reasonably confident that they can complete that work. In addition to providing managers the capability to ensure the highest priority PM and trouble work orders are completed first, the CMMS allows FOM to spread the due dates for PMs evenly over the entire year and smooth out the peaks and valleys of their maintenance work load. It also allows supervisors to group work orders by facility, ensuring that, when possible, a single technician completes multiple work orders in a facility on the same day, reducing inefficiencies associated with travel time.

**Communicate scheduled work with clients.** Creating daily schedules will also enable FOM to improve client communication. This is especially important for trouble calls. Previously, technicians determined when they did a particular job, with input from supervisors for high-priority work. There was no visibility at any level as to when a particular job would be addressed, leaving clients completely in the dark. FOM can now inform their clients when their work is scheduled. As Clairmont advises, "Improving your client communications brings you added benefits." He gives two examples:

- Communication sets clients' expectations and avoids completing work out of priority because a client has called FOM multiple times to ask when a technician will be there.
- Coordinating in advance minimizes wasted trips such as when a technician arrives unannounced only to find that the client or space is unavailable.



### What is the impact or risk to the university if you do not get the resources you are requesting?

Risk is possibly the most important piece of the puzzle because it communicates impact to the university mission, but it is also the most difficult to quantify for decision makers. A maintenance organization that determines and implements the most effective maintenance approach employs a “reliability-centered maintenance” (RCM) philosophy. RCM was originally developed in the 1960s by the airline industry to evaluate the effectiveness and costs associated with the maintenance of their fleets. In terms of university facilities, this focus on reliability means reducing the negative effects associated with building system failures. Examples include facility (and productivity) down time, risk to significant property and research experiments in controlled environments, health and safety implications, or discomfort in educational offices and classrooms—all of which directly affect the university’s mission. And a more reliable maintenance program is also a more cost-effective program—another fundamental component of providing good stewardship to the university. RCM affects the operational life-cycle cost of a facility, as effective and appropriate PMs will help extend the life of equipment, reduce down time, and reduce capital expenditures for major building system renewal.

The MI<sup>2</sup> team utilizes an RCM approach to develop maintenance objectives and procedures by first identifying the different ways equipment failure may affect the mission of the university. These failures do not need to be catastrophic and are largely dependent on the function of the space they affect. It could be as simple as an uncalibrated sensor in a vivarium with extremely tight temperature and



*The diversity of building maintenance at UT Austin. Old and new facilities of many types but one common mission make up the university’s 431-acre Main Campus.*

humidity requirements. Once the team identifies the ways a given piece of equipment can fail and its impact on the mission, they can identify the maintenance activities that will most likely reduce the probability of that type of failure. This analysis ensures that the maintenance performed has the greatest benefit for the university and helps FOM communicate the risk of not completing it.

“Our goal is to complete 100 percent of the Life Safety & Code required PMs to protect the health and safety of faculty, staff, and students as well as property and research. As good stewards of the university, we strive to complete 85-95 percent of the required and recommended PMs for proper operation of the building equipment and reduce the unscheduled downtime of systems,” Mack says. “In Austin, Texas, proper operation of the HVAC systems are critical when temperatures can reach 100°F during the day, so our PMs are important to keep the students and faculty comfortable and protect valuable research,” she adds.

## Conclusion

Implementing this major initiative will provide multiple benefits to FOM's maintenance team and to the university. After completion of the MI<sup>2</sup> steps FOM teams will be able to:

- Know which maintenance activities they are not doing and why they are not doing them;
- State how many worker-hours it would take to perform the maintenance they are not able to provide;
- Articulate the impact of not performing a specific maintenance activity;
- Describe the maintenance activities they *are* doing, why they are doing them, and the benefit to the university;
- Provide a level of confidence that they are working efficiently and effectively, and
- Improve communication and information flow with clients.

FOM's overhaul of their maintenance program is taking these facilities managers to a whole new level, a world-class level. And they are up to the task. For this team, stewardship of the university's facilities is much more than keeping the facilities running. It's about knowing they are keeping the facilities running better and longer by maximizing the useful life, reliability, and efficiency of the building systems in the most cost-effective manner, and being able to prove it!

*For more information about the Maintenance Improvement Initiative (MI<sup>2</sup>) at The University of Texas at Austin, contact Dan Clairmont at [dan.clairmont@austin.utexas.edu](mailto:dan.clairmont@austin.utexas.edu).*

**Next up:** *What resources do you think you need?* Learn more about how UT Austin captured the realm of assessing needed resources.