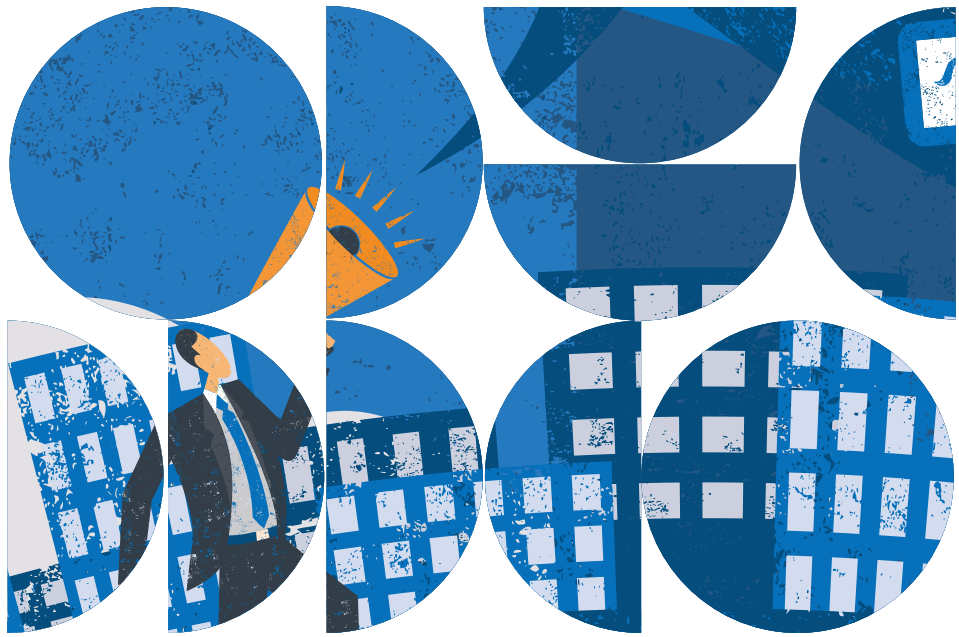
EAB

Shifting the Balance from Reactive to Preventive Maintenance

Best Practices for Eliminating Common Timesinks and Reprioritizing Critical Preventive Maintenance Tasks

Facilities Forum



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Supporting Members in Best Practice Implementation

Resources Available with Your Membership

This publication represents only one of our many resources to support members in their efforts to address maintenance challenges on campus. Details about additional resources are provided below.

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Addressing Increasingly Complex Deferred Maintenance Decisions

- Crafting a compelling narrative that increases stakeholder awareness of deferred maintenance backlog and buy-in for solutions
- Improving the rigor of prioritization by aligning facilities investments with academic priorities and financial constraints

Capital Renewal Funding Playbook

- Details 100 creative capital renewal funding strategies and their potential impact on maintenance funding and prevalence along with implementation guidance and case studies of successful implementation for each tactic
- Offers 10 executive-level lessons to help Facilities leaders choose 10–12 successful capital renewal funding strategies for their institution

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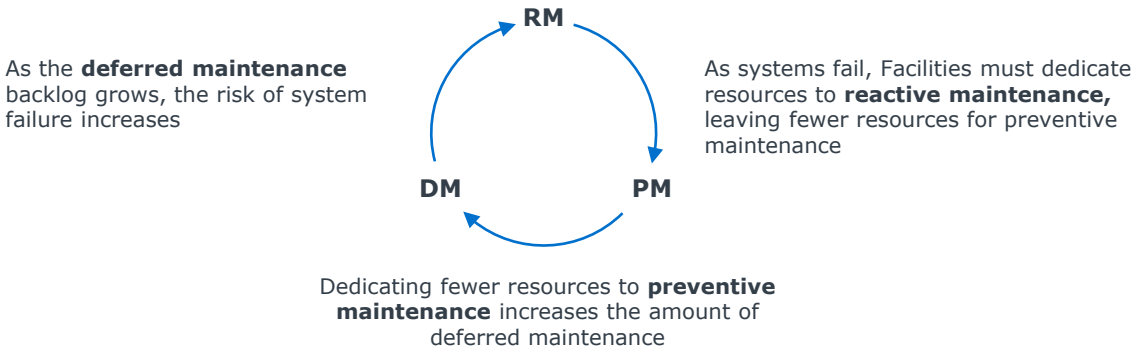
Executive Summary

Higher Education Facing Critical and Multifaceted Maintenance Challenge

While colleges and universities have faced maintenance challenges for decades, recent trends have combined to elevate maintenance to a strategic imperative for senior leaders. Beyond tighter budgets and widening funding gaps, most institutions face the dual challenge of replacing or renovating aging buildings while maintaining newer "smart" buildings that require more frequent and complex upgrades.

Most significantly, the relationship among deferred, reactive, and preventive maintenance (PM) creates a multifaceted problem. As deferred maintenance backlogs grow and building systems begin to fail, Facilities must divert resources to reactive maintenance activities, which in turn leaves fewer resources for preventive maintenance.

Relationship Between Deferred, Reactive, and Preventive Maintenance



Shifting the Balance from Reactive to Preventive Maintenance

Fortunately, preventive maintenance offers a clear and compelling return on investment. One organization found that for every $1 invested in PM, institutions save $2.73 in future reactive needs.[1]

The challenge for most campuses is determining how to pivot from reactive to preventive maintenance. Cuts to Facilities operating budgets across the last decade have led to decreases in preventive maintenance. Therefore, even when leaders want to expand their preventive maintenance program, they struggle to pinpoint where to invest limited resources first. To begin to build a more robust preventive maintenance program, the Facilities Forum recommends a four-part strategy:

- Increase PM capacity by eliminating the most common timesinks
- Build a better PM schedule that prioritizes the most essential tasks
- Leverage a staffing model to ensure the desired amount of PM occurs
- Use qualitative and quantitative strategies to engage staff in the transition to a PM-centric shop

Resources to Improve Preventive Maintenance Programs

To help Facilities leaders shift the balance from reactive to preventive maintenance, this report provides 11 executive-level best practices to improve the allocation of limited staff, data, and financial resources for preventive tasks.

1) Sightlines, "State of Facilities in Higher Education: 2015 Benchmarks, Best Practices & Trends," http://www.sightlines.com/insight/state-of-facilities-2015/.

Three Themes Central to Maintenance Challenge

As senior leaders in higher education shift their focus to maintenance, they most often cite money, data, and communication as the major barriers to success. They point out that more funding, better data, and engaging key stakeholders are all core to resolving the maintenance challenge.

However, each of these issues is more nuanced and requires action from Facilities units. While institutions need more dollars to put against maintenance needs, they must also make better use of the resources they have and prioritize the projects with greatest return. Similarly, senior leaders must marshal the data they have to make a more compelling case for investment. Finally, better communication should also include Facilities staff – engaging them in new and different kinds of work. To help Facilities leaders address these issues, the table below maps the 11 best practices in this publication against those three themes.

Practice	Money	Data	Communication
Practice 1: Process Improvement Toolkit	Reducing process inefficiencies and waste frees up Facilities resources that can be repurposed	Equips Facilities with better information about current processes, enabling targeted interventions	
Practice 2: Point-of-Service Information Hubs		Ability to submit work orders and updates from anywhere increases data capture and integrity	Decentralized information hubs ensure staff have information they need when they need it
Practice 3: Automated Inventory Procurement	Just-in-time material delivery reduces warehousing costs by requiring fewer supplies on hand	Automated inventory management provides better picture of actual material needs	
Practice 4: Strategy-Based Maintenance Standards	Diverts limited dollars against the most critical PM activities	Leverages existing data to make informed decision about maintenance priorities	Signals to Facilities staff what work is most important and should be prioritized
Practice 5: Data-Driven PM Scheduling	Increasingly affordable predictive technologies help campuses avoid costly failures	Equips Facilities with better information about true asset condition	
Practice 6: Preventive Maintenance Czar		Leverages system and work order data to build better preventive maintenance schedules	Serves as spokesperson and advocate for burgeoning PM program
Practice 7: Dedicated Preventive Maintenance Staffing	Provides framework for stretching labor dollars against PM tasks		Signals to Facilities staff what work is most important and should be prioritized
Practice 8: Maintenance SWAT Teams	Cost-effective alternative to comprehensive PM staff overhaul		Narrow staff focus ensures critical PM tasks are completed
Practice 9: Resident Facility Assistants	Low-cost alternative for lower skill maintenance activities		
Practice 10: Behavior-Reinforcing Metrics	Shifts focus from short-term cost reduction of assets and equipment to long-term cost management	Equips senior leaders with metrics to make better decisions and track progress in becoming less reactive	Refocuses staff on most important tasks and activities
Practice 11: Mission-Focused Town Halls			Creates venues for Facilities leaders to reinforce staff role in advancing institutional mission

Higher Education's Maintenance Imperative

INTRODUCTION

Stewardship Impacts Everyone

Facilities Maintenance Challenges Have Ripple Effects Across Campus

Maintenance has been a top priority for Facilities leaders for decades. Yet as institutions face aging buildings and growing deferred maintenance backlogs, tackling this challenge has increasingly become an area of focus of other institutional leaders, including chief business officers, presidents, and boards. The growing attention on maintenance in higher education is unsurprising given that maintenance issues affect all areas of campus. Four examples of Facilities maintenance challenges and their impact on other institutional leaders are described below.

Representative Facilities Maintenance Challenges		Implications for Other Institutional Leaders
Facilities forced to make budget trade-offs between routine maintenance and landscaping/grounds	→	**VP of Enrollment Management** worries about recruiting students due to diminishing curb appeal of campus
Facilities must sink research renewal dollars into unexpected HVAC failure in lab building	→	**Provost** unable to recruit star faculty with current research labs
Facilities deprioritizes classroom upgrades in favor of infrastructure investments	→	**Deans** forced to invest their own budget into upgrading classrooms and lecture halls
Facilities executive told to refresh teaching labs, expands work to address critical overdue renewal	→	**CBO** becomes frustrated when a series of modernization and renewal projects go over budget

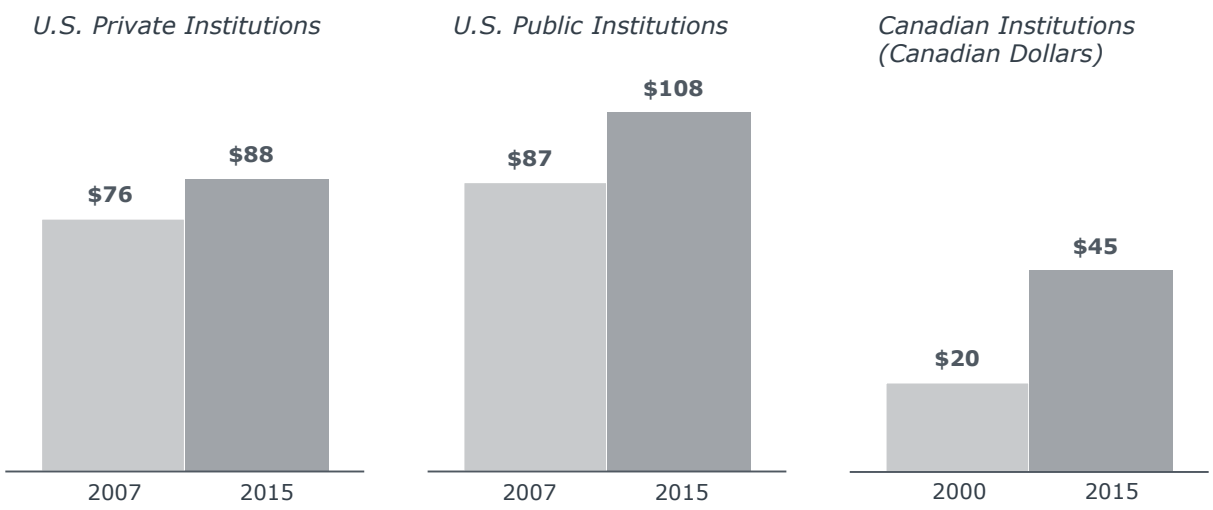
Source: Facilities Forum interviews and analysis.

Moving in the Wrong Direction

Deferred Maintenance per Square Foot Increasing Across North America

Unfortunately, while senior leader focus on deferred maintenance grows, so does the backlog on most campuses. According to Sightlines data, the deferred maintenance backlog per square foot increased 16% at U.S. private institutions and 24% at U.S. publics between 2007 and 2015, and 56% at Canadian institutions between 2000 and 2015.

Deferred Maintenance Backlog per Square Foot



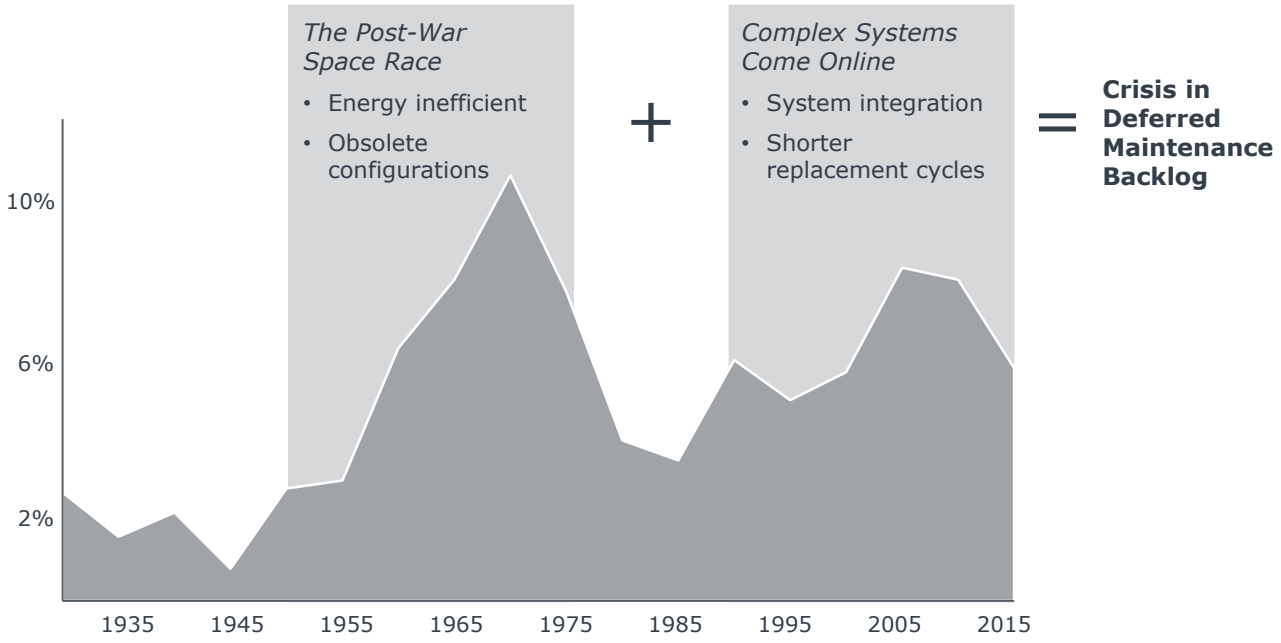
Source: CAUBO, "A Point of No Return: The Urgent Need for Infrastructure Renewal at Canadian Universities," 2000, http://www.caubo.ca/knowledge-centre/surveysreports/caubo_point_of_no_return/; CAUBO and Sightlines, "Deferred Maintenance at Canadian Universities: An Update," May 2014, http://www.caubo.ca/knowledge-centre/surveysreports/caubo_deferred_maintenance_2014/; Sightlines, "State of Facilities in Higher Education: 2015 Benchmarks, Best Practices & Trends," 2015, http://www.sightlines.com/insight/state-of-facilities-2015/; Facilities Forum interviews and analysis.

The Perfect Storm

Post-WW2 Building Boom, New 'Smart' Buildings Driving Growth in Backlogs

Beyond growing backlogs, Facilities leaders in higher education face four unique maintenance challenges, detailed across the following pages. The first challenge is a perfect storm of renewal needs. As illustrated below, most institutions face the dual problem of replacing or renovating antiquated buildings while maintaining newer "smart" buildings that require more frequent and complex upgrades.

Percentage of Total Higher Ed Space by Year of Construction



Among higher education institutions in the United States, 35% of current space was built in the post-war construction boom between 1960 and 1975, and many of these buildings now require significant renovations. Simultaneously, institutions must fund renewal costs for newer, more advanced buildings constructed in the last two decades, which comprise 31% of facilities on campuses nationally. While Facilities leaders agree that campuses should invest between 2% and 3% of total asset value into campus facilities, most institutions fall well short of that benchmark.

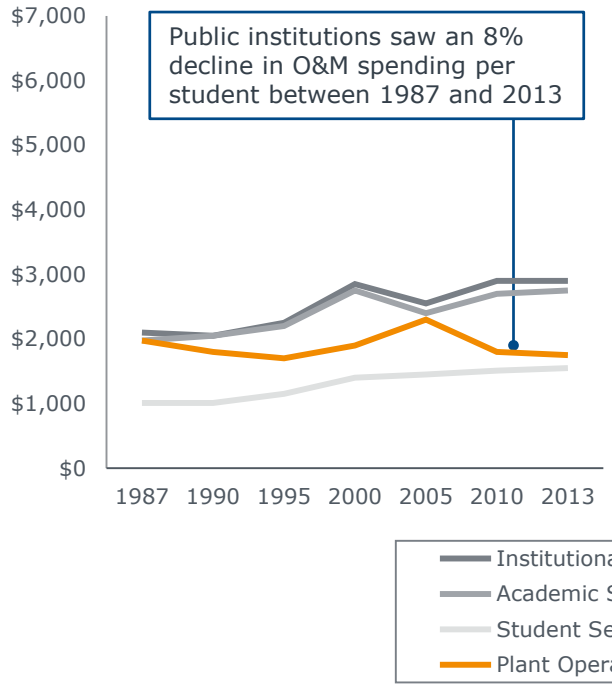
Source: Sightlines, "State of Facilities in Higher Education: 2015 Benchmarks, Best Practices & Trends," http://www.sightlines.com/insight/state-of-facilities-2015/; Facilities Forum interviews and analysis.

O&M[1] Spending Far Outpaced by Other Investments

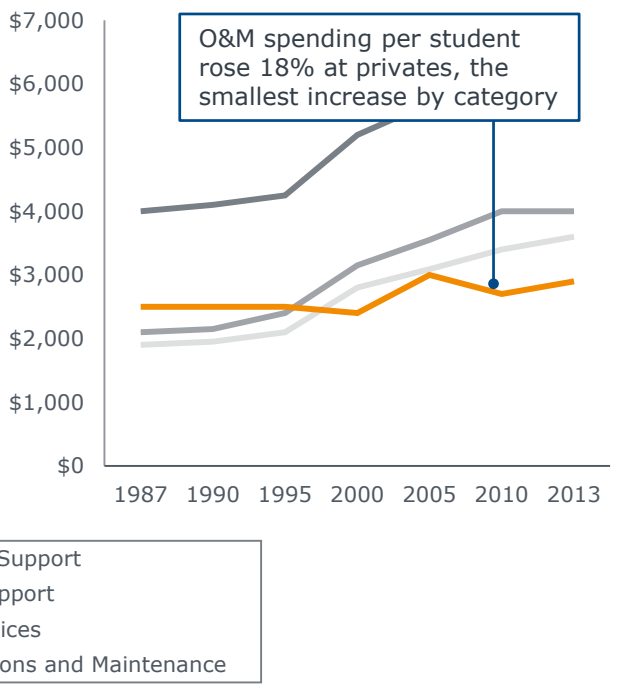
Tighter Budgets Lead to Painful Trade-Offs

The second challenge for Facilities leaders is tighter budgets. Nearly all institutions face declining revenues due to changes in enrollment, public support, research funding, and debt capacity. Unfortunately, tightening budgets across higher education have disproportionately impacted Facilities units. The graphs below depict spending per student in inflation-adjusted 2013 dollars across four spending categories at public and private institutions between 1987 and 2013.

Spending per Student by Public Institutions (2013 Dollars)



Spending per Student by Private Institutions (2013 Dollars)



At public institutions, every spending category has risen back above pre-recession level except plant O&M spending, which has dropped 8% since 1987. At private institutions, plant O&M has grown the least over the past 20 years compared to the other categories, growing less than 1% each year.

Source: Hinrichs PL, "Trends in Expenditures by US Colleges and Universities, 1987-2013," Federal Reserve Bank of Cleveland, September 2016, https://www.clevelandfed.org/en/newsroom-and-events/publications/economic-commentary/2016-economic-commentaries/ec-201610-trends-in-expenditures-by-us-colleges-and-universities.aspx; Facilities Forum interviews and analysis.

1) Operations and maintenance.

Even If You Had $300 Million…

Simultaneously Executing That Many Capital Projects Logistically Impossible

The third maintenance challenge is that even with adequate funding, campuses can only execute so many capital projects at one time. The table below compares the theoretical impact of $8 million worth of capital projects to campus versus $300 million. On the left, $8 million in capital projects would minimally impact campus operations, resulting in mostly localized and manageable interruptions.

Theoretical Impact of Capital Renewal Funds at Example Institution

	$8M Provided for Capital Renewal	$300M Provided for Capital Renewal
Planning Resources Required	Number of projects funded small enough to be managed by institutional team	Huge amounts of time and financial resources needed to develop details, execute projects at once
Number of Units Affected	Fraction of total units impacted at one time	Most units affected simultaneously, creating impossible swing space needs
Staging Area Required	Localized projects share small, nearby preparation space	Projects across campus require multiple worksites, redundant tools
Ripple Effects on Campus	Students and staff able to adjust to minor disruptions to campus	Majority of buildings and throughways inaccessible at once

> "It's a whole lot better to get $10 million a year for 10 years than to get nothing for nine years and then have $100 million dumped on you all at once."
>
> *Dennis Bailey, Senior Associate VP, Facilities*
> *Florida State University*

By comparison, $300 million in capital projects would massively disrupt an entire campus for three reasons. First, most campuses lack sufficient swing space to absorb the units displaced by construction. Second, institutions would likely need to repurpose fields and parking lots as project staging areas, which would drastically impact underground infrastructure and traffic patterns. Lastly, most institutions simply lack enough staff to support planning, scheduling, and executing more than a few capital projects at once.

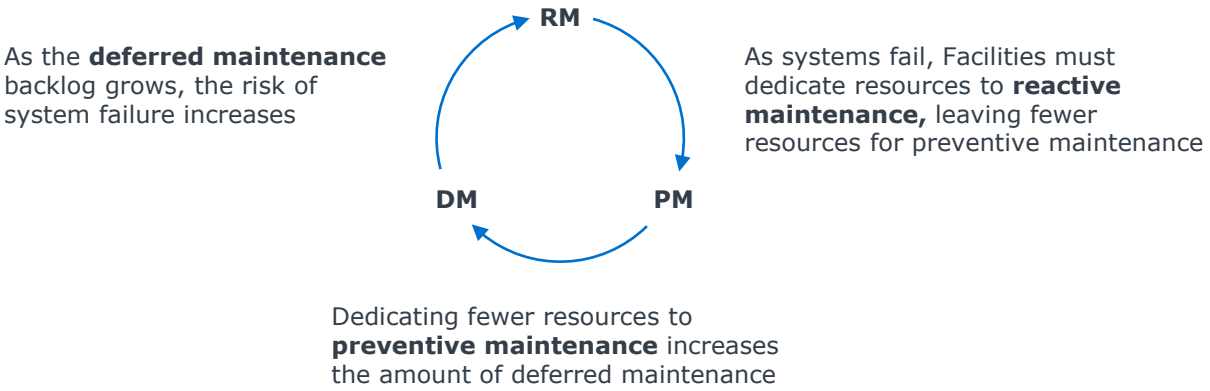
Source: Facilities Forum interviews and analysis.

A Messy and Multifaceted Problem

Deferred Maintenance Language Is Misleading and Obscures Complexity

The last maintenance challenge is that Facilities leaders are facing a multifaceted maintenance problem. The graphic below illustrates the interdependence between deferred, reactive, and preventive maintenance (PM). A growing deferred maintenance backlog results in an increased risk of system failure. As systems begin to fail, Facilities must divert resources to reactive maintenance activities. However, this leaves fewer resources for preventive maintenance, ultimately increasing the deferred maintenance backlog.

Relationship Between Deferred, Reactive, and Preventive Maintenance



Given this interdependence, Facilities leaders must adopt a two-pronged strategy to address these maintenance challenges on multiple fronts. The first strategy is to adopt a methodical approach to smartly chip away at the deferred maintenance backlog over time. For executive lessons on reducing deferred maintenance, please download our publication *Addressing Increasingly Complex Deferred Maintenance Decisions,* available on eab.com.

The second strategy is to develop a strong preventive maintenance program by eliminating common timesinks and reprioritizing critical preventive maintenance tasks. The remainder of this publication details best practices on transitioning from reactive to preventive maintenance.

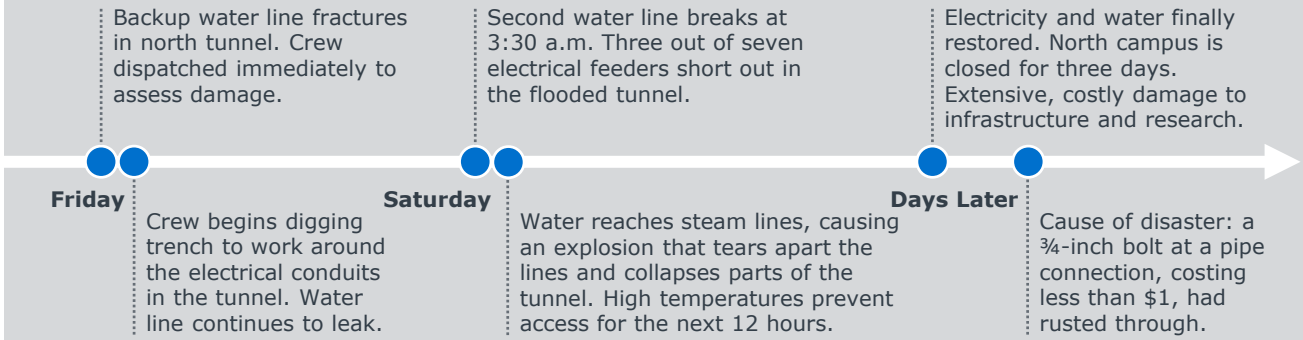
Source: Facilities Forum interviews and analysis.

The Best Offense Is a Good Defense

Preventive Maintenance Almost Always a High-Return Investment

Even small maintenance problems can dramatically impact faculty, staff, and students—and may require millions of dollars to address. University of New Mexico (UNM) has experienced the far-reaching impact of maintenance failures firsthand. Years ago, UNM noticed a small crack in a backup water line due to a rusty ¾-inch bolt. As Facilities began addressing the leak, a second line burst and shorted out three electrical feeders. The water continued to spread and reached nearby steam lines, causing an explosion and collapsing a tunnel. Work halted for 12 hours due to high temperatures, and the entire north campus was closed for three days.

University of New Mexico: For Want of a $1 Bolt



Return on Investment of Maintaining Assets

$1 to $2.73 Estimated relationship between investment in preventive maintenance and avoided future reactive maintenance costs

When the leak and its ripple effects were fully resolved, the university had spent over $100,000 on the repair itself, not counting labor hours or lost productivity. All told, UNM estimates it lost over a million dollars in productive time for faculty and staff. And while UNM suffered an unexpectedly large failure from a small leak, campuses are increasingly facing similar risks when they are forced to deprioritize routine tasks and renewal projects. In fact, data from Sightlines shows that every $1 invested in preventive maintenance saves nearly $3 in future reactive maintenance costs. Other research illustrates that:

- The lifespan of a chiller is 25% longer with regular preventive maintenance than without it.
- A 50% reduction in preventive maintenance increases the total cost of ownership by 32.4%.

Source: CBRE|Whitestone, " The Impact of Underfunding Preventative Maintenance on Total Cost of Ownership ," November 8, 2016, http://f.tlcollect.com/fr2/216/48935/Whitestone_Impact_V12_Internal.pdf; Sightlines, "The State of Facilities in Higher Education: An In-Depth Look at the 2015 Trends and Best Practices," http://www.sightlines.com/insight/2015-state-of-facilities-in-higher-education-webinar/; Schooldude, "A Process to Help Future-Proof Your Facilities," March 31, 2017, https://www.schooldude.com/community/discover/blogs/a-process-to-help-future-proof-your-facilities; Rose R, Charting a New Course for Campus Renewal, Alexandria, VA: APPA, 1999; University of New Mexico, Albuquerque, NM; Facilities Forum interviews and analysis.

Easier Said Than Done

Common Obstacles Hindering Efforts to Increase Preventive Maintenance

Institutions struggle to move away from a reactive maintenance focus for three main reasons. First, tighter Facilities budgets require many institutions to reduce preventive maintenance. As a result, campuses are forced into a reactive mode where Facilities must dedicate limited resources to responding to emergencies and equipment failures rather than preventing them. Finally, even when leaders want to expand their preventive maintenance programs, they struggle to pinpoint where to invest limited resources first.

PM typically **the first activity cut** when Facilities budget tightens

Facilities then **forced into a reactive maintenance** mode

Leaders **unsure where to start** in building out a more robust PM program

Source: Facilities Forum interviews and analysis.

Executive Framework

To build a more robust preventive maintenance program, this publication recommends a four-part strategy. The first section provides strategies for increasing preventive maintenance capacity by improving efficiency and eliminating timesinks. The second section provides guidance on building a better preventive maintenance schedule that prioritizes the most important tasks. The third section details how to leverage the staffing model to lock in the amount of PM that takes place. The final section details qualitative and quantitative strategies to engage staff in the transition to a PM-focused culture.

The framework below presents a four-part strategy and 11 best practices to build a more robust PM program.

1

Create Greater PM Capacity by Eliminating Common Timesinks

Practice 1
Point-of-Service Information Hubs

Practice 2
Automated Inventory Procurement

Practice 3
Process Improvement Toolkit

2

Better Prioritize Scheduled Activities to Optimize Maintenance Efforts

Practice 4
Strategy-Based Maintenance Standards

Practice 5
Data-Driven Preventive Maintenance Scheduling

Practice 6
Preventive Maintenance Czar

3

Align Staffing Plan to Preventive Maintenance Goals

Practice 7
Dedicated Preventive Maintenance Staffing

Practice 8
Maintenance SWAT Teams

Practice 9
Resident Facility Assistants

4

Build a Culture of Stewardship

Practice 10
Behavior-Reinforcing Metrics

Practice 11
Mission-Focused Town Halls

Source: Facilities Forum interviews and analysis.

Create Greater PM Capacity by Eliminating Common Timesinks

SECTION 1

- Practice 1: Point-of-Service Information Hubs
- Practice 2: Automated Inventory Procurement
- Practice 3: Process Improvement Toolkit

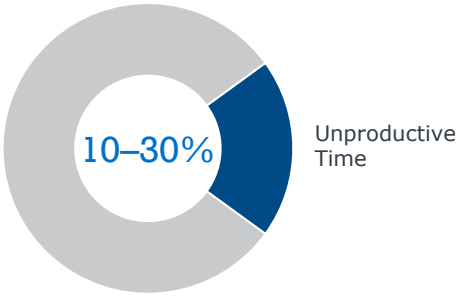
Maintenance 'Timesinks' Cut into Wrench Time

The first step toward becoming a less reactive shop is to create capacity for staff to do more preventive maintenance. For most institutions, the current approach to scheduling and completing work leaves significant room for improvement. The schedule below illustrates this opportunity.

Representative Schedule for Technician

Time	Activity
7:00 a.m.	Arrives at work and gathers day's work orders
7:30 a.m.	Heads to first work site
8:30 a.m.	Interrupted by dean's assistant to swap lightbulb
8:45 a.m.	Proceeds back to work site
9:15 a.m.	Runs to supply room to gather necessary parts
10:00 a.m.	Travels back to shop for break
10:15 a.m.	Heads to second work site
10:45 a.m.	Hunts down manufacturer's manual for reference
11:30 a.m.	Returns to shop for lunch break
12:30 p.m.	Gathers supplies for afternoon work
12:45 p.m.	Returns to main supply room to grab more tools
1:00 p.m.	Reassigned to check emergency call nearby
2:00 p.m.	Heads back to work site
2:15 p.m.	Returns to shop to check CMMS and work history

Breakdown of Productive vs. Unproductive Time



From the moment a technician begins the work day, timesinks (i.e., non-essential tasks such as changing lightbulbs, hunting down supplies, and looking up manufacturer's guidelines) pull him or her away from more valuable wrench time. In fact, Facilities leaders estimate that maintenance staff spend up to 30% of their time on common timesinks. Though no role can achieve 100% efficiency, eliminating as much unproductive time as possible enables technicians to focus on the activities with the highest return on investment. Recapturing even a small portion of that 30% of unproductive time can drive a dramatic uptick in preventive maintenance.

Source: Facilities Forum interviews and analysis.

Two Main Inefficiencies in Higher Education

The majority of timesinks fall into two main categories. The first inefficiency is getting the information needed to complete a preventive maintenance task. As a result, staff leave their work sites to hunt down information from reference manuals, work order history, and even maps to pinpoint where a piece of equipment is located.

Accessibility of Information

Technicians spend time hunting down necessary equipment manuals, work order history, and maps and floorplans before completing work order

Practice 1: Point-of-Service Information Hubs

Accessibility of Tools and Materials

Technicians dedicate time traveling to and from the supply room, even traveling off campus to purchase necessary supplies

Practice 2: Automated Inventory Procurement

The second inefficiency is gathering the necessary tools and materials required to complete a task. Maintenance staff must pause work to hunt down supplies, visit the supply room, or place material delivery orders. The first two practices in this section address these inefficiencies.

Source: Facilities Forum interviews and analysis.

Practice 1: Point-of-Service Information Hubs

Practice in Brief

Institutions speed time to information by providing staff with decentralized computer terminals and mobile devices.

Rationale

While Facilities departments possess extensive information about work order history and equipment condition, it is often captured on paper or in centralized databases. Though valuable, this information is often inaccessible to maintenance staff in the field, and hunting down this information cuts into completing actual work. By providing staff with real-time access in the field, institutions speed time to information, thereby freeing maintenance staff to dedicate more time to scheduled work.

Implementation Components

Component 1: Mark assets with unique identification tags

Institutions assign each asset a unique identification number—typically through a tag or barcode system—to establish a complete asset inventory and create easy-to-access information points.

Component 2: Establish decentralized information hubs

Institutions distribute mobile devices to staff or install computer terminals in the field to allow workers to access information from work sites.

Practice Assessment

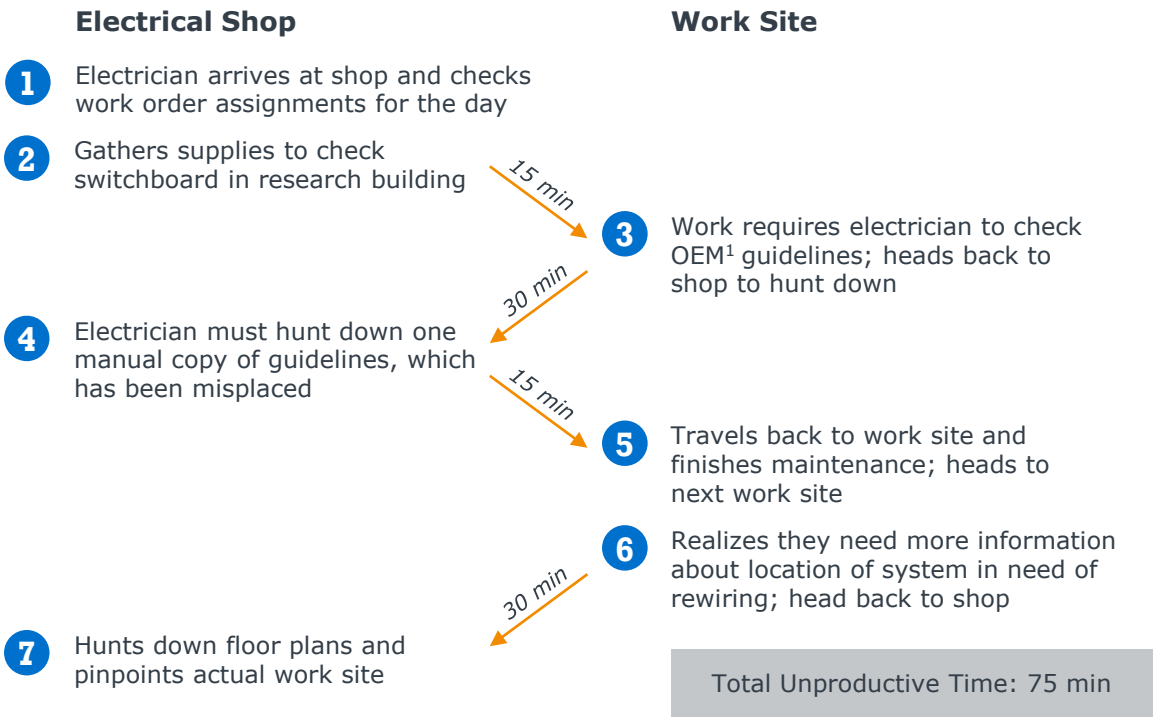
The technical implementation of this practice requires institutions to obtain a complete asset inventory. However, this inventory has advantages beyond establishing information hubs. For example, it is also a critical component to building a better preventive maintenance schedule by allowing Facilities to accurately track the service history and frequency of individual pieces of equipment. Therefore, institutions should complete an asset inventory even if their solution for decentralizing information is less technically complex.

Source: Facilities Forum interviews and analysis.

These Boots Were Made for Walkin'

Staff Waste Valuable Time Hunting Down Information

The first major inefficiency that leads to maintenance timesinks and reduces preventive maintenance wrench time is the need for maintenance staff to hunt down information to complete their assigned work. The example schedule below shows how one electrician spends time walking between the shop and work site to gather necessary information. In hunting down work order history, equipment manuals, and asset maps, the electrician spends 75 minutes across a single day in transit rather than completing his or her work.



To speed time to information and increase staff productive time, some institutions have adopted strategies to make information available in the field.

1) Original equipment manufacturer.

Source: Facilities Forum interviews and analysis.

Power (and Information) to the People

Brown University Increases Field Accessibility of Equipment Data

Component 1: Mark assets with unique identification tags

The first component is to mark assets with unique identification tags. Brown University began investing in asset identification in 2013, when Facilities started barcoding their assets with easy-to-spot yellow tags. This initiative has two benefits. First, it gives Brown a complete and detailed inventory of their assets, including type, number, and location of each piece of equipment. Second, the barcodes allow technicians to access information about the asset while in the field using their mobile devices.

Equipping Staff with Mobile Devices for On-Demand Access

- Brown began equipping field technicians with iPads in 2015
- iPads equipped with CMMS; techs can scan barcodes and access work orders, maps, and manuals in the field
- 116 iPads in circulation, one per tradesperson

Digitizing Equipment Manuals and Maps for Mobile Accessibility

- First, Brown deployed hard copies of color-coded zone maps and other manuals
- In 2015, began digitizing information for faster mobile accessibility
- Effort generated savings of 1,000 labor hours

Barcoding Assets to Create Complete Inventory and Establish Information Access Points

- In 2013, Brown partnered with external vendor to inventory and barcode equipment; 100% of equipment is now inventoried
- Inventory effort costs on average 15.8 cents per net usable square foot,[1] including labor hours, photo records, and PM parts lists

BROWN

48%
Percentage of total work orders categorized as PM

30%
Reduction in work orders categorized as reactive

4,800
Total labor hours captured through inventory effort

In 2015, Brown augmented their barcoding effort by providing each staff member with an iPad. They also decentralized manuals and color-coded maps, starting with hard copies in the field before transitioning them to a digital format for iPad accessibility.

Brown estimates that the barcoding effort, which concluded at the end of 2016, cost about 16 cents per assignable square foot. The one-time investment yielded impressive savings, including nearly 5,000 labor hours saved (which translate to $2 million in labor savings for Brown). Overall, Brown has seen a 30% reduction in reactive work orders.

1) Defined as the "sum of all areas on all floors of a building either assigned to, or available for assignment to, an occupant or specific use, or necessary for the general operation of a building" (FICM definition).

Source: Brown University, Providence, RI; Facilities Forum interviews and analysis.

Two Access Points at the University of Arkansas

Component 2: Establish decentralized information hubs

The second component is to establish decentralized information hubs. Like Brown, the University of Arkansas equips staffs with iPads. Furthermore, Arkansas supplements these mobile devices with decentralized, zone-based computer terminals. This two-tiered approach allows staff to track and close work orders from their mobile devices, while using the computer terminals to access more information-heavy and interactive data such as building information and work order history.

UNIVERSITY OF ARKANSAS	Zone-Based Computer Terminals	Mobile Devices
Purpose	Used at beginning and end of shift to access work order information and order materials	Used throughout day to access CMMS, check supply levels and avoid unnecessary supply runs, and quickly fill out timesheets
Penetration	Two terminals per zone[1]; one for supervisor, one for technicians	One iPod Touch and one iPad per zone
Considerations	• Some tasks, such as reporting, viewing building information, and accessing equipment maintenance history, are more efficiently completed from computer • Cheaper to implement but only accessible from one spot	• Mobile devices and tablets more portable and save time with manual tasks like time tracking and checking work order assignments • Both phones and tablets have upfront costs; phones require mobile plan, incurring additional monthly cost

1) The University of Arkansas is divided into five zones.

Source: University of Arkansas, Fayetteville, AR; Facilities Forum interviews and analysis.

Practice 2: Automated Inventory Procurement

Practice in Brief

Institutions automate the collection and distribution of maintenance tools and materials to eliminate the need for staff to gather materials.

Rationale

For most institutions, collecting and delivering supplies from the supply room to work sites is a time-consuming process. Even institutions that schedule work in advance face delays when maintenance staff search for their own supplies or pause work while waiting for materials to arrive. As a result, shop managers are often forced to dedicate more time to administrative tasks like tracking and ordering supplies. Automating the procurement and distribution of supplies ensures maintenance staff have the necessary tools and materials when and where they need them, without extra time on their part.

Implementation Opportunities

Opportunity 1: Streamline procurement process to ensure faster delivery of common supplies

Institutions use e-procurement platforms and 24-hour turnaround delivery time frames to establish efficient relationships with suppliers for common materials. The goal is to minimize the need for staff and supervisors to order and pick up supplies themselves.

Opportunity 2: Distribute materials directly to work sites

Institutions implement processes to deliver materials to work sites, unburdening staff from the responsibility of gathering supplies.

Practice Assessment

While this practice is recommended for all institutions, familiarity and comfort with technology will determine specific implementation details. Lower tech options are faster and cheaper to implement but require administrative time to properly manage. More complex solutions have a higher upfront cost; however, they yield additional benefits such as reduced administrative burden, additional time saved, and lower risk of unexpected supply shortages.

Source: Facilities Forum interviews and analysis.

Supply Chain Breakdowns Impede Efficiency

The second major inefficiency that reduces wrench time is gathering tools and supplies. This inefficiency manifests in two ways. The first is procurement: maintenance staff do not have the materials they need when they need them. This forces staff to spend time collecting materials, ordering new parts, or at the extreme, traveling off campus to buy them. The second problem is distribution: maintenance staff do not have the materials they need where they need them. When materials are dispersed haphazardly across campus, Facilities workers must leave work sites to search for what they need, often in multiple locations.

Source of Inefficiencies

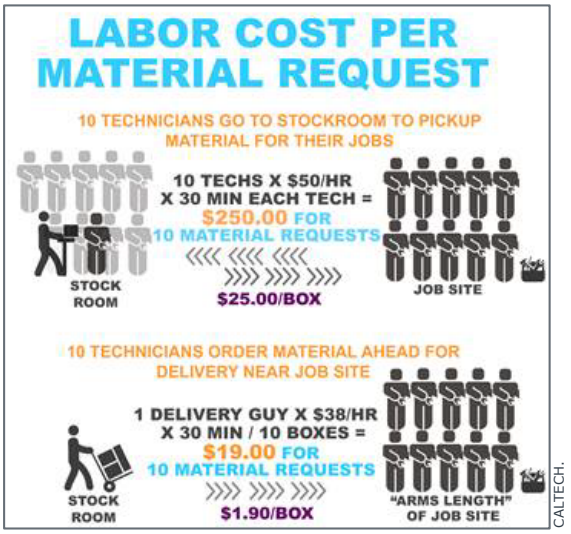
Procurement

Lack of comprehensive procurement practices, prompting both technicians and supervisors to spend time hunting down, ordering, and even traveling to pick up necessary tools and materials

Distribution

Inefficient distribution of tools and materials, causing staff to spend unnecessary wrench time traveling to and from the central shop or supply locker and work site

Pinpointing the High Cost of Inefficient Supply Distribution at Caltech



Caltech estimates that ordering and obtaining materials takes up as much as **27%** of work hours for tradespeople

The California Institute of Technology measured the cost of this inefficiency and found that when technicians gather their own supplies, it costs about $25 per box. By comparison, a single person could deliver those same materials to a work site for less than $2 per box. Further, Caltech estimated that their technicians spent 27% of their day ordering and obtaining materials. The following pages provide solutions that institutions have implemented to address both procurement and distribution problems.

Source: California Institute of Technology, Pasadena, CA; Facilities Forum interviews and analysis.

Eliminate Supply Runs to Town

Wheaton College Contracts with On-Demand Suppliers to Minimize Errands

Opportunity 1: Streamline procurement process to ensure faster delivery of common supplies

The first opportunity is to streamline the procurement and delivery of common supplies. Wheaton College in Illinois found their highly skilled tradespeople were too often driving into the nearby town to purchase materials and equipment. These trips, which could last an hour or more, were an ineffective and expensive use of highly-skilled staff time.

An Overabundance of Town Runs

- Highly skilled tradespeople often running into town to secure necessary supplies, losing at least an hour per trip
- Shop foreman also spending too much time dealing with administrative work and ordering supplies rather than supervising work
- Facilities leader recognizes that one-off town runs consuming too many labor hours

Implementation of E-Procurement System

Wheaton College®
For Christ and His Kingdom

- Implemented Unimarket e-procurement system in 2015
- New system allows Wheaton to generate approved purchase orders quicker than before
- Manages Wheaton's relationship with 200 suppliers
- Software enabled Wheaton to reduce Purchasing headcount by one and increase on-contract spend

24-Hour Turnaround Time with Local Suppliers

- Wheaton has next-day/24-hour turnaround time arranged with five suppliers
- Approved purchase orders automatically sent to local vendors providing electrical, HVAC, plumbing, and carpentry supplies
- **Results:** 400 avoided town trips per year, or $16,000 in compensation savings

To resolve this issue, Wheaton implemented a two-step procurement strategy. First, Facilities leaders transitioned the campus to an e-procurement system. Their new vendor, Unimarket, allows Facilities to track materials, submit faster purchase orders, and more easily manage their relationships with 200 suppliers. Though the E-procurement system does involve upfront and ongoing costs, Wheaton has seen a return through a steady increase of on-contract spend and downsizing procurement staff through voluntary attrition. Second, Wheaton also established defined relationships with five local suppliers to provide parts within a 24-hour window. This new turnaround time allowed Wheaton to eliminate 400 annual town runs, which they equate to $16,000 in labor costs.

Source: Wheaton College, Wheaton, IL; Facilities Forum interviews and analysis.

Lower-Tech Maintenance Supply Strategies

Opportunity 2: Distribute materials directly to work sites

The second opportunity is to distribute materials directly to work sites. The University of Oklahoma and East Carolina University each implemented low-tech solutions for distributing resources. The University of Oklahoma realized that insufficient information about customer-requested work resulted in multiple trips for maintenance staff. Previously, staff checked work sites before returning to the central shop and gathering the necessary materials.

The University of Oklahoma

Developing Standardized Supply Checklists for Most Common Calls

Problem: No standardization in describing most common service calls; often requires multiple visits to gather necessary supplies

Solution:

1. Develop and standardize work codes for most common calls
2. Use CMMS to track most-used materials for service calls
3. Generate supply lists for common service calls to increase their ability to address work upon the first visit

East Carolina University

Instituting Monthly Truck Stock Supply Lists

Problem: Maintenance staff spending valuable wrench time driving around to locate necessary supplies

Solution:

1. Develop starting list of supplies to address most common PM work orders
2. Customize list to meet monthly supply needs of specific shops (including electrical, plumbing, roofing, locksmith, paint, masonry, steam, and carpentry)
3. Equip each truck with designated number and type of supplies
4. Maintenance staff track supply use and work with department administrators and purchasing agent to regularly reorder supplies

Now, Oklahoma is implementing standardized service call language that maps the requests to common types of service calls. They are complementing this with standard supply lists so technicians know what to bring to the site. This allows Oklahoma's technicians to complete 80% of service calls on their first visit.

East Carolina University tackles their distribution concerns similarly, but over a longer time frame. For each shop, Facilities developed a standardized list of supplies a technician may need across an entire month. They then stock trucks with those materials, which each technician takes to his or her worksite. Staff track supply consumption so that the purchasing unit knows what particular pieces to reorder during monthly restocks. While this approach is slightly more complex, it allows Facilities to account for almost every supply and tool a technician regularly needs. More information on East Carolina University's program can be found on page 30.

Source: East Carolina University, Greenville, NC; University of Oklahoma, Norman, OK; Facilities Forum interviews and analysis.

From Schedule to Supply Locker

University of Arkansas Automates Procurement and Distribution of Materials

While the distribution solutions at the University of Oklahoma and Eastern Carolina University are technology-neutral, the University of Arkansas uses its computerized maintenance management system (CMMS) to automate material distribution on a two-week cycle. In the first week, their CMMS generates a supply list for the following week's preventive maintenance schedule. The list then goes to their central supply unit, which gathers and delivers the materials to zone-based maintenance lockers. In the second week, technicians pick up their materials in the zone locker that corresponds to the job's location and complete their work. To simplify an otherwise complex process, Arkansas automates the scheduling, ordering, and delivery of preventive maintenance supplies.

Automated Material Distribution Process

UNIVERSITY OF ARKANSAS

Week 1

1. CMMS generates following week's preventive maintenance schedule
2. CMMS sends notice to Central Supply with pending work orders, including tools and materials required
3. Central Supply gathers materials and delivers them to a zone-based locker

Week 2

4. Preventive maintenance staff in the zones receive work orders for the week
5. Staff gather the necessary materials from the zone-based locker
6. Staff execute the work order and track completion using their mobile device

Source: University of Arkansas, Fayetteville, AR; Facilities Forum interviews and analysis.

Efficiency Efforts Pay Off at Arkansas

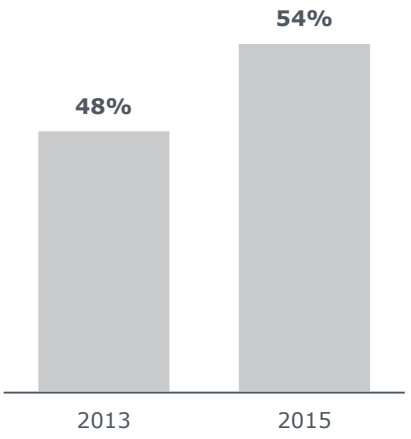
The University of Arkansas's automated procurement and distribution strategy has resulted in significant savings. Their automated procurement process (combined with the introduction of zone computer terminals and mobile devices) increased staff wrench time by 20% from 2014 to 2016. Arkansas's preventive maintenance to reactive maintenance (PM/RM) balance has shifted as well, with 54% of their work orders now preventive.

UNIVERSITY OF ARKANSAS

20%

Increase in wrench time since introduction of tablets and automated procurement

Increase in Preventive Maintenance in PM/RM Ratio at University of Arkansas



Source: University of Arkansas, Fayetteville, AR; Facilities Forum interviews and analysis.

East Carolina University's Truck Stock Program Description

East Carolina University

FACILITIES SERVICES STANDARD PRACTICE

TITLE: **Truck Stock**

INSTRUCITON NUMBER: **31-0007**

I. GENERAL

In order to work productively, craftsmen must have needed parts and materials on hand. To that end, Facilities Maintenance, Main Campus installation and repair vehicles are stocked with a fixed stock called "Truck Stock" which is a combination of "Consumables" and "Chargeable Items".

II. DEFINITIONS

A. CONSUMABLES consist of those items that are not charged to individual work orders. They are frequently used maintenance supplies and materials which generally meet at least two of the following criteria:
    1. Commonly needed in the field in small quantities for routine job performance.
    2. Nominal unit value generally under about $0.50 per item/quantity used on a job.
    3. Issued in bulk (i.e., box, roll, pound, etc.) but used in fractions of a unit of issue.

B. CHARGEABLE ITEMS are those items that are authorized as truck stock items but which must be individually accounted for as they are used by charging them against the applicable work order. They are commonly used but of more value than consumables.

C. TRUCK STOCK consists of CONSUMABLES and CHARGEABLE ITEMS.

III. RESPONSIBILITIES

A. Department managers will authorize the stock to be maintained on each truck.

B. Craftsmen will document use of truck stock and will see that stocks are maintained.

C. Departmental staff will prepare Central Warehouse orders from work orders and/or stock reorder lists.

D. The Central Warehouse will stock truck stock and fill replacement orders in a timely manner.

E. The Facilities Services Purchasing Agent in Utilities Services (FS Purchasing Agent) will administer this program.

IV. PROCEDURE

A. General
    1. A list of the stock to be maintained on a truck will be kept on each truck. It will specify the quantity to be maintained and indicate whether the item is chargeable.
    2. Certain items fit the criteria of being truck stock (routinely used, needed quickly) but are not easily kept on a truck (e.g. too bulky to always be on a truck). These items will be kept in the shop stock or Facilities Services Warehouse stock and controlled in accordance with these procedures.
    3. Items should be stocked in quantities adequate to not run out during the time it takes to process a reorder. Rule of thumb would be minimum of a week's supply.

Source: "Facilities Services Standard Practice Manuals," East Carolina University, http://www.ecu.edu/cs-admin/campus_operations/fsspkeyword.cfm.

East Carolina University's Truck Stock Program Description

4. The FS Purchasing Agent will keep the master list. Changes must be authorized by the department manager and will be made by the FS Purchasing Agent.
5. The list of stock kept on each truck is maintained in an Access database. The "Print Truck Contents" button from the database's main menu allows the user to access stock lists for each truck.

B. Chargeable Items
1. Chargeable truck stock will be charged to the work order on which it is used.
2. Craftsmen will document use of chargeable items used from truck stock by inserting the appropriate bar code listing on each work order but not for surplus material/equipment.
3. Items ordered from the Central Warehouse (not used from truck stock) to complete a specific job will be charged to the work order on the Central Warehouse ticket. Do not list these items on the work order.
4. Departmental staff will tabulate the chargeable items used. This will:
    a. charge the items to the work order and
    b. generate a replacement order to the Central Warehouse

C. Consumables
1. Consumable truck stock will be charged to the truck's account. Where an auxiliary supports a truck, the account will be the auxiliary's, otherwise it will be the shop's account.
2. Consumables will be used as needed in the performance of jobs and will be routinely replaced as on-hand quantities are depleted.
3. Individual consumable items (i.e., 3 wire nuts, two feet of tubing, etc.) will not be charged to work orders.
4. If extraordinary quantities (Rule of thumb—more than half the amount in a box, roll, etc.) of consumables are required for specific jobs, the consumables will be obtained from the Central Warehouse. The Central Warehouse ticket will reference the work order. So, these items should not be listed on the work order itself or the stock reorder list.

D. Restocking
1. The Central Warehouse will maintain supplies of all items authorized as stock to assure that these frequently used items can be readily re-supplied as they are used in the field. Once suitable demand experience is established, stock levels at the Central Warehouse will be adjusted periodically (according to demand and order/ship time experience) to assure that all requests for consumables replenishment are satisfied from stock on hand.
2. On a regular basis departments will place orders to the Central Warehouse to restock trucks. The order will properly identify the trucks and appropriate account numbers.
3. Items stocked in bulk (i.e. box, roll, bag, etc.) should be reordered before the entire supply is used up. Replacement stock will be ordered in bulk.
4. Replenishment requests may not exceed the approved quantity to be stocked on the truck.
5. The Central Warehouse will deliver the stock to the departments with the items for each truck packaged separately.

Source: "Facilities Services Standard Practice Manuals," East Carolina University, http://www.ecu.edu/cs-admin/campus_operations/fsspkeyword.cfm.

East Carolina University's Truck Stock Program Description

E. Auditing
   1. Quarterly, the stock on each vehicle will be counted. The quantities will be documented on count sheets.
   2. Each department will determine the shortages and restock the trucks to the authorized levels. A report including the count sheets, PM work order number, date completed, employee's signature, and an itemization of the shortages will be provided to FS Purchasing Agent. The FS Purchasing Agent will analyze the reports and prepare a summary with significant discrepancies identified for the Executive Director and the Assistant Director, Utilities Services.
   3. Items stocked by the box, roll, etc. should be considered accounted for if at least a partial package is present. The exact quantity does not have to be counted.
   4. The stock will be subject to random audits by Facilities Administration.

Source: "Facilities Services Standard Practice Manuals," East Carolina University, http://www.ecu.edu/cs-admin/campus_operations/fsspkeyword.cfm.

East Carolina University's Electrical Shop
Truck Stock Supply List

Description	Stock No	Quantity	Chargeable
Blank Plate 1/2 Hole, 4 Sq.	640-46880	4	☑
Blank Plate Stainless, Single Gang	640-46960	4	☑
Blank, W.P. Cover/Bell Box	640-47152	4	☑
Box Comb. KO, 4 Oct.	640-40470	2	☑
BX Connector w/ Blushing, 1/2	642-41242	10	☐
DUST OFF 10 OZ. CAN, #994053	485-13440	1	☐
EMT Connector Compression, 1/2	640-41420	5	☐
EMT Connector Compression, 3/4	640-41430	5	☐
EMT Coupling Compression, 1/2	640-41750	5	☐
EMT Coupling Compression, 3/4	640-41760	5	☐
EMT One Hole Strap, 1/2, roll	640-40980	10	☐
EMT One Hole Strap, 3/4, roll	640-41000	10	☐
KO Blank, 1	640-42620	10	☐
KO Blank, 1/2	640-42600	10	☐
KO Blank, 3/4	640-42610	10	☐
Old Work Box w/ Ear 1/2 KO	640-40592	2	☑
Photocell, Bracket for	640-46863	2	☑
Photocell, Canopy Type 120/208	640-46862	2	☑
Photocell, Nipple Type 1/2 Thread 120/208	640-46860	2	☑
Photocell, Twist Lock 120/208	640-46850	3	☑
Plug, 3 Prong, Male	640-40900	2	☑
PVC Cement Glue, Pt. size	640-49600	1	☐
PVC Connector, 1	640-49550	5	☐
PVC Connector, 3/4	640-49525	5	☐
PVC Coupling, 1	640-49530	5	☐
PVC Coupling 3/4	640-49500	5	☐
Receptacle Brown, Duplex	640-46750	10	☐
Receptacle Brown, Ground Fault	640-46790	2	☑
Receptacle Brown, Single	640-46754	4	☑
Receptacle Ivory, Duplex	642-46752	10	☑
Receptacle Ivory, Ground Fault	642-46792	2	☑
Receptacle Ivory, Single	640-46780	4	☑
Receptacle Plate Stainless, Duplex	640-46950	6	☑
Receptacle Plate Stainless, Single Gang	640-47040	4	☑
Receptacle Plate, 4 Sq. Raise Duplex	640-41880	2	☑
Receptacle Plate, 4 Sq. Raise Two Gang	640-47900	2	☑
Receptacle Plate, w/ Proof	640-47150	2	☑

Source: East Carolina University, Greenville, NC.

East Carolina University's Electrical Shop
Truck Stock Supply List

Description	Stock No	Quantity	Chargeable
Scotch 23, Rubber Tape	640-48080	3	☐
Scotch 33, Tape	640-48120	3	☐
Scotch 35, Marking Tape Blue	642-48122	1	☐
Scotch 35, Marking Tape Brown	642-48132	1	☐
Scotch 35, Marking Tape Gray	642-48136	1	☐
Scotch 35, Marking Tape Green	642-48126	1	☐
Scotch 35, Marking Tape Orange	642-48134	1	☐
Scotch 35, Marking Tape Red	642-48124	1	☐
Scotch 35, Marking Tape White	642-48128	1	☐
Scotch 35, Marking Tape Yellow	642-48130	1	☐
Splice Kit #10 & #20	640-47590	4	☑
Switch Brown, Single Pole	640-47920	10	☑
Switch Brown, Three Way	640-47940	10	☑
Switch Ivory, Single Pole	642-47922	10	☑
Switch Ivory, Three Way	642-47942	10	☑
Switch Plate Stainless, Single Gang	640-46940	6	☑
Switch Plate Stainless, Two Gang	640-47070	4	☑
Switch Plate, 4 Sq. Raise	640-41850	2	☑
Switch Plate, w/ Proof	640-47151	2	☑
Toggle Bolt 1/4 x 4, box	700-21870	1	☐
Toggle Bolt, 3/16 x 4, box	700-21850	1	☐
Tyrap 11 1/16	640-48773	1	☐
Washer, Reducing 1 x 3/4	640-48262	10	☐
Washer, Reducing 3/4 x 1/2	640-48260	10	☐
Wire #12 THHN Solid Copper Black, Roll	640-48300	1	☐
Wire #12 THHN Solid Copper Blue, Roll	640-48340	1	☐
Wire #12 THHN Solid Copper Green, Roll	640-48330	1	☐
Wire #12 THHN Solid Copper Red, Roll	640-48320	1	☐
Wire #12 THHN Solid Copper White, Roll	640-48280	1	☐
Wire Nut, Big Blue 78B, box	640-46680	1	☐
Wire nuts, blue 72B, box	640-46620	1	☐
Wire nuts, red, box	640-46660	1	☐
Wire nuts, yellow, box	640-46640	1	☐

Source: East Carolina University, Greenville, NC.

East Carolina University's Carpentry Shop Truck Stock Supply List

Description	Stock No	Quantity	Chargeable
1/4 Arrow Staples	700-29920	1	☐
3 in 1 Oil	760-26570	1	☐
Balastol Spray	760-26560	1	☐
Blades – Hacksaw	680-20510	1	☐
Blades – Utility Knife	680-25280	1	☐
Butt Hinge – 4 1/2 x 4 1/2 (Box 1 1/2 pair)	700-22160	1	☑
Caulk, latex, tube	780-70320	1	☐
Combination Head Screws, 10 x 1, box	700-29153	1	☐
Combination Head Screws, 10 x 1/2, box	700-29155	1	☐
Combination Head Screws, 10 x 2, box	700-29157	1	☐
Combination Head Screws, 12 x 1 1/4, box	700-29163	1	☐
Combination Head Screws, 12 x 1/2, box	700-29164	1	☐
Combination Head Screws, 12 x 2 1/2, box	700-29166	1	☐
Combination Head Screws, 12 x 2, box	700-29165	1	☐
Combination Head Screws, 12 x 3, box	700-29167	1	☐
Combination Head Screws, 6 x 1, box	700-29127	1	☐
Combination Head Screws, 6 x 1/2, box	700-29090	1	☐
Combination Head Screws, 6 x 3/4, box	700-29126	1	☐
Combination Head Screws, 8 x 1 1/2, box	700-29148	1	☐
Combination Head Screws, 8 x 3/4, box	700-29142	1	☐
Flat Head Phillips 10 x 1 1/2, box	700-28557	1	☐
Flat Head Phillips 10 x 1, box	700-28556	1	☐
Flat Head Phillips 10 x 2, box	700-28558	1	☐
Flat Head Phillips 12 x 1, box	700-28560	1	☐
Flat Head Phillips 12 x 2, box	700-28561	1	☐
Flat Head Phillips 12 x 3, box	700-285656	1	☐
Flat Head Phillips 6 x 1/2, box	700-28552	1	☐
Flat Head Phillips 6 x 3/4, box	700-28553	1	☐
Flat Head Phillips 8 x 1, box	700-28555	1	☐
Flat Head Phillips 8 x 3/4, box	700-28554	1	☐
Galvanized Deck Screws 1 5/8, box	700-28570	1	☐
Galvanized Deck Screws 2, box	700-28572	1	☐
Galvanized Deck Screws 3, box	700-28574	1	☐
Gloves, nitrile, box	680-24110	1	☐
Mask, Filter, box	600-26100	1	☐
Nails 10 Gal. Finish, box	Restock from Shop Stock	1	☐
Nails 3 CC, box	Restock from Shop Stock	1	☐
Nails 4 CC, box	Restock from Shop Stock	1	☐

Source: East Carolina University, Greenville, NC.

East Carolina University's Carpentry Shop Truck Stock Supply List

Description	Stock No	Quantity	Chargeable
Nails 4 CC, box	Restock from Shop Stock	1	☐
Nails 4 Galv. Finish, box	Restock from Shop Stock	1	☐
Nails 6 CC, box	Restock from Shop Stock	1	☐
Nails 6 Galv. Finish, box	Restock from Shop Stock	1	☐
Nails 8 CC, box	Restock from Shop Stock	1	☐
Nails 8 Galv. Finish, box	Restock from Shop Stock	1	☐
Plastic Anchor 10/12 Screw (1/4"), box	700-27900	1	☐
Plastic Anchor 6/8 Screw (3/16"), box	700-27870	1	☐
Rags, box	720-60440	1	☐
Screws – drywall 1 1/4", box	700-28130	1	☐
Screws – drywall 1 5/8", box	700-28132	1	☐
Screws – drywall 2", box	700-28140	1	☐
Screws – drywall 6 x 2 1/4", box	700-28144	1	☐
Screws – drywall 8 x 3", box	700-28160	1	☐
Screws – sheetmetal 8x1, box	700-29143	1	☐
Self Drilling Screws 10 x 1 1/2, box	700-29069	1	☐
Self Drilling Screws 10 x 1, box	700-29068	1	☐
Self Drilling Screws 10 x 2, box	700-29070	1	☐
Self Drilling Screws 8 x 1, box	700-29064	1	☐
Self Drilling Screws 8 x 1/2, box	700-29052	1	☐
Self Drilling Screws 8 x 3/4, box	700-29053	1	☐
Spray Kiltz – Paint White	780-71320	1	☐
WD40, can	760-26060	1	☐
Yellow Wood Glue	700-22933	1	☐

Source: East Carolina University, Greenville, NC.

East Carolina University's Roofers Shop Truck Stock Supply List

Description	Stock No	Quantity	Chargeable
Bits- Masonry 1/8"	683-20418	1	☐
Bits – Masonry 3/16"	680-20420	1	☐
Bits – Metal 1/4"	680-20310	1	☐
Bits – Metal 1/8"	680-20230	1	☐
Bits – Metal 3/6"	680-20270	1	☐
Blades – SawZall, metal	680-20515	1	☐
Blades – SawZall, wood	680-20546	1	☐
Blades – Utility Knife	680-25280	1	☐
Caulking – NP – 1 (black)	783-70340	1	☐
Caulking – NP – 1 (brown)	783-70342	1	☐
Caulking – NP – 1 (gray)	783-70344	1	☐
Fiber Cloth – 6" roll	626-19808	1	☐
Frames – 9" roller	780-70580	1	☐
Gloves – cotton. Pair	680-24190	1	☐
Gloves, nitrile, box	680-24110	1	☐
Glue – Rubber Carlisle, gallon	626-19802	1	☐
Goggles – Safety	680-24200	1	☐
Hacksaw Blade – 24 Teeth	680-25010	1	☐
Hacksaw Blade – 32 Teeth	680-20511	1	☐
Hand Cleaner w/ grit	723-61181	1	☐
Mapp gas, bottle	800-84860	1	☐
Mask, Filter, box	600-26100	1	☐
Masonry Bit 1/4	680-20430	1	☐
Nails – Button, box	Restock from Shop Stock	1	☐
Nails – Copper, box	Restock from Shop Stock	1	☐
Nails – roofing 1 1/4", box	Restock from Shop Stock	1	☐
Nails – roofing 1", box	Restock from Shop Stock	1	☐
Nails 8 CC, box	Restock from Shop Stock	1	☐
Oil – 2 cylinder	603-10485	1	☐
Oil Brushes – 4"	780-70160	1	☐
Paint Frame – 4"	783-70578	1	☐
Pin Gripper 1/4" X 3/4 " (nail drive), box	703-27993	1	☐
Pin Gripper 3/10" X 3/4 " (nail drive), box	703-27995	1	☐
Pin Gripper 3/16" X 1 " (nail drive), box	703-27997	1	☐
Plastic Anchor 10/12 Screw (1/4"), box	700-27900	1	☐
Plastic Anchor 6/8 Screw (3/16"), box	700-27870	1	☐
Plastic Bucket – 5 gallon	780-70280	1	☐
Plastic Liner	720-60822	1	☐

Source: East Carolina University, Greenville, NC.

East Carolina University's Roofers Shop Truck Stock Supply List

Description	Stock No	Quantity	Chargeable
Pop Rivets - #42 Aluminum	703-28042	1	☐
Pop Rivets - #42 Copper	703-28040	1	☐
Pop Rivets - #42 Gan	703-28044	1	☐
Primer – Rubber Carlisle, gallon	626-19806	1	☐
Rags, box	720-60440	1	☐
Roof Cement, gallon	626-19814	1	☐
Self Drilling Screws, 10 X 1, box	700-29068	1	☐
Self Drilling Screws, 10 X 3/4, box	700-29066	1	☐
Self Drilling Screws, 8 X 1, box	700-29064	1	☐
Self Drilling Screws, 8 X 1/2, box	700-29052	1	☐
Self Drilling Screws, 8 X 3/4, box	700-29053	1	☐
Solder, 50/50, roll	800-86330	1	☐
Soldering Flux, NO-Korode, 8oz.	800-85800	1	☐
Tape – peel & stick 6", roll	626-19182	1	☐
Tape, Florescent	800-86560	1	☐
Wasp Spray	720-61120	1	☐
WD40, can	720-26060	1	☐

Source: East Carolina University, Greenville, NC.

Practice 3: Process Improvement Toolkit

Practice in Brief

Institutions vet problematic processes against two specific issues that cause substantial inefficiencies beyond information and material barriers. The goal is to provide Facilities staff with a proscriptive framework to identify and fix the most likely causes of these inefficiencies, increasing the effectiveness of improvement efforts.

Rationale

Process redesign efforts stall because staff often lack the time or expertise to analyze complex process maps or identify and correct bottlenecks that may free up staff time for PM activities. Given that many inefficiencies tend to be campus-specific and difficult to generalize, this resource helps clarify confusing process maps by focusing staff on prioritizing efforts around common sources of process inefficiency.

Implementation Components

Component 1: Evaluate and rank processes to prioritize redesign efforts

Institutions identify the most important processes to target for improvement. The corresponding resource is Tool 1: Process Redesign Prioritization Matrix on page 43.

Component 2: Identify and eliminate low-value, redundant process steps

Institutions remove process steps that contribute relatively little to a desired outcome yet consume significant staff time. The goal is to shorten processing time by reducing duplicative steps and the total amount of work required. The corresponding resource is Tool 2: Audit to Identify Steps to Eliminate on page 46.

Component 3: Parallel process non-sequential steps

Institutions restructure processes to allow units to complete multiple steps simultaneously. Rather than completing all steps in rigid sequence, staff work on non-prerequisite steps parallel to prerequisite steps. The goal is to speed up the process and allow staff to more effectively manage other job responsibilities in tandem. The corresponding resource is Tool 3: Guide to Identify Tasks for Parallel Processing on page 47.

Practice Assessment

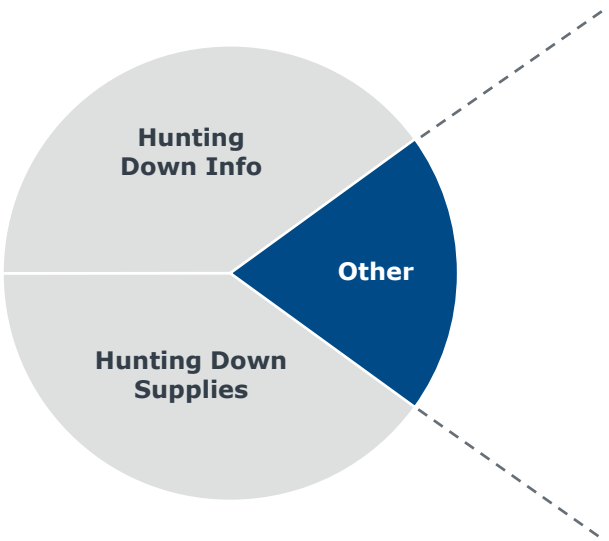
While this tool is a starting point for any process improvement effort, institutions seeking to specifically address the most common and pervasive Facilities inefficiencies—inaccessible information and time-consuming supply distribution—should first see Practices 1 and 2 for more targeted solutions.

Source: Facilities Forum interviews and analysis.

Not All Processes Created Equal

While the previous two practices explored the major timesinks for maintenance staff, the reality is that many inefficiencies are campus- and department-specific. The graphic below provides examples of inefficient practices beyond gathering information or supplies. For instance, some Facilities leaders report their current processes often result in sending two technicians to the same building for the same type of work on the same day, or technicians waiting on others to complete work.

Breakdown of Types of Maintenance Inefficiencies



Representative Maintenance Inefficiencies

- Sending multiple techs to complete similar work orders in the same building on the same day
- Completing life/safety equipment checks or other tasks too frequently
- Incomplete or inconsistent work order documentation due to unclear or nonexistent policies
- New techs lacking skills necessary to complete work orders independently
- Client confusion about who to contact for what type of issue
- Techs waiting on other techs to complete work so they can do their own
- Sending higher-skilled tech to complete low-skill work
- Lacking access to site when task is assigned

These inefficiencies tend to manifest differently on each campus and therefore present fewer standardized solutions. Addressing them requires that institutions identify the problem, determine why it occurs, and then resolve it. Process improvement is one method of tackling a variety of inefficiencies.

Source: Facilities Forum interviews and analysis.

Got DOWNTIME?

Framework for Evaluating Inefficiencies in Maintenance Tasks

Process improvement has become an entire cottage industry, with terms such as Kaizen, Six Sigma, and Lean becoming more familiar in professional conversation. Some Facilities leaders have made extensive process improvement investments by hiring outside consultants to conduct efficiency studies. While their output has value, it can be exhausting and expensive to find campus-specific solutions.

	Waste Category	Definition	Representative Examples
D	**Defective Production**	Mistakes that require additional inputs to fix	Recent work requires repeat visits because original tasks not completed the first time
O	**Overproduction**	Work non-responsive to inputs or future needs	Tradespeople perform tasks more frequently than required, such as replacing parts or taking readings
W	**Waiting**	Unintended stops in work	Tech prevented from initiating work immediately due to lack of access to work site when task is assigned
N	**Non-Used Employee Talent**	Underutilizing the training or capacity of workers	High-skilled workers assigned tasks that do not require their expertise or experience
T	**Transportation**	Waste caused by unnecessary movement	Staff traveling around campus to pick up necessary materials and supplies for work order
I	**Inventory**	Over-or under-abundance of materials	Excess supplies stored on campus, taking up useable space and risking obsolescence as systems are modernized or replaced
M	**Motion**	Movement that does not add value or detracts from work	Tradesperson's daily assignments sends him past upcoming work on way to other tasks or brings him back to same space on same day
E	**Excessive Processing**	Poorly designed, redundant, or repetitive processes	Maintenance staff cannot complete assignment during single visit to site, requiring multiple trips to finish

> "The average American worker has 50 interruptions a day, of which 70% have nothing to do with work."
>
> *W. Edward Deming*
> *Father of Global Quality Improvement*

> "A bad system will beat a good person every time."
>
> *W. Edward Deming*
> *Father of Global Quality Improvement*

Encouragingly, a straightforward framework exists that offers some initial insights. Facilities leaders who do not want to overinvest in process improvement can use the framework DOWNTIME, an acronym capturing eight major types of process waste. The table above provides definitions and Facilities examples for each category. Institutions can use this table to start discussions with foremen and shop supervisors about possible areas of Facilities waste and opportunities for improvement.

Source: Facilities Forum interviews and analysis.

Target the Primary Sources of Inefficiency

Institutions that wish to explore process improvement more extensively can deploy EAB's Process Improvement Toolkit to fix timesinks and increase preventive maintenance wrench time. Full page versions of these three tools start on page 43.

Three Common Problems Plaguing Facilities Departments

Hard to Know Where to Begin

Staff unsure which of many processes results in most inefficiencies

Example: Manager oversees dozens of workers and hundreds of tasks daily

Tool 1: Process Redesign Prioritization Matrix

Too Many Process Steps

Staff complete work that adds little value to the process or is duplicative to other steps

Example: Electrician forced to wait for plumber and refrigeration techs to arrive before completing assigned work order

Tool 2: Audit to Identify Steps to Eliminate

Only One Step Processed at a Time

Staff needlessly wait to begin designated portion of process work

Example: Technician waits for order of fan belts to arrive before checking if any need to be replaced

Tool 3: Guide to Identify Tasks for Parallel Processing

Source: Facilities Forum interviews and analysis.

Tool 1: Process Redesign Prioritization Matrix

Prioritizing Processes for Improvement

This tool helps Facilities leaders determine which processes to improve by ranking them based on predetermined evaluation criteria. Although Facilities leaders can identify inefficient processes through staff and customer feedback, many institutions need a more systematic way to pinpoint the improvements that will yield the highest return on investment. This tool provides a framework to help Facilities leaders select variables most relevant to their institution and rank processes to determine process improvement investment.

Instructions

1. Catalogue all identified inefficient processes in the template (see page 45).

2. Select variables that align with Facilities goals and broader institutional priorities and enter selected variables into the template. Below is a sample list of variables to use in evaluating processes. The Facilities Forum recommends selecting no more than five variables on which to evaluate processes.

   - *Time to Fix*
     What is the expected timeline for process redesign and implementation?
   - *Compliance Risk*
     Does the process currently comply with institution, state, or federal regulations?
   - *Impact on Customers*
     What impact will redesign have on customer experience and satisfaction?
   - *Impact on Staff Efficiency*
     Does the process consume a significant amount of support staff time?
   - *Control*
     To what degree is improvement of the identified process dependent on collaboration with external units?
   - *Organizational Readiness*
     How prepared are the staff and department leaders for process changes?
   - *Expense to Continue*
     What are the expected costs of maintaining the status quo?
   - *Expense to Fix*
     What are the expected costs of process improvement?
   - *Ease of Implementation*
     How easily can Facilities administrators adjust process steps to make the process less burdensome?
   - *Strategic Alignment*
     Is redesigning the process critical for meeting larger institutional goals and/or executing on strategic initiatives?

Source: Facilities Forum interviews and analysis.

Tool 1: Process Redesign Prioritization Matrix

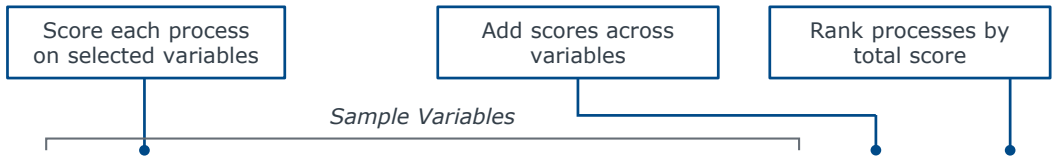
3. Evaluate each variable on a scale of one to three. A score of one should represent the least ideal scenario for process improvement, and a score of three should represent the most ideal scenario.

Variable	1	2	3
Cost of Improvement	High cost	Moderate cost	Low cost
Time to Fix	>6 months	2-6 months	<2 months
Impact on Staff Efficiency	Consumes less than 10% of staff time	Consumes 10-20% of staff time	Consumes more than 20% of staff time
Compliance Risk	Low risk of noncompliance	Moderate risk of noncompliance	High risk of noncompliance

4. Score each process on each variable, using the variable levels as a guide.

5. Sum variable scores for each process.

6. Rank the processes according to total score (highest to lowest) to determine which processes should receive redesign priority. Higher ratings indicate a process is a strong candidate for process improvement.



Process Name	Cost of Improvement	Time to Fix	Impact on Staff Efficiency	Compliance Risk	Total Score	Rank
Work order submission	1	2	2	1	6	3
Supply orders	2	2	3	1	8	1
Staff assignments	2	1	3	1	7	2

Source: Facilities Forum interviews and analysis.

Tool 1: Process Redesign Prioritization Matrix

Sample Matrix

Selected variables

Process Name						Total Score	Rank

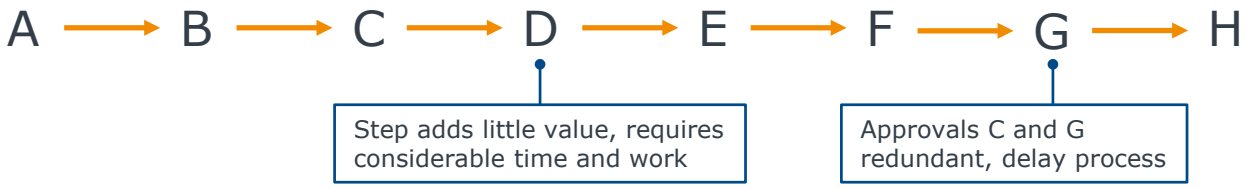
Source: Facilities Forum interviews and analysis.

Tool 2: Audit to Identify Steps to Eliminate

This tool helps Facilities leaders evaluate maintenance processes where an overabundance of steps creates bottlenecks and inefficiencies. The graphic below displays a sample process with outdated, redundant, or value-neutral steps. Eliminating these steps can free up staff time, energy, and resources.

Representative Model for Step Reduction within a Process

Sample Process Before Redesign



Sample Process After Redesign

The audit below poses a series of questions around four common processes steps to help guide elimination efforts. A "no" answer suggests a possible step for elimination.

Question	Yes	No
1. Data Recording		
Are tradespeople and technicians required to record data that is unchanged or unmodified since the last time the system was serviced?		
Are supervisors or managers required to review data on systems without a compliance risk or without a history of malfunction?		
2. Asset Management		
Do tradespeople and technicians need to input information about individual assets each time a new asset is brought online?		
Are tradespeople and technicians doing work too frequently on non-critical, no-compliance-risk systems?		
3. Communication		
Do all the people in the department and on campus need to be informed about changes or deliberations about Facilities maintenance processes?		
Is customer input solicited and vital to the completion of assigned work?		
4. Approval		
Are tradespeople or technicians required to wait for supervisor or senior-level approval for a task with no compliance risk?		
Are supervisors and managers required to obtain senior-level approval to make modifications to preventive maintenance schedules or procedures?		

Source: Facilities Forum interviews and analysis.

Tool 3: Guide to Identify Tasks for Parallel Processing

This tool helps Facilities leaders restructure processes that enables staff to complete multiple process steps simultaneously.

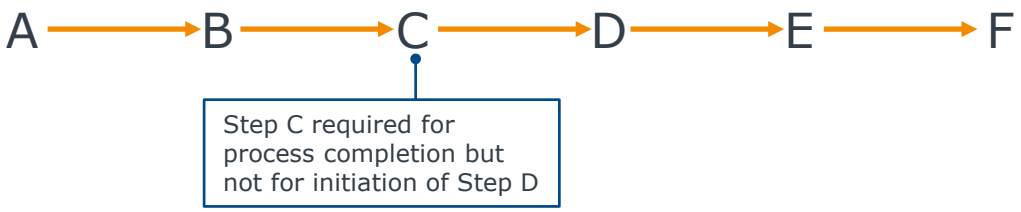
To use this tool, Facilities leaders must distinguish between two types of process steps:

- **Prerequisite steps** must be completed before the next step can begin
- **Secondary steps** do not have to be completed in order for the immediately subsequent step to begin. However, secondary steps still must be completed in order to finalize the process.

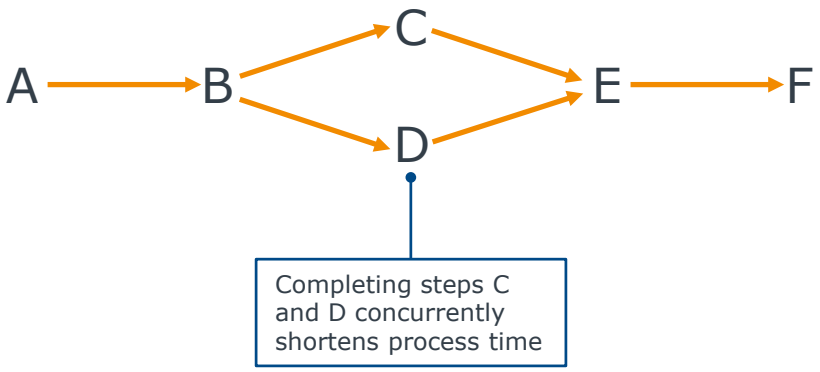
Rather than completing all steps in sequence one at a time, staff can complete secondary steps and prerequisite steps concurrently. This idea is illustrated by the graphic below. Step C is a secondary step because its completion is not necessary to initiate step D. Rather than waiting until step C is complete before beginning step D, the process can move from step B to steps C and D, completing steps C and D in parallel. Parallel processing expedites process completion and shortens the time staff must wait to initiate subsequent tasks.

Representative Model for Concurrent Processing

Sample Process Before Redesign



Sample Process After Redesign



This tool provides a guide for identifying secondary steps to perform concurrently with prerequisite process steps.

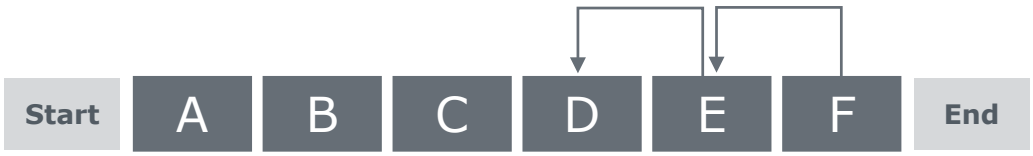
Source: Facilities Forum interviews and analysis.

Tool 3: Guide to Identify Tasks for Parallel Processing

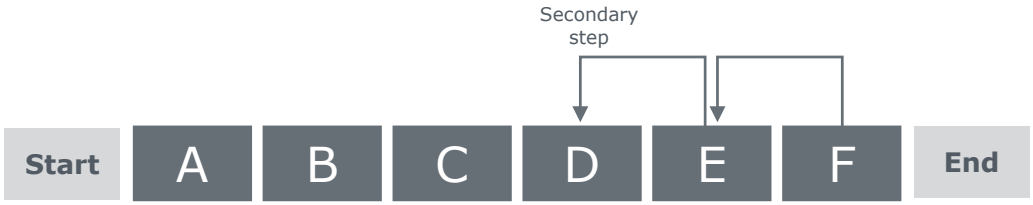
1 Identify Secondary Steps

i. Beginning with the last step in the process, identify whether each step is directly dependent on the completion of the immediately preceding step.

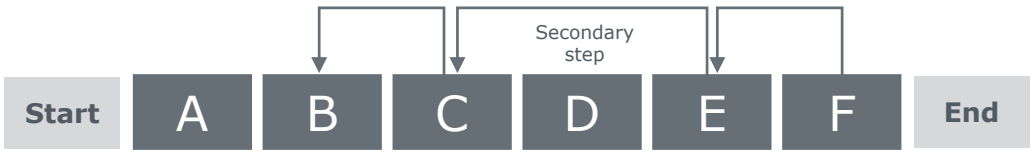
If a step is directly dependent on the step before it, the preceding step is a prerequisite task. Continue working backward until finding a step that is **not** directly dependent on completion of the preceding step.



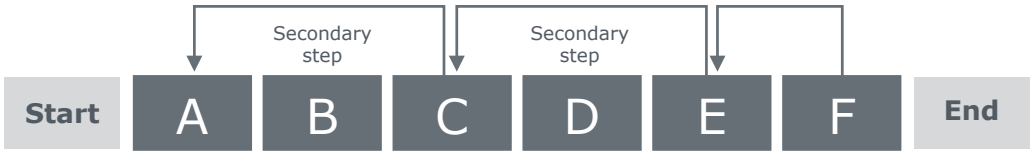
ii. If the step is not directly dependent on the preceding step's completion, the preceding step is a secondary step. Label it accordingly.



iii. Returning to the last step in the process, repeat the above exercise, asking whether each step is directly dependent on the preceding step's completion, **but skipping labeled secondary steps.** For example, in the illustration below, ask if step E is directly dependent on step C.



iv. Continue this exercise, returning to the last step each time a secondary step is identified, until reaching the first step in the process.



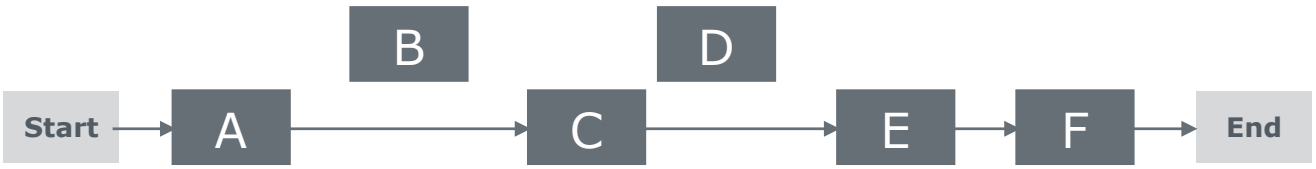
Source: Facilities Forum interviews and analysis.

Tool 3: Guide to Identify Tasks for Parallel Processing

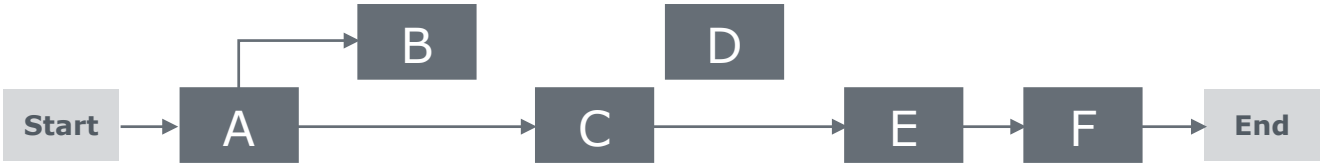
2 Determine Secondary Step Dependencies

i. Write all secondary steps identified in Section 1 above the primary process path.

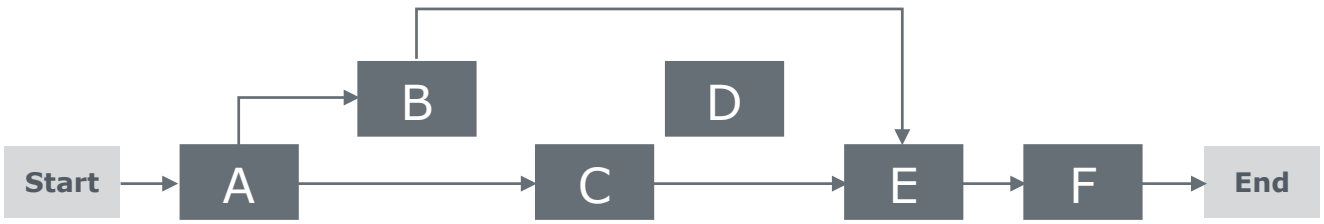
ii. Using arrows, connect all prerequisite steps remaining on the primary process path.



iii. Examining the first secondary step in the process, determine which of the preceding steps are necessary for initiation of that secondary step. Draw an arrow connecting the most immediately preceding step to the secondary step. If no preceding steps are necessary for the initiation of the secondary step, the step can commence at the start of the process. In this case, draw an arrow connecting the secondary step to the start of the process.



iv. Now determine which of the subsequent process steps are dependent upon the completion of that secondary step. Draw an arrow connecting the most immediately dependent subsequent step to the secondary step. If no steps are directly dependent on the secondary step, the step is necessary only for the completion of the process as a whole. In this case, draw an arrow connecting the secondary step to the end of the process.



v. Repeat (iii) and (iv) for each secondary step, moving from first to last.

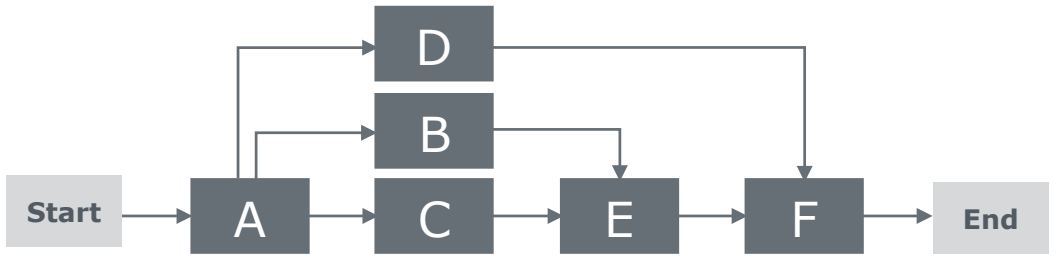
Source: Facilities Forum interviews and analysis.

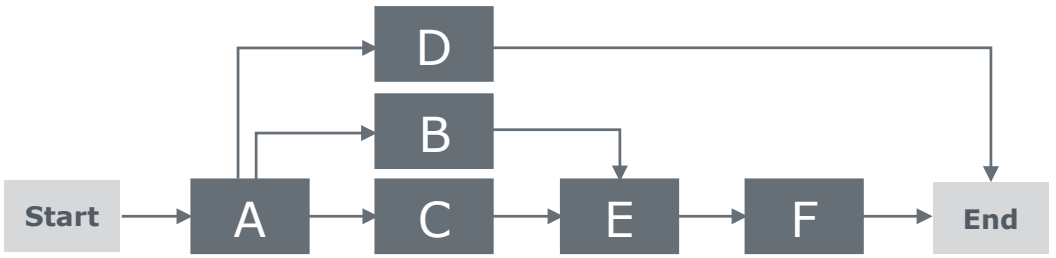
Tool 3: Guide to Identify Tasks for Parallel Processing

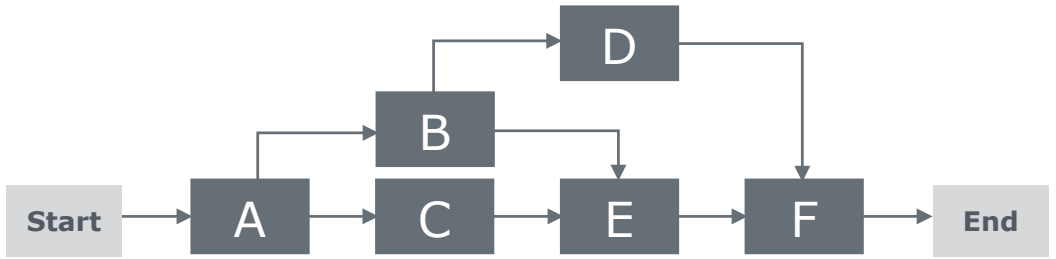
3 Position All Steps So That They Are Preceded by a Task Necessary for Its Completion

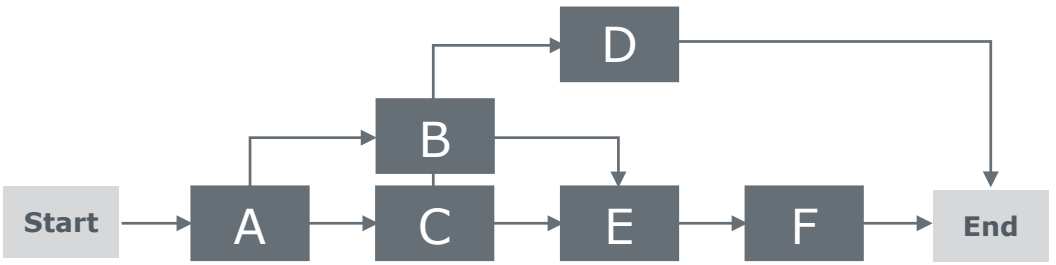
Arrange the resulting process map so secondary steps immediately follow the step necessary for its initiation, and sit directly above prerequisite steps that can be parallel processed.

Possible sequences based on this example include but are not limited to:









The update of this process is now complete. Circulate this information to impacted staff and communicate the changes to the process.

Source: Facilities Forum interviews and analysis.

Tool 3: Guide to Identify Tasks for Parallel Processing

Limitations for Rearranging and Re-sequencing Process Steps

This portion of the tool helps Facilities leaders rearrange process steps to reduce the number of handoffs among units or individuals. The collaborative nature of Facilities work necessitates interactions between many staff members. However, excessive back-and-forth causes two significant process inefficiencies. First, staff productivity is lowered because staff complete process work in small batches rather than working continuously. As a result, staff are constantly disrupted from their current tasks each time the process involves them. Second, handoffs increase the likelihood of delays, as lag times and errors can increase each time a process is passed.

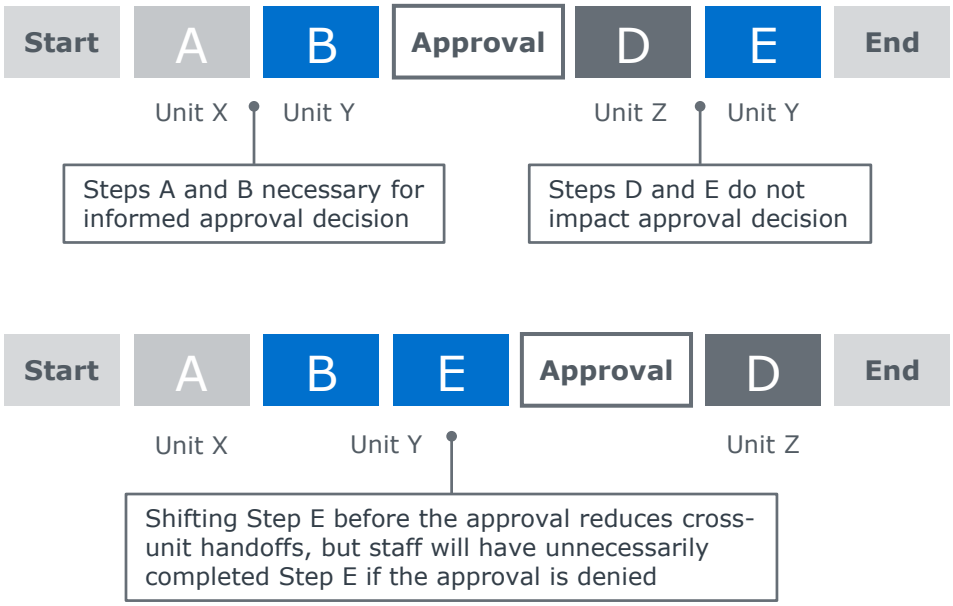
Grouping and reordering process tasks based on ownership can reduce the number of handoffs that contribute to process errors and delays. However, Facilities leaders must be cognizant of two limitations to avoid inadvertently creating new process inefficiencies:

1 Prerequisite Process Steps

Some process steps are directly dependent on others or must be completed before others can be initiated. This limits Facilities' ability to freely move these tasks within a process. To pinpoint prerequisite steps that are less flexible and secondary steps that can more easily be grouped or reordered, refer to the first portion of this tool.

2 Approvals

Approval steps in a process can limit Facilities' ability to group or reorder other steps within a process. A denied approval can result in the termination of a process prior to its completion. Front-loading tasks that are not necessary for an approval decision increases the likelihood that staff will dedicate time to a project that will not be approved. Instead, Facilities staff should use approvals as boundaries when consolidating or sequencing process tasks.



Source: Facilities Forum interviews and analysis.

Better Prioritize Scheduled Activities to Optimize Maintenance Efforts

SECTION 2

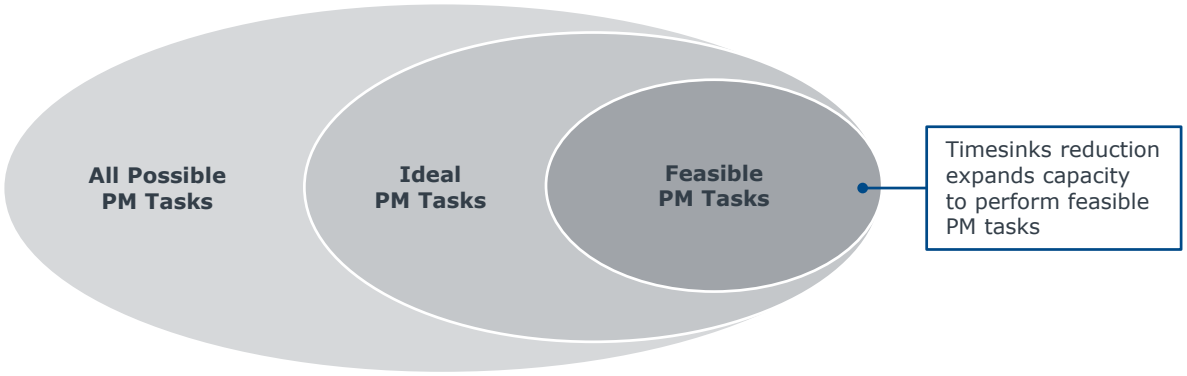
- Practice 4: Strategy-Based Maintenance Standards
- Practice 5: Data-Driven Preventive Maintenance Scheduling
- Practice 6: Preventive Maintenance Czar

Impossible to Complete All PM Activities

Institutions Must Make Tough Trade-Offs Between Ideal and Feasible Tasks

While Facilities leaders want to complete all necessary maintenance activities, the reality of shrinking budgets means they must make trade-offs. In a perfect world, Facilities would have infinite resources to complete every preventive maintenance task, represented by the largest circle below. Since this is not possible, leaders narrow their focus to an ideal subset of work, the middle circle. However, most Facilities leaders lack even the resources for all ideal tasks. Instead, Facilities leaders must focus on the innermost circle, which represents the preventive maintenance tasks staff can reasonably accomplish. This section provides three practices to better isolate, schedule, and complete the most important preventive maintenance tasks.

Representation of Possible Preventive Maintenance Activities



Source: Facilities Forum interviews and analysis.

Practice 4: Strategy-Based Maintenance Standards

Practice in Brief

Institutions establish prioritization levels for preventive maintenance tasks that better reflect the condition and strategic importance of certain equipment, systems, and buildings.

Rationale

Institutions often lack a formal system for prioritizing preventive maintenance tasks, leaving individual staff members to decide which tasks to complete. This can result in consistently inefficient decisions as time and resources are shifted away from the most critical work (such as tasks required by code or that mitigate risk to campus) and toward more urgent or customer-requested work. By establishing prioritization levels aligned to strategic priorities, institutions ensure staff complete the most essential preventive maintenance work first.

Implementation Options

Option 1: Organize standards by facility type

Institutions group buildings into portfolios and set differential task completion standards that reflect the relative strategic importance of various building types.

Option 2: Organize standards by task criticality

Institutions organize task completion standards by criticality, prioritizing certain tasks such as fume hoods and HVAC work over others based on strategic importance.

Practice Assessment

This practice is recommended for all institutions. Institutions creating their first prioritization grids should organize tasks by building types, as this approach is more straightforward to implement. As an institution's preventive maintenance program matures, the Facilities department can transition to organizing by task criticality.

Source: Facilities Forum interviews and analysis.

Many Considerations for Prioritizing PM Activities

Too Many Variables to Consider Case by Case

While institutions tend to prioritize preventive maintenance tasks based on one or two metrics, schedules built around a single variable often prioritize the wrong tasks. The graphic below captures a number of metrics institutions could use to prioritize preventive maintenance. For instance, equipment health is logical from a triage standpoint. However, since most assets are in desperate need of attention, this metric is not helpful in informing the distribution of limited resources. Manufacturer's recommendations is another principled approach to PM prioritization. But given actual utilization, manufacturer's guidelines typically recommend scheduling tasks too frequently, which can draw resources away from other important work.

Potential Factors for Prioritizing Preventive Maintenance

While using multiple factors would result in a more principled preventive maintenance schedule, a multivariable approach is almost impossible to implement because some factors are more easily quantifiable than others. The following pages provide two examples of how institutions have built their own standards to weigh factors and prioritize preventive maintenance activities.

Source: Facilities Forum interviews and analysis.

Option 1: Organize Standards by Facility Type

Brown Manages Building Portfolios to Different Maintenance Standards

The first option for developing strategy-based maintenance standards is to organize standards by facility type. Brown University groups buildings into different portfolios, listed in the final column of the table below. Buildings in each portfolio are maintained to one of four levels, which are adapted from APPA's maintenance standards and organized by strategic importance of the building. Each standard has a unique maintenance completion goal that reflects its strategic importance. For example, an academic research building is considered a "Level 1 Showpiece Facility," meaning all preventive maintenance tasks should be completed. By comparison, athletic facilities are classified as "Managed Care" facilities with a 50% to 60% target PM completion rate.

Building Portfolio Maintenance Standards at Brown University

Maintenance Level	Description	PM Goal	Building Portfolios
Level 1: Showpiece Facility	All recommended PM performed	100%	0. Central Heat Plant 1. Academic Research
Level 2: Comprehensive Stewardship	Almost all recommended PM performed	85%	2. Academic Non-Research 3. Student Life
Level 3: Managed Care	Majority of recommended PM performed	50%–60%	4. Admin/Support 5. Athletics 6. Residence Halls
Level 4: Reactive Management	Minority of recommended PM performed	<25%	7. Auxiliary Housing

Source: Brown University, Providence, RI; Facilities Forum interviews and analysis.

Option 2: Organize Standards by Task Criticality

University of Texas at Austin Scales Completion Goals to Task Importance

The second option is to organize standards by task criticality. The University of Texas at Austin (UT Austin) prioritizes certain tasks over others, regardless of building. Their maintenance prioritization grid is shown below. The four categories highlighted in grey correspond to preventive maintenance tasks: Life Safety/Code PM, Required PM, Manufacturer Recommended PM, and Top Tier PM, which includes all miscellaneous tasks performed by a mature program but not critical to operations. Overall, UT Austin aims to complete between 85% and 100% of scheduled preventive maintenance tasks.

THE UNIVERSITY OF TEXAS AT AUSTIN

Scheduled Maintenance Prioritization Grid

Scheduled Priority[1]	Description	Examples	Target Completion Rate
1	Emergency Maintenance	Fires, power outage, flooding	95%
2	Client Requested Work	Most work orders	100%
3	Expedited Reactive Work	Minor leaks, hot & cold calls	90%
4	Life Safety/Code PM	Fume hoods, fire systems	98%–100%
5	Required PM	HVAC, steam, generators	95%–100%
6	Routine Reactive Maintenance	Doors, windows, lighting	85%
7	Manufacturer Recommended PM	All calendar cycle tasks	85%–95%
8	Top Tier PM	Predictive, less critical tasks	N/A

It is important to note that these priorities reflect a mature maintenance program. For instance, UT Austin now puts client requests as the second highest priority. Because UT Austin has invested heavily in their maintenance program over many years, they can stay ahead of much of the lower-tier work that clients typically request. Institutions just starting to build a more robust program are better served by initially deprioritizing client requests to preserve time for preventive maintenance tasks.

1) This table reflects all prioritized maintenance activities, including reactive needs. The shaded rows highlight preventive maintenance activities.

Source: University of Texas at Austin, Austin, TX; Facilities Forum interviews and analysis.

Practice 5: Data-Driven Preventive Maintenance Scheduling

Practice in Brief

Institutions incorporate data on asset condition to continuously adjust the preventive maintenance schedule, more accurately catalogue equipment condition, and predict future system needs.

Rationale

Preventive maintenance schedules are typically built using a combination of staff knowledge and manufacturers' recommendations, which results in some tasks being completed too frequently while others are not done frequently enough. To better schedule preventive maintenance tasks, institutions need a more thorough understanding of current condition. Institutions can deploy sensors, predictive technologies, and data collection strategies to better identify trends and dynamically adjust schedules.

Implementation Opportunities

Opportunity 1: Formalize data collection

Institutions provide active checklists to staff, either electronic or paper-based, to formalize data collection and document standardized information for all assets.

Opportunity 2: Leverage technology to complete the picture of asset condition

Institutions use wireless sensors and predictive technologies to obtain a comprehensive picture of equipment health.

Opportunity 3: Translate data into decisions

Institutions analyze sensor and condition data through manual analysis, performance trending, or software-enabled analysis to better anticipate and schedule preventive maintenance work.

Practice Assessment

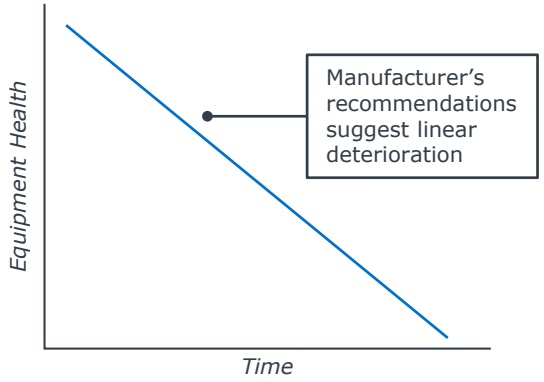
While these opportunities are additive and most effective when institutions pursue all three, pursuing any one will create a more robust preventive maintenance schedule. Furthermore, institutions can implement these solutions independently or as part of a broader transition to specific models of preventive maintenance, such as reliability-centered maintenance, condition-based maintenance, or predictive maintenance. Each model offers principled ways to prioritize tasks and would be enhanced by the approaches outlined in this practice.

Source: Facilities Forum interviews and analysis.

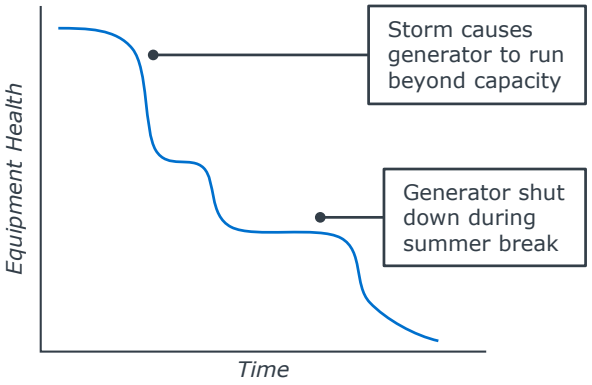
Struggling to Pinpoint Changing Asset Conditions

A robust preventive maintenance schedule requires a clear picture of asset condition. However, leaders struggle to ascertain this information as it constantly changes and evolves. The graphs below illustrate this challenge. If condition devolved linearly like in the left graph, scheduling maintenance activities would be as simple as following manufacturer's recommendations. However, asset condition degrades more like the graph on the right. For instance, the condition of a generator depends on many factors, such as the weather and time of year. Even with established standards and task prioritization, the challenge is making informed, dynamic work scheduling decisions.

Ideal Generator Conditions



Real Generator Conditions



Three Major Barriers To Dynamic Optimization

- No systematic way to capture observable equipment data
- Difficult to assemble complete picture of asset health
- Unsure how to translate reams of data into action

There are three major barriers to asset data optimization. First, Facilities leaders lack a systematic way to capture observable equipment data and therefore miss relevant information. Second, it is difficult to assemble a complete picture of asset health. Finally, even when all relevant data are collected, Facilities leaders struggle to translate reams of data into action. This practice outlines three strategies to help Facilities leaders overcome each barrier and build a better preventive maintenance schedule.

Source: Facilities Forum interviews and analysis.

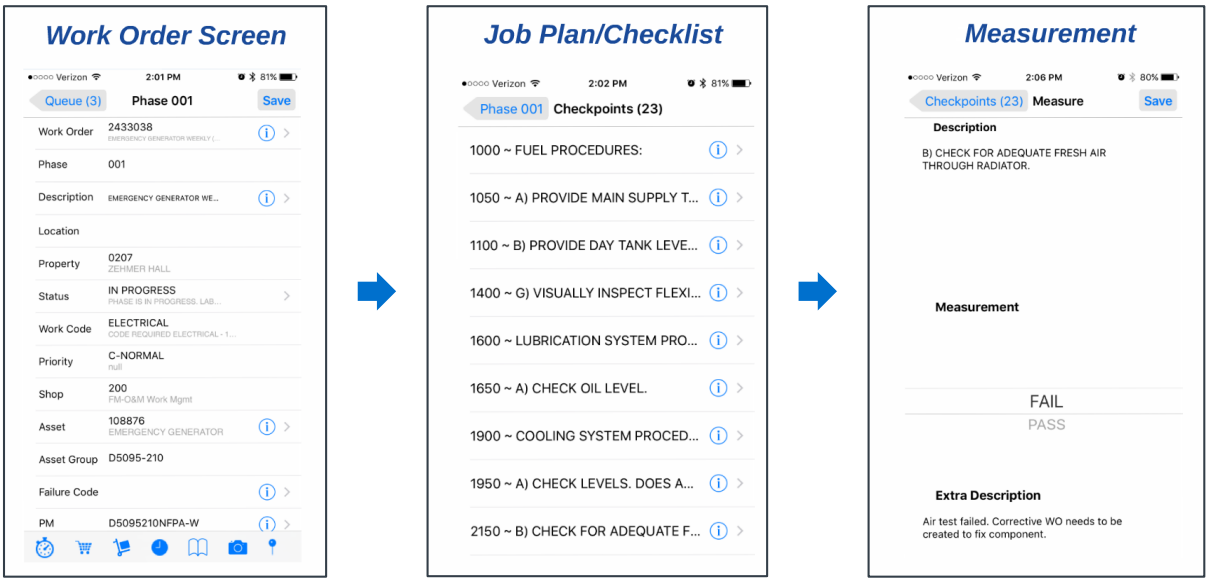
Checklists Capture Staff Knowledge

Combat Dependence on "Anecdata"

Opportunity 1: Formalize data collection

The first opportunity for improving preventive maintenance scheduling is to formalize data collection by establishing a systematic way to capture observable data. One rich source of information is staff knowledge. In fact, staff knowledge is one of the most valuable resources for insight into maintenance needs, as staff constantly work with equipment and intuitively understand equipment health. In practice, supervisors continuously check in with frontline staff, both formally and informally, to obtain asset information. However, most Facilities units lack a standardized way to document and codify complete asset information.

University of Virginia's Mobile Checklist for Emergency Generator Maintenance



Main screen for work order, providing context

List of tasks in work order, categorized for reference

An individual task, with work details and data input

The University of Virginia (UVA) formalizes data collection with mobile checklists to capture information beyond the work performed. These checklists serve as a reminder of the tasks required for each work order and provide space for staff to capture both quantitative and qualitative asset information. UVA used their CMMS AiM to build this checklist. However, Facilities leaders can implement a similar system with paper-based tools.

Source: University of Virginia, Charlottesville, VA; Facilities Forum interviews and analysis.

Plan with the End in Mind

UVA Makes Occupancy Conditional on Full Asset Inventory

Notably, UVA goes one step further in pursuit of creating better PM schedules. When UVA designs a new building, Facilities receives the drawings and specs to start creating a preventive maintenance schedule before construction begins. Facilities may even suggest modifications to make maintenance more efficient, such as changing the location of a mechanical room. When construction is complete, occupants do not receive a permanent occupancy certificate until Facilities receives a complete asset inventory. While ideally preventive maintenance requirements in brand new buildings are minimal, UVA ensures that they have the information necessary to evaluate and support maintenance needs across the lifecycle of the building. This step also supports future data collection and task scheduling.

Facilities Data Process Prior to Building Occupancy

Source: University of Virginia, Charlottesville, VA; Facilities Forum interviews and analysis.

Sensors and Predictive Tools Offer New Insights

NASA and WVU See Quick Returns on Investment

Opportunity 2: Leverage technology to complete the picture of asset condition

The second opportunity is to leverage technology to complete the picture of asset condition. Facilities leaders can build a more thorough picture of asset condition in two ways. The first option is using sensors to monitor variables like pressure, temperature, and air flow to better track equipment condition and performance. Then, Facilities can use these data points to better schedule maintenance tasks. For example, NASA installed sensors on nearly 300 assets, leading to a 750-hour reduction in annual maintenance work and $143,000 in avoided failures. In fact, the investment paid for itself in just under a year.

Sensors

- Built into equipment or manually installed
- Measure pressure, temperature, flow, current, and other metrics
- Results recorded by staff or transmitted wirelessly to CMMS
- Example: monitoring battery outputs to time replacements

Predictive Technologies

- Non-destructive testing techniques to evaluate conditions
- Output a variety of evaluations, images, and suggested next steps
- Data used to modify future preventive maintenance frequency
- Example: infrared scanners uncover near-invisible roof cracks

NASA Sees Big Gains from Sensor Implementation

- Installed sensors on 280 pieces of equipment across 37 buildings
- Sensor information led to 750-hour reduction in annual maintenance work
- $143K in avoided failures in 11 months; investment paid for itself in a year

WVU Leverages Predictive Tools to Update PM Task Frequencies

- Load calculations reduced the frequency they serviced air filters
- Motor analysis determined which coils dirtied faster and required more regular cleaning

The second option is implementing predictive technologies to obtain an up-to-date picture of asset condition and maintenance needs. For example, many Facilities leaders use infrared scanners to detect near-invisible cracks in a roof to identify potential failures and efficiently allocate maintenance and renewal resources. West Virginia University is making investments in predictive technology, such as using load calculations on air filters to lower the frequency of filter changes. WVU also conducted coil analysis to determine which HVAC units would benefit from more frequent maintenance.

Source: NASA, Washington, DC; West Virginia University, Morgantown, WV; Facilities Forum interviews and analysis.

High Tech, Not High Cost

Predictive Tools Increasingly Affordable

Encouragingly, most predictive tools are becoming increasingly affordable. To support Facilities leaders in their efforts to educate staff and build a business case for investment in predictive technology, the Facilities Forum offers the following guide to the most common predictive technologies. This guide provides a description of how technologies work, as well as applications, training needs, and cost.

Field Guide to Predictive Technologies

Technology	Description	Output	Applications	Training	Cost[1]
Thermography/ Infrared Scanner	Detects leaks and cracks by measuring infrared radiation emitted by objects proportional to heat, either with **radiometer** or **imager**	**Radiometer**: measures energy number **Imager:** records and analyzes IR map of image	Pumps, motors, generators, condensers, circuit breakers, valves, HVAC, electric systems, boilers, steam systems, fluid units, roofs	• **Radiometer**: Minimal training required • **Imager**: Requires tool and software training	$-$$ ETR[2]: 1 year
Vibration Analysis	Measures cyclical motion around a point and compares it against a vibration severity chart and historic data	Vibration displacement, velocity, and acceleration; detects misalignment, mechanical looseness, failures	Rotating machinery, including pumps, motors, generators, and compressors	Mobile transducer requires orientation and charting guide; mounted sensors automatically report data	$-$$ ETR: 2 years
Ultrasonic Analysis	Measures high-frequency sound waves produced by fluids; isolates waves and looks for changes in pattern	Sound waves recorded and store to be used for baseline or comparative analysis; detects system leaks, cracking	Pumps, motors, generators, condensers, valves, HVAC, fans, insulators, transformers, steam systems	Minimal training required	$$ ETR: 6 months
Motor Analysis	Sends high-frequency charge through system and looks for inconsistencies, checks for current variations along power cords	Complex reports showing various metrics; detects deterioration, short-circuits, poor coil settings, misalignments	Motors, circuit breakers, electrical systems, insulation, open coils	Complex system; specialized support required	$$$ ETR: Single prevented failure pays for program with large motor numbers
Oil/Fluid Analysis	Identifies water, metals, particles, or flow rate of lubricant in machines through analysis of samples from equipment	Testing provides breakdown of chemicals, density, and other metrics, compared against safety ranges	Pumps, motors, generators, transformers, boilers, hydraulics, lubricated machinery	Complex system; specialized support recommended	$$ ETR: Single prevented failure pays for program over several years
Performance Trending	System compiles data from sensors and manual inputs and analyzes them for performance patterns	Detects current underperformance and predicts future maintenance needs	Relevant to all systems, but particular advantage with HVAC, pumps, refrigeration units, compressors, filters	Requires tool and software training	$ ETR: Immediate

1) Cost evaluated on a scale of $ (low), $$ (medium), and $$$ (high).
2) Estimated time for return.

Source: O&M Best Practices Guide 3.0, Department of Energy, https://www1.eere.energy.gov/femp/pdfs/OM_6.pdf; Preventive and Predictive Maintenance, Life Cycle Engineering, https://www.lce.com/pdfs/The-PMPdM-Program-124.pdf; Facilities Forum interviews and analysis.

Recognize Problems Before They Arise

Low- and High-Complexity Ways to Isolate Trends and Update Schedules

Opportunity 3: Translate data into decisions

The third opportunity is to translate data into decisions that support better task scheduling. The graphic below organizes analytic options from low- to high-tech. The low-tech approach is manual analysis. Facilities leaders use spreadsheets to track broad patterns in a metric, like number of work orders by equipment or customer complaints, to determine if a piece of equipment needs additional maintenance. A marked increase in work orders or customer complaints may merit more comprehensive maintenance checks and investment.

Technical Complexity of Preventive Maintenance Analyses

Manual Data Analysis

- Manually analyze data to uncover broad patterns and outliers
- Time intensive, but requires few additional resources beyond data spreadsheets
- Example: Analyze spreadsheets of work orders, labor hours, and complaints on HVAC systems to prioritize attention

Performance Trending

- Analyze data with regression software tools to estimate future maintenance needs
- Costs depend on intensity and frequency of analysis
- Example: Establish best-fit trend line using filter breakdown data to predict replacement rate, increasing filter maintenance efficiency

Automated Analysis

- Integrate system components with monitoring software to update data constantly
- High upfront and ongoing costs, including hardware/ software updates and connectivity monitoring
- Example: Building automation system integration with CMMS notifies Facilities when maintenance is needed

Next, performance trending involves analyzing data with regression software tools to estimate future maintenance needs and update task schedules. This approach is more complex and costly than manual analysis. However, some Facilities leaders successfully leverage performance trending to increase the efficiency of maintenance operations. For example, the University of Texas at Austin used performance trending to determine that most pre-filters had no significant impact on air filter performance. As a result, the institution's Facilities leader decided to stop using them.

The most technologically complex solution is automated analysis, in which Facilities leaders leverage software to continuously monitor system and equipment performance. While this method incurs high upfront and ongoing costs, it offers the greatest potential improvements in task scheduling efficiency. For example, one institution integrated its homegrown building automation system with its CMMS to automatically generate work orders when maintenance is required on a piece of equipment, ensuring that maintenance staff do not spend time or resources on unnecessary tasks.

Source: University of Texas at Austin, Austin, TX; Facilities Forum interviews and analysis.

Implementation Guidelines

Words of Wisdom from Your CIO

Data integrity is crucial to the reliability of analyses. To ensure Facilities collects the best data possible, the table below outlines insights and lessons from chief information officers (CIOs) about maximizing data quality through proper data hygiene and governance.

- **Assign ownership.** Facilities leaders must assign someone within the department responsibility over the data parameters and the software used to manage them to ensure the collection of data occurs regularly through reliable processes.
- **Lock in variables.** Consistency in the collection and measurement of terms from year to year allows for better tracking and analysis over time.
- **Focus on groups of assets, not individual units.** While experienced Facilities leaders might see particular pieces of equipment as unique, data analysis requires categorizing equipment by similarities to have pools from which to extract data. Such labels can include location, function, type, criticality, and age.
- **Refrain from reinventing the wheel.** Many modern CMMS platforms come with performance trending modules built into the software, with training resources available from the company's website or representatives. Additionally, some institutions' IT units have experience implementing similar data structures and may have the capacity to provide advisory or developmental support to Facilities leaders.

Source: Facilities Forum interviews and analysis.

Practice 6: Preventive Maintenance Czar

Practice in Brief

Institutions dedicate one staff member to manage the preventive maintenance program, which includes tracking and analyzing preventive maintenance data, developing task prioritization criteria, and building and maintaining a PM schedule.

Rationale

As institutions build out more technologically-enabled and complex preventive maintenance programs, the various components can become increasingly difficult to manage. Institutions are beginning to hire a staff member specifically to manage the complexity and support the continuous improvement of the preventive maintenance program.

Implementation Components

Component 1: Scope the role to ensure decision-making authority over preventive maintenance process

Institutions craft the role to manage and have decision-making authority over PM processes including data collection, scheduling, and data analysis.

Component 2: Prioritize data analytics background over Facilities expertise

Institutions prioritize candidates with strong backgrounds in data analytics rather than expertise in Facilities. This background is critical to ensuring that the "czar" is able to optimize tasks and schedules to actual conditions based on quantitative as well as qualitative information.

Practice Assessment

The Facilities Forum rarely recommends new roles as best practice, as no institution has the resources to dedicate a person to address every challenge. However, because PM programs are only increasing in its technical and administrative complexity, institutions are increasingly hiring a dedicated staff member to manage the process. This practice is designed to help institutions in the process of or considering pursuing a dedicated role by offering guidance on structuring and staffing the position. Budget realities will constrain the degree to which most campuses can pursue this practice.

Source: Facilities Forum interviews and analysis.

Creating a Preventive Maintenance Champion

Institutions Hiring Dedicated Role to Manage Increasingly Complex Program

Multiple factors have converged to make preventive maintenance more complex and difficult to complete than ever, including advanced technology in buildings and systems, increased customer expectations, and tightly constrained budgets. On many campuses, building a more robust preventive maintenance program has become so complex that some Facilities leaders are turning to a dedicated role to oversee the process. The list on the right captures a number of roles that have cropped up at different institutions, with titles that vary from scheduler to planner to director.

Increasing Complexity of Preventive Maintenance Responsibilities


Dynamic scheduling

Quality assurance

Data oversight


Technology training


Trend analysis


Staff adjustments


Work order prioritization


Task list development

List of Roles Emerging to Meet New Need:

- Preventive Maintenance Scheduler
- Maintenance Control Director
- Preventive Maintenance Project Planner
- Physical Plant Data Overseer
- Preventive Maintenance Planning and Control Manager
- Chief Engineer of Preventive Maintenance
- Preventive Maintenance Manager
- Associate Director of Facilities Maintenance and Operations
- **Preventive Maintenance Czar**

This practice focuses on the scoping and hiring of this "preventive maintenance czar" role. The Facilities Forum does not typically recommend new roles as best practice. However, as this role becomes more common and more institutions look to hire a dedicated preventive maintenance leader, this practice supports institutions in effectively establishing this role to maximize impact.

Source: Facilities Forum interviews and analysis.

Clarify Responsibilities and Qualifications

Seek Applicants with Data Skills and Broad Maintenance Familiarity

Component 1: Scope the role to ensure decision-making authority over preventive maintenance process

The first component to scoping the preventive maintenance czar role is to ensure it has sufficient decision-making authority. Essential responsibilities for the position are listed on the left. This role should have responsibility for the Facilities asset database, crafting a dynamic preventive maintenance schedule, and performing data analytics. Allowing the czar to make decisions about the preventive maintenance schedule ensures he or she can readily adapt it to actual asset condition based on qualitative or quantitative inputs.

Critical Responsibilities of Preventive Maintenance Czar

The PM Czar will:

1. Oversee the collection of Facilities' equipment and system data
2. Review PM task lists to make modifications based on staff observations or equipment and system needs
3. Perform data analytics to determine trends and patterns
4. Manage the scheduling of PM work orders to improve efficiency and bundle assignments
5. Make preventive maintenance decisions independent of financial considerations
6. Coordinate with Facilities leadership to advocate for adjustments to PM program

Prioritized List of Qualifications to Seek Out in Potential Candidates

Experience with data-driven maintenance programs

Ability to organize and analyze digital data

Knowledge of mechanical systems and construction profession

Background in facilities that balances knowledge of specific systems with institution-wide perspective

To ensure the preventive maintenance czar can act in the best interest of the institution, this role should report centrally, typically up to the Director of Operations and Maintenance or directly to the senior-most Facilities leaders on smaller campuses (rather than sitting in a shop or zone).

Component 2: Prioritize data and analytics background over Facilities expertise

The second component is to prioritize a strong data and analytics background over facilities expertise in the hiring process. The ideal qualifications of a preventive maintenance czar are listed in order of importance on the right. Institutions with a preventive maintenance czar point out that the ability to manipulate data is required for the majority of the responsibilities. Facilities expertise, on the other hand, can be learned on the job.

Source: Facilities Forum interviews and analysis.

Align Staffing Plan to Preventive Maintenance Goals

SECTION 3

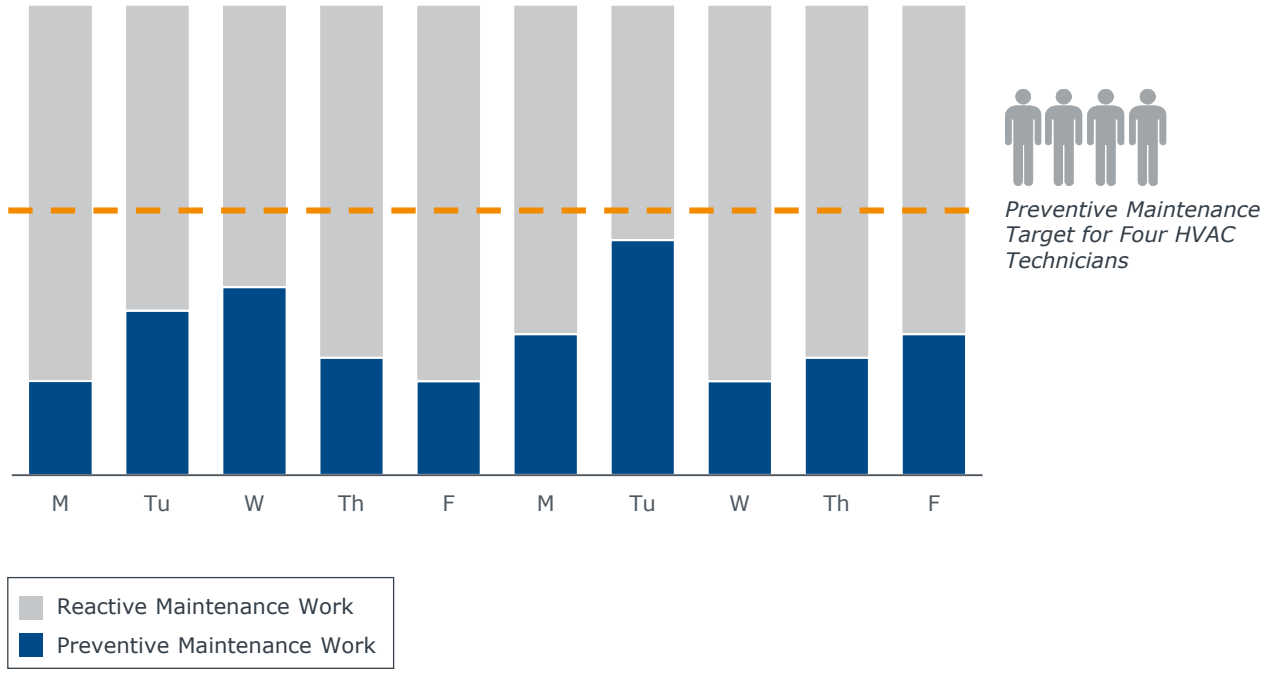
- Practice 7: Dedicated Preventive Maintenance Staffing
- Practice 8: Maintenance SWAT Teams
- Practice 9: Resident Facility Assistants

Is 'Urgent' Always 'Important'?

Reactive Mindset Threatens Preventive Goals

While all institutions aspire to complete more preventive maintenance work, scheduled tasks often fall in priority when urgent work arises. The graph below illustrates this tension, showing the distribution of maintenance work across several weeks. In particular, it shows how four full-time HVAC technicians spend their time across a two-week period, split between light grey reactive work and dark grey preventive work. The dotted line in the middle is the preventive maintenance target. While the techs occasionally approach the desired target, more often than not, responding to urgent, reactive needs impedes their ability to complete preventive maintenance tasks.

Representative Breakdown of Two-Week HVAC Workload by Maintenance Activity



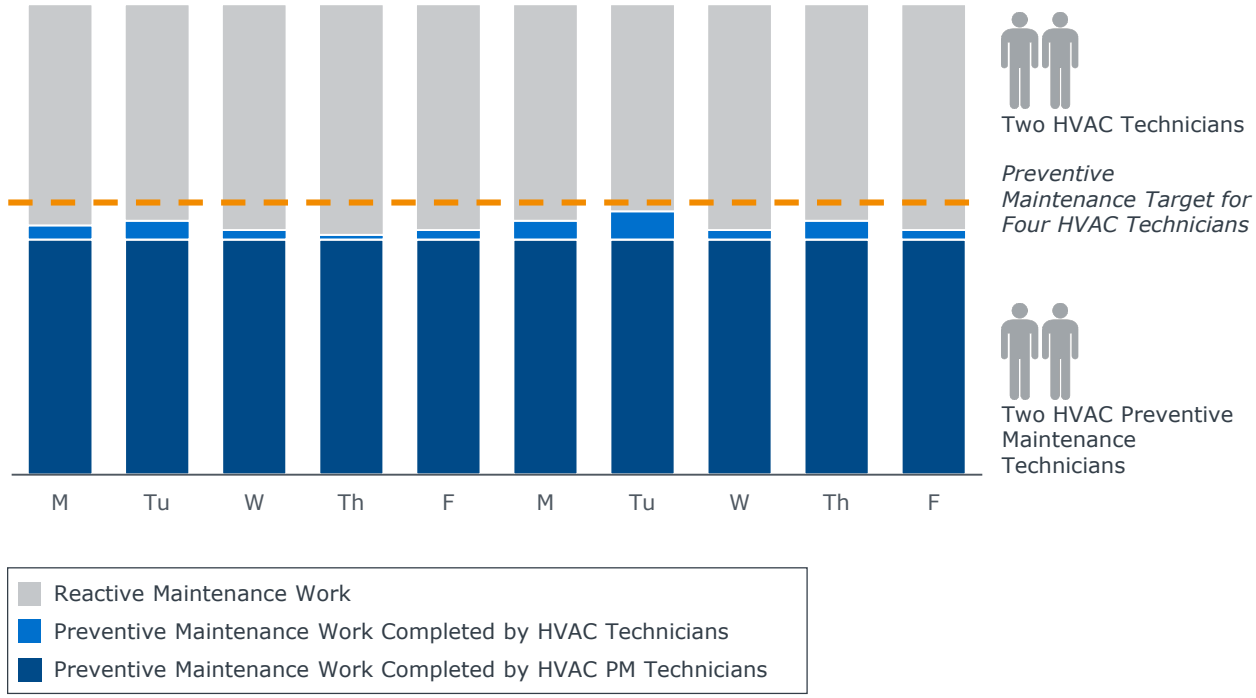
Source: Facilities Forum interviews and analysis.

Lock in Staff Time for PM

Moving Toward Planned Maintenance Requires the Right Staffing Model

One way to ensure the completion of scheduled tasks is to leverage the staffing plan to lock in a desired amount of PM. The graph below illustrates this point using the same four HVAC technicians as the preceding page. Instead of all completing both reactive and preventive tasks, the four technicians are divided into pairs with discrete areas of focus. On the bottom, two technicians complete only preventive maintenance activities. This means that even when emergencies arise, the institution maintains a consistent level of preventive maintenance work. Meanwhile, the other pair of technicians complete both reactive and preventive maintenance. As a result, the institution more consistently achieves its desired preventive maintenance target.

Representative Breakdown of Two-Week HVAC Workload by Maintenance Activity



However, this is only a conceptual model. Clearly, locking in a minimum amount of PM is not as simple as assigning pairs of technicians to preventive maintenance work. This section focuses on three strategies institutions can use their staffing models to ensure the completion of more preventive maintenance.

Source: Facilities Forum interviews and analysis.

Practice 7: Dedicated Preventive Maintenance Staffing

Practice in Brief

Institutions dedicate specific staff members or staff hours to preventive maintenance tasks, either by creating a designated team or requiring a fixed number of labor-hours to be exclusively dedicated to preventive maintenance work.

Rationale

At many institutions, maintenance workers are responsible for both reactive and preventive maintenance. When crises arise, preventive maintenance is typically deprioritized so that workers can address urgent corrective issues. In addition, the staff members responsible for preventive maintenance tasks often have higher skill levels than necessary for the work. Dedicating specific employees or groups of employees to preventive maintenance ensures that this work is always accomplished, even when unplanned needs arise. The dedicated model further allows Facilities to hire less skilled (and therefore lower paid) workers to perform preventive maintenance tasks.

Implementation Options

Option 1: Create a dedicated preventive maintenance team

Institutions form a dedicated team that solely executes preventive maintenance tasks.

Option 2: Distribute a percentage of preventive maintenance work across all staff

Institutions require all or a subset of maintenance staff to dedicate a specific amount of staff time to preventive maintenance.

Practice Assessment

While both options improve the amount of PM completed relative to programs without dedicated preventive maintenance roles, creating a dedicated team is more strongly recommended. While less of a deviation from the current staffing model, pursuing the second option may result in less stringent implementation of the target without serious follow through by senior leaders. However, Facilities leaders must consider factors such as labor agreements when determining which option to implement. For example, institutions with unionized employees may need to determine whether labor agreements restrict their ability to dedicate certain staff to certain tasks.

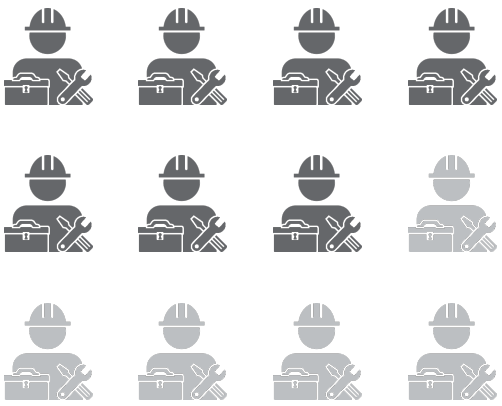
Source: Facilities Forum interviews and analysis.

Two Approaches to Dedicate Staff to PM

There are two ways institutions can lock in staff time for preventive maintenance. The first option is to dedicate some staff exclusively to preventive maintenance, illustrated on the left. In this example, about 60% of staff exclusively conduct preventive maintenance work. The second option, illustrated on the right, is to distribute preventive maintenance work across all staff. In this model, each person dedicates at least 60% of his or her time to preventive maintenance. While the execution is different, the resulting amount of preventive maintenance should be the same under both models. The following pages explore each option in greater detail.

Option 1: Create a dedicated preventive maintenance team

"I want approximately 60% of my staff exclusively doing preventive maintenance work."



Option 2: Distribute a percentage of preventive maintenance work across all staff

"I expect at least 60% of all staff time to be devoted to preventive maintenance."

Source: Facilities Forum interviews and analysis.

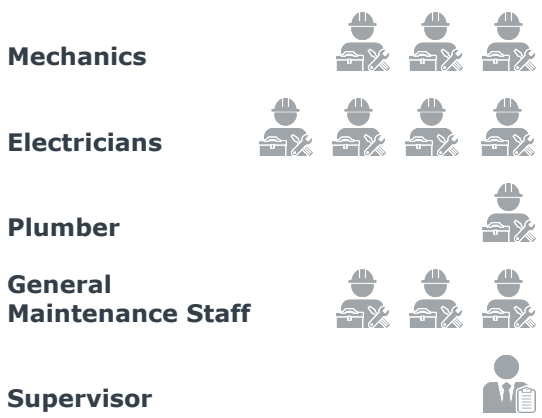
Improving Completion Rate with Dedicated Team

Option 1: Create a dedicated preventive maintenance team

The first option is to dedicate a team to perform preventive maintenance exclusively. The University of Texas at San Antonio (UTSA) has maintained a dedicated preventive maintenance team for over a decade. Their team structure is outlined below.

UTSA
The University of Texas at San Antonio™

UTSA's Preventive Maintenance Team



- UTSA has one team for 5.4 million GSF and 29,000 students
- Team completes all PM work excluding work on boilers, refrigeration units, and fire safety systems

UTSA's Preventive Maintenance Program by the Numbers

20%	Percentage of maintenance staff assigned to PM team
58%	Percentage of total PM work orders under team's purview
93%	Preventive maintenance completion rate

"I used to be called after hours three to five times a week when things failed. Now, I can't remember the last time I was called at night or on the weekend."

Dave Riker, Associate Vice President for Facilities
University of Texas at San Antonio

This group of 11 (10 tradespeople and 1 supervisor) make up 20% of the total maintenance staff and is exclusively dedicated to completing preventive maintenance tasks. The team is responsible for a pre-determined subset of buildings and assets. Importantly, while the dedicated team only performs preventive work, not all preventive work is performed by the team. For example, in 2016, UTSA's team completed over 50% of all preventive maintenance for the 5.4 million square foot campus. The remaining work was completed by other staff performing a mix of planned and unplanned work.

UTSA's dedicated preventive maintenance team has yielded great results. Their Facilities leader points to a significant reduction in after-hours service calls and an increase in the institution's overall preventive maintenance completion rate, which is now at 93%.

Source: University of Texas at San Antonio, San Antonio, TX; Facilities Forum interviews and analysis.

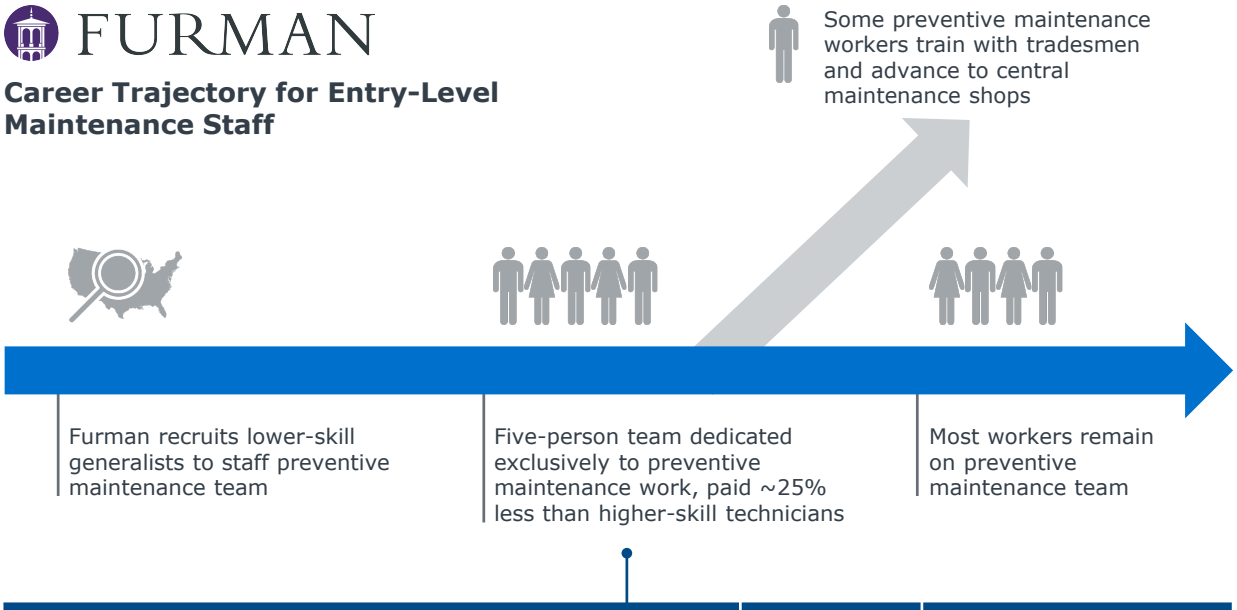
Matching Skill Level to Task Complexity

Furman University Staffs PM Team with Entry-Level Workers

To maximize the efficiency of dedicated preventive maintenance teams, some institutions staff teams with lower-skill and entry-level staff. This enables Facilities to better match worker skill level to task difficulty.

FURMAN

Career Trajectory for Entry-Level Maintenance Staff



Role	Pay Grade	Hourly Rate Range
Preventive Maintenance Staff, Painters	4	$14.42 to $22.31
Carpenters	5	$16.63 to $25.77
HVAC Technicians, Plumbers, Electricians, Locksmiths	6	$19.28 to $29.90

Furman exclusively recruits lower-skill generalists for their five-person preventive maintenance team. There are two benefits to this approach. First, as shown in the table above, Furman pays preventive maintenance staff around 25% less than skilled tradespeople. Second, it creates a talent pipeline for Furman to train much-needed skilled workers. While some team members have opted to stay in preventive maintenance roles because they enjoy the work, others have taken advantage of the career ladder and moved into more skilled roles.

Source: Furman University, Greenville, SC; Facilities Forum interviews and analysis.

Applying the Principle on a Smaller Scale

Three Institutions Focus Specialists on High-Priority PM Needs

Institutions hesitant to completely transition to a dedicated preventive maintenance team have still found ways to apply this principle by focusing on a critical subset of equipment, systems, or tasks. Three examples are shown here. First, some institutions have created dedicated preventive maintenance roles for HVAC systems, which is often the system requiring the most time and attention. For example, George Mason University's 33,000-student campus requires a 16-person HVAC team. Meanwhile, the University of Hartford, which has about 7,000 students, hired a single technician to complete most HVAC preventive maintenance tasks.

GMU Focuses on System with Highest Work Order Volume

- George Mason University (GMU) has a 16-person PM team dedicated to HVAC, the system with the highest requirements
- All other preventive maintenance is handled through main shops

The University of Hartford takes a similar approach, scaled to their campus size; they employ a single HVAC technician dedicated exclusively to PM

UNB Prioritizes Work with Highest Return on Investment

- The University of New Brunswick (UMB) has a two-person team focused on steam system PM
- UNB identified steam traps as high priority because the central heating plant is the primary steam source and large utility cost for the entire university and several nearby non-university buildings, including the local hospital
- Steam trap PM saves UNB about $229K annually in corrective needs

Nebraska Dedicates Team to Complex Code Compliance Tasks

- The University of Nebraska has a separate preventive maintenance team for systems with high regulatory documentation requirements
- Team includes staff trained in highly technical work required to keep fire systems, sprinklers, generators, fume hoods, and biosafety cabinets up to code

Next, the University of New Brunswick established a two-person team to complete preventive maintenance on their steam system. Not only does this ensure their crucial steam system—which powers their campus as well as a nearby hospital—remains operational, but their Facilities leader estimates that the team's work saves the institution $229,000 annually in corrective costs. Finally, the University of Nebraska has a team that focuses specifically on code compliance activities, lessening the urgency of training all staff on these complex requirements.

Source: George Mason University, Fairfax, VA; University of Hartford, West Hartford, CT; University of Nebraska, Lincoln, NE; University of New Brunswick, Fredericton, NB; Facilities Forum interviews and analysis.

Caltech Assigns Fixed Percentage of PM

Option 2: Distribute a percentage of preventive maintenance work across all staff

The second option is to distribute preventive maintenance work across staff. Institutions that do not want to take the dedicated team approach have found success in dedicating a fixed amount of time to preventive maintenance. By scheduling more of each worker's time, leaders can ensure preventive maintenance takes priority. Caltech takes this approach, requiring 80% of staff time be scheduled. Shop supervisors have the flexibility to schedule work in whatever way works best for their team as long as they hit the 80% target.

Caltech's Shop-Based Preventive Maintenance Program

Caltech

Supervisors Schedule 80% of Shop's Time

Shop supervisors incorporate preventive maintenance work orders into daily assignments; goal is for each technician to have 80% of his or her day scheduled, with remaining 20% for emergencies and unanticipated delays

PM Work Assignment Varies by Shop

Some supervisors assign PM work to specific person while others spread PM across staff; supervisors can take whichever approach best suits shop while still hitting 80% scheduled work target

Scheduling Flexibility Maximizes Efficiency

The flexibility to modify schedules and work assignments at the shop level enables supervisors to match campus needs with staff expertise

Potential Cons of Dedicated PM Staff

While the Facilities Forum recommends a dedicated team as the method that best ensures PM actually occurs, some Facilities leaders still have concerns with this approach. These concerns include unnecessarily sending two people to the same building to do the work of one, missing out on pre-existing staff expertise, and preventing development opportunities that naturally emerge from mixed teams. Facilities leaders concerned with these shortcomings have opted for the second option described here.

This option does not necessarily require a new staffing model, as the target can be implemented through existing zones and/or shops. As a result, Caltech's approach may seem easier to implement than a dedicated team because it is less of a departure from most existing staffing models. However, regardless of the intended outcome, some institutions have found that this model still allows urgent work to crowd out preventive maintenance tasks. For some institutions, a dedicated team is more likely to ensure preventive maintenance actually happens, even if it is a bigger change.

Source: California Institute of Technology, Pasadena, CA; Facilities Forum interviews and analysis.

Practice 8: Maintenance SWAT Teams

Practice in Brief

Institutions staff a temporary team that ensures the completion of critical preventive maintenance work.

Rationale

Some institutions lack the resources to fully staff their maintenance programs. Others find that they face high maintenance demands at certain times of the year. When institutions face these challenges, creating temporary maintenance SWAT teams allows institutions to resolve maintenance gaps through short-term staffing solutions.

Implementation Opportunities

Opportunity 1: Create a transition-focused SWAT team

While switching staffing models, institutions employ a Facilities team to respond to urgent and semi-urgent one-off requests, such as from customers to ensure high levels of customer service.

Opportunity 2: Deploy recurring SWAT teams

Institutions focus all or a subset of Facilities staff on a particular type of space and/or during certain times of the year to efficiently complete predictable work.

Practice Assessment

This practice is well-suited for institutions undergoing maintenance staffing transitions or those lacking the staff to perform predictable and important work at particular times of the year.

Source: Facilities Forum interviews and analysis.

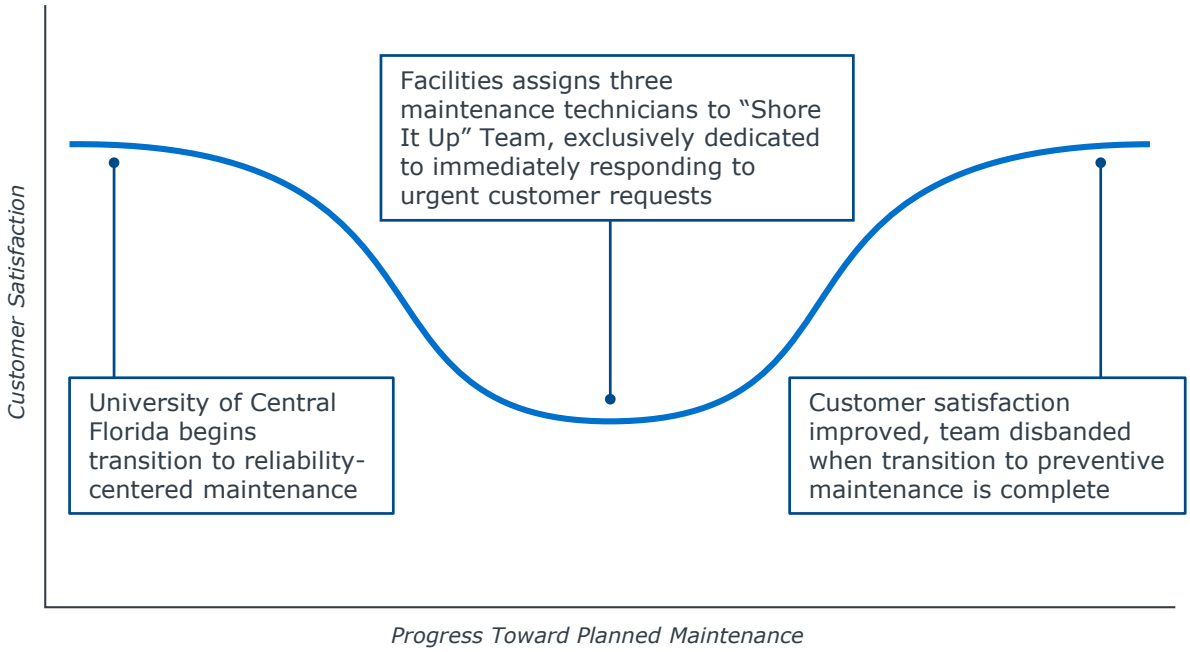
UCF 'Shores Up' Customer Needs with SWAT Team

Group Preserves Responsiveness and Satisfaction Amidst PM Transition

Opportunity 1: Create a transition-focused SWAT team

Institutions trying to improve their preventive maintenance programs still have one-off or recurring corrective needs that require resolution, like time-constrained tasks or customer-requested work. Some campuses have resolved these maintenance needs through short-term staffing solutions, generally known as maintenance SWAT teams. The first opportunity is a transition-focused maintenance SWAT team. One school that experienced a need for a temporary SWAT team is the University of Central Florida (UCF).

Customer Satisfaction Across PM Transition at University of Central Florida



When UCF began their transition to a reliability-centered maintenance (RCM) model, they experienced a noticeable drop in customer satisfaction. While the new model ensured staff prioritized preventive maintenance work, customers expressed frustration when Facilities did not address their requests immediately anymore.

UCF addressed this by creating a temporary maintenance SWAT team. This team, called the "Shore It Up" Team, consisted of three newly hired staff members dedicated exclusively to responding to urgent customer requests. This allowed Facilities to continue building out its new maintenance program while still responding to customer needs. Once UCF completed the transition to RCM, they regained the capacity to respond to customer requests within their normal staffing structure, and the Shore It Up Team employees moved into other roles within the new model.

Source: University of Central Florida, Orlando, FL; Facilities Forum interviews and analysis.

Many Reasons for Maintenance SWAT Teams

Several Institutions Use Specialized Teams to Give PM a Boost

Opportunity 2: Deploy recurring SWAT team

The second opportunity is to establish a recurring maintenance SWAT team. This approach can take a number of different forms. Due to the disproportionate wear and tear they face, residence halls are the most common place for this kind of SWAT team. For example, Messiah College converts its entire maintenance staff into a SWAT team after graduation to perform a two-week sweep of residence halls. Staff scrutinize every room to identify necessary maintenance, making quick repairs on the spot and submitting work orders for larger issues.

MESSIAH COLLEGE

"Blitzing" Residence Halls

- After graduation, all maintenance staff participate in a two-week sweep of residence halls to make repairs and perform PM
- Resident assistants scope rooms in advance to identify necessary repairs
- Workers only complete tasks that take under an hour; larger tasks are submitted as work orders

Resetting the Clock

- Multi-specialty maintenance team completes all necessary preventive maintenance in a single building to "reset the clock" on PM needs
- Resetting the clock on buildings lays a foundation for a more extensive PM program

In addition, a few institutions use recurring SWAT teams to "reset the clock" in a single building when maintenance needs are particularly dire. These teams sporadically convene to complete all necessary preventive maintenance in a building floor by floor. This is especially helpful for institutions looking to implement a new preventive maintenance program or improve an existing one.

Source: Messiah College, Mechanicsburg, PA; Facilities Forum interviews and analysis.

Practice 9: Resident Facility Assistants

Practice in Brief

Institutions hire student employees to live in residence halls and address minor maintenance and custodial issues in exchange for benefits such as room and board, scholarships, or stipends.

Rationale

Facilities departments at many institutions dedicate significant maintenance and custodial staff time to small fixes and upkeep tasks that require a low skill level. Using high-skill employees to respond to overtime calls, low-skill emergencies, and minor customer-requested fixes takes away resources from more complex work. Delegating minor maintenance and custodial tasks to students or other less specialized employees allows higher skilled Facilities workers to dedicate more time to complex work.

Implementation Components

Component 1: Determine which tasks to delegate to student employees

Institutions identify which low-skilled tasks can be reasonably offloaded to students. These tasks may include minor work orders, routine inspections and preventive maintenance, data entry, or other tasks as requested by the Facilities office.

Component 2: Craft appropriate qualifications and compensation for the positions

Institutions determine the necessary skills and appropriate compensation (e.g., room and board, stipend) for the student positions based on role requirements.

Practice Assessment

While this practice is most directly applicable to maintenance in residence halls, most institutions can likely find opportunities to offload low-skill tasks to students or other less specialized employees.

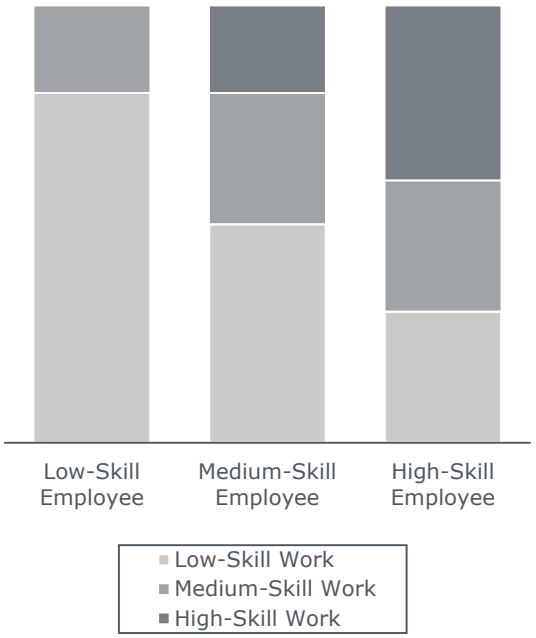
Source: Facilities Forum interviews and analysis.

Maintenance Staff Bogged Down with Low-Skill Tasks

University of Hartford Identifies Residence Halls as the Greatest Timesink

Almost all institutions have high-skill employees spending some time performing low-skill work. The chart below illustrates how differently skilled workers at many institutions often spend their time. As expected, the low-skill employee largely does low-skill work. Yet the medium-skill employees spend the majority of their time also doing low-skill work. Meanwhile, even high-skill workers are forced to spend about a third of their time on work a low-skilled worker could do.

Time Allocation of High-, Medium-, and Low-Skill Work



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75%

Percentage of overtime work orders coming from residence halls

This problem prevents Facilities from maximizing the impact of its highest-skilled employees. The University of Hartford found the greatest mismatch between task and skill level occurred in residence halls, where 75% of overtime work orders originated. In response, the University of Hartford created student resident facilities assistants to complete some of the low-skilled work required within the residence halls.

Source: University of Hartford, Hartford, CT; Facilities Forum interviews and analysis.

Help from an Unlikely Source

Hartford Taps Students to Absorb Low-Skill Work in Residence Halls

Component 1: Determine which tasks to delegate to student employees

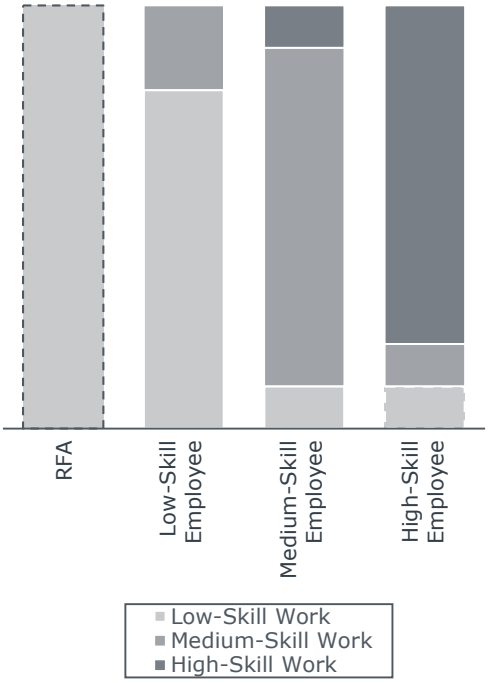
The first component of creating resident facilities assistants (RFAs) is to determine which tasks to delegate to student employees. The University of Hartford hired student RFAs to complete low-skill work in residence halls. RFAs function like traditional residential assistants and are responsible for responding to work orders in dorms as well as select emergencies across campus.

UNIVERSITY OF HARTFORD

Resident Facility Assistant Responsibilities

- Participate in the processes of residence hall preparation and shut-down
- Participate in a rotating, on-call duty system and respond on behalf of Facilities to facility needs campus-wide
- Participate in management and general operation in all aspects of Facilities' Service Delivery Center including the Maximo work order system
- Conduct routine and ad-hoc facility inspections
- Provide direct service to maintenance issues where practical; including but not limited to unclogging toilets and replacing light bulbs
- Provide follow-up as needed to residents affected by facility issues
- Serve as members of a 'crisis response group', to assist where needed in the event of a serious facilities related emergency

RFAs Take on Low-Skill Tasks, Better Matching Work to Skill Level



The staffing implications of the RFA program are shown in the graph on the right. Now, RFAs absorb most of the low-skill work in residence halls that previously fell to Facilities. This frees up time for medium- and high-skill Facilities employees to focus on tasks better matched to their skill level.

Source: University of Hartford, Hartford, CT; Facilities Forum interviews and analysis.

Structuring the RFA Program

Component 2: Craft appropriate qualifications and compensation for the position

The second component is to identify the qualifications and compensation for the position. To participate in Hartford's RFA program, students must meet a basic level of physical fitness, maintain a 2.3 GPA, and be eligible for financial aid (since compensation takes the form of room and board).

Resident Facility Assistant Program Structure

Qualifications

- Physical fitness (for instance, able to lift up to 25lbs, climb ladders)
- GPA of 2.3 or above
- Eligible for financial aid in the form of room and board

Training

- Two-week training program takes place before fall semester
- Program includes skill training with Facilities trade groups, preparing campus for students' arrival, and safety instruction

Benefits

- Compensated with room and board
- Learn basic maintenance and administrative skills
- Student leadership role
- Student-helping-student culture

Schedule

- 18 RFAs assigned to manage residence halls that house a total of 3,200 students
- Each RFA works 6–8 hours per week and is on call 13–14 nights each semester

Importantly, students are not required to have Facilities knowledge before entering the program. Rather, they attend a two-week training program before the fall semester to learn the necessary job skills. Students receive safety instruction and learn basic maintenance and administrative skills, such as unclogging drains, replacing lightbulbs, answering customer calls, and processing work requests. RFAs are compensated with room and board in exchange for a small time commitment of 6 to 8 hours per week and 13 to 14 on-call nights each semester.

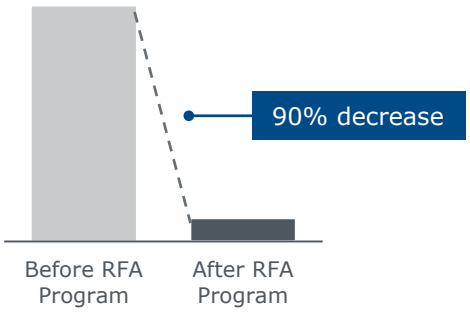
Source: University of Hartford, Hartford, CT; Facilities Forum interviews and analysis.

RFAs a Win-Win for Facilities and Students

Program Reduces Overtime, Creates Staff Pipeline, and Builds Student Skills

The University of Hartford's RFA program has benefited both Facilities and students. Since the program launched in 2003, Hartford has seen a 90% decrease in after-hour calls from residence halls. Additionally, the program has become a talent pipeline for the Facilities department. To date, Hartford has hired 14 RFAs in a part-time capacity after graduation and 2 RFAs into full-time Facilities leadership positions. Meanwhile, students who become RFAs learn new technical skills and share that knowledge with their peers, captured in the testimony from a former RFA below. More information on Hartford's program can be found starting on page 89.

Decrease in Residence Hall After-Hours Requests for Full-Time Staff



RFAs Transition to Full-Time Positions in Facilities

14 RFA alums employed as graduate assistants or part-time Facilities staff over the past ten years

2 RFAs transitioned to full-time management positions in Facilities

Students Gain Practical Life Skills in RFA Program

"Obviously any RFAs who go through the program benefit from the information they learn… But the bigger picture is that having RFAs helps educate the student body. If a plumber or electrician shows up to your door, students expect them to just fix the problem. If a student shows up… I think the other students are more likely to pay attention… that gives the program credit and respect."

RFA Alum
University of Hartford

Source: University of Hartford, Hartford, CT; University of Hartford, "RFA/GA Student Employment Information," http://www.hartford.edu/facilities/rfa_info.aspx; Facilities Forum interviews and analysis.

Apply the Principle of RFAs Across Campus

Where Are the Opportunities to Offload Low-Skill Work at Your Institution?

While Hartford's RFA program focuses specifically on residence halls, institutions can modify and apply this concept across a variety of Facilities tasks. The value of offloading low-skill work to low-skill employees is clear; as one Facilities leader said, "You shouldn't be paying someone $75 an hour to go check if a light is red or green." A number of institutions have taken steps to more closely match worker skill level to the tasks they complete, as shown below.

Opportunities for Matching Worker Skill Level with Facilities Tasks

- Hire mechanical engineering students to complete asset inventory
- Pay students to shovel snow
- Create custodian "electrician helpers" to replace lightbulbs
- Hire students to work full-time over the summer on a unionized campus; enables students to pay union dues and move to part-time work during school year
- Employ high school students for landscaping, who are managed by the full-time groundskeepers, allowing the staff to also develop managerial skills

> "You shouldn't be paying someone $75 an hour to go check if a light is red or green."

Source: University of Hartford, Hartford, CT; Facilities Forum interviews and analysis.

University of Hartford's Resident Facility Assistant Position Description

Resident Facility Assistant
Position Description (2016-2017)

Position Summary
The Resident Facility Assistant (RFA) team consists of 18 RFAs and serves as a live-in extension of Facilities. With a focus of providing consistent, quality service to all members of the campus community, RFAs work primarily with the Service Delivery Center to perform and/or coordinate maintenance, investigations, inspections, and follow-ups. Staff members serve the entire campus during the course of their general responsibilities and while on duty.

Key Responsibilities
- Participate in the processes of residence hall preparation and shut-down
- Participate in a rotating, on-call duty system and respond on behalf of Facilities to facility needs campus-wide
- Participate in the management and general operation in all aspects of Facilities' Service Delivery Center including the Maximo work order system
- Participate in various administrative projects
- Conduct routine and ad-hoc facility inspections
- Provide direct service to maintenance issues where practical; including but not limited to unclogging toilets and replacing light bulbs
- Develop, plan and implement Facilities outreach efforts including literature, events, and programs
- Provide follow-up as needed to residents affected by facility issues
- Provide various levels of advocacy, representation and management to all facilities and grounds on behalf of Facilities
- Identify and report facility related issues and actively work toward solutions
- Serve as members of a 'crisis response group', on behalf of Facilities, to assist where needed in the event of a serious facilities related emergency
- Work with other campus departments to ensure common visions and goals for campus facilities
- Other duties as assigned

Key Job Requirements
- Maintain knowledge of applicable University and departmental policies, procedures and standards
- Be enrolled as a full-time undergraduate (minimum of 12 credits) student and/or continuing a program from undergraduate studies (Physical Therapy, etc.)
- Live full time in the residence halls while employed as an RFA
- Maintain satisfactory academic progress throughout the course of employment and maintain a cumulative (and period) GPA of 2.3/4.0
- Be financially eligible for Room and Board as compensation (defined by an individual's University financial aid package)
- Have and maintain good standing with the Office of Residential Life
- Be found not responsible for significant or repeated violations of the University Code of Student Conduct
- Be available for employment for a full academic year
- Be able to effectively work in a team environment with diverse groups

Source: University of Hartford, Hartford, CT.

University of Hartford's Resident Facility Assistant Position Description

Key Job Requirements (continued)

- Be able to perform physical requirements as outlined below:
  - Typically standing and/or walking
  - Requires repeated reaching by extending hand(s) and/or arm(s) in any direction
  - Climbing ladders
  - Intermittently sitting, standing, stooping
  - Typically crawling and/or kneeling
  - Typically pushing and/or pulling
  - Lifting up to 25 lbs
  - Using equipment requiring high dexterity
  - Regular exposure to moving machinery and/or vehicles.
  - Works on slippery or uneven surfaces.

Availability (All Dates Subject to Change)

- Participate in fall staff training and residence hall preparation beginning Thursday, August 11th, 2016 at 9:00 am through Monday, August 29th, 2016
- Participate in residence hall winter shut-down through Wednesday, December 21st, 2016 at 1 pm
- Participate in winter training and residence hall preparation beginning Friday, January 20th, 2017 at 9:00am through Monday, January 23rd, 2017
- Participate in residence hall spring shut-down through 5 pm the Monday after Spring 2017 Commencement (May 22nd 2017)
- Participate on duty 13-14 nights per semester (approx 10 weekdays and 3-4 weekends)
- Be available for overnight duty for at least two weeknights (Su-Th) per week beginning at 4:15pm
- Be available for 6-8 hours per week of project/building/office work during the regular business day (8am - 4:30pm)
- Attend bi-weekly full staff meetings on Monday mornings 7:45am-8:30am

Terms and Compensation

- RFA positions are contracted for one academic year, renewable upon mutual agreement of the staff member and supervisor(s)
- Compensation includes a stipend equal to room and board costs during the period of employment (amount varies depending upon the assigned area)
- Room and board are provided during periods of training

Source: University of Hartford, Hartford, CT.

University of Hartford's Resident Facility Assistant Training Materials

RFA Training Schedule

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RFA Training Expectations

1. Be on time, alert, and attentive during all training sessions. Sessions start on time and end on time.
2. Learn and take notes.
3. No inappropriate behavior (including but not limited to: texting, sleeping, passing notes, having side conversations, playing Pokémon Go, snap chatting, facebooking, etc.). No cell phone usage during training – *Jessica reserves the right to confiscate cell phones for the day for repeat offenders*.
4. Do not complain or whine. Leave all bad/negative attitudes at the door!
5. Be open to changes and looking at things from a new perspective.
6. Encourage new ideas and respect each other's opinions.
7. Think of reasons why we can instead of reasons why we can't.
8. Take ownership over your actions and behavior. Lead by example!
9. Ask questions if you don't know or if you're not sure.
10. Have fun and play when appropriate.
11. Everyone must eat lunch together during training.

Thursday, August 11, 2016

9:00 am / Jessica	*Breakfast / welcome back / icebreakers *Job description / training schedule / calendar *Teambuilding	Harry Jack Gray Rm B
10:45 am / Jessica	* Quiz	Harry Jack Gray Rm B
12:00 pm / Staff	Lunch	Gengras
1:00 pm / Theresa	RFA Advice	Regents Park Office
2:00 pm / Theresa	Teambuilder	Regents Park Office
2:30 pm / Jessica	Duty discussion	Regents Park Office

Friday, August 12, 2016

9:00 am / Plumbing	Trade info session	Regents Park Office
11:30 am / Custodial	Trade info session	Regents Park Office
12:00 pm / Staff	Lunch	Gengras
1:00 pm / Jessica & Catherine	Office discussion	Facilities Conference Room
3:00 pm / Jessica	Murder One	Regents Park Office

Saturday, August 13, 3016

Day off	Day off	On your own

Sunday, August 14, 2016

Day off	Day off	On your own
6:00 am – 12:00 pm	Electrical Shutdown	Campus

Source: University of Hartford, Hartford, CT.

University of Hartford's Resident Facility Assistant Training Materials

RFA Training Schedule (cont.)

Monday, August 15, 2016

9:00 am / Theresa	Teambuilder	Regents Park Office
9:30 am / Jessica	Buttoning up training	Regents Park Office
10:00 am / Judy & Jason	Maximo info session	Auerbach 113D
12:00 pm / Staff	Lunch	Gengras
1:00 pm / Theresa	Teambuilder	Regents Park Office
1:15 pm / Judy	Trade info session	Regents Park Office
1:45 pm / Carpentry	Trade info session	Regents Park Office

Tuesday, August 16, 2016

9:00 am / Theresa	Residence hall preparation	Regents Park Office
12:00 pm / Staff	Lunch	Gengras
1:00 pm / Theresa	Teambuilder	Regents Park Office
1:15 pm / Paint	Trade info session	Regents Park Office
1:45 pm / Electrical	Trade info session	Regents Park Office

Wednesday, August 17, 2016

9:00 am / Lock	Trade info session	Facilities – Lock Shop
11:00 am / JP Bellamo	Exterminator info session	Facilities Conference Room
12:00 pm / Staff	Lunch	MOOYAH
1:00 pm / Jessica	Residence hall preparation	Regents Park Office

Thursday, August 18, 2016

9:00 am / Jessica	Residence hall preparation	Regents Park Office
12:00 pm / Staff	Lunch	Gengras
1:00 pm / OTS & Comcast	UHTV Info Session	Dana Mali I
1:30 pm / Nick Macy	Construction/projects update	Regents Park Office
2:00 pm / Jessica	Office & duty schedule	Regents Park Office

Friday, August 19, 2016

9:00 am / Jessica	Residence hall preparation	Regents Park Office
12:00 pm / Staff	Lunch	Gengras
1:00 pm / Transportation	Trade info session	Facilities
2:00 pm / Theresa	Teambuilder	Regents Park Office
2:30 pm / Jessica	Painting the anchor	Anchor

Saturday, August 20, 2016

Day off	Day off	On your own

Sunday, August 21, 2016

Day off	Day off	On your own
4:15 pm	Duty starts	Facilities

Source: University of Hartford, Hartford, CT.

University of Hartford's Resident Facility Assistant Training Materials

RFA Training Schedule (cont.)

Monday, August 22, 2016

8:15 am – 3:30 pm / Jessica	Winding Trails outing – Bus WO 218553 – PACK A LUNCH	Meet at Konover

Tuesday, August 23, 2016

9:00 am / Theresa	Residence hall preparation	Regents Park Office
12:00 pm / Staff	Lunch	Gengras
1:00 pm / Jason	Taking the HEAT	KF Room (HJG Library)
2:00 pm / Gary Feldman	Hazardous material training	KF Room (HJG Library)
3:00 pm / Jessica	Opening discussion & schedule	KF Room (HJG Library)

Wednesday, August 24, 2016

9:00 am / Jessica	Residence hall preparation	Regents Park Office
12:00 pm / Staff	Lunch	Gengras
1:00 pm / Theresa	Teambuilder	Regents Park Office
1:30 pm / Power Plant	Trade info session	Regents Park Office
2:00 pm / Grounds	Trade info session	Regents Park Office
2:30 pm / Theresa	Protect the Egg	Regents Park Office
3:15 pm / Chris Lyons	Public Safety info session	Regents Park Office

Thursday, August 25, 2016

9:00 am / Jessica	Residence hall preparation	Regents Park Office
12:00 pm / Staff	Lunch	Gengras Cafe
1:00 pm / Jessica	Quiz	Hillyer Hall 207
2:00 pm / Jessica	Expectations & training wrap-up	Hillyer Hall 207

Friday, August 26, 2016

8:00 am – 12:30 pm / Jessica	Residence halls open – 6 RFAs	Regents Park Office
12:30 pm – 5:00 pm / Jessica	Residence halls open – 6 RFAs	Regents Park Office

Saturday, August 27, 2016

8:00 am – 12:30 pm / Theresa	Residence halls open – 8 RFAs	Regents Park Office
12:30 pm – 5:00 pm / Theresa	Residence halls open – 8 RFAs	Regents Park Office

Sunday, August 28, 2016

8:00 am – 12:30 pm / Theresa	Residence halls open – 8 RFAs	Regents Park Office
12:30 pm – 5:00 pm / Theresa	Residence halls open – 8 RFAs	Regents Park Office

Monday, August 29, 2016

8:00 am – 12:30 pm / Jessica	Residence halls open – 6 RFAs	Regents Park Office
12:30 pm – 5:00 pm / Jessica	Residence halls open – 6 RFAs	Regents Park Office

Tuesday, August 30, 2016

8:00 am / Staff	Classes & office hours begin	Campus

Source: University of Hartford, Hartford, CT.

University of Hartford's Resident Facility Assistant Training Materials

RFA Duty Response Protocol

Resident Facility Assistant Duty Response Protocol

Hours

RFA duty shifts begin at 4:20 pm each scheduled day. Shifts end at 8 am the following morning when the Facilities Service Response Center is open and at 4:30 pm on weekends or when the office/University is closed. **Both** RFAs on duty Friday nights spend 9 am – 12 pm on Saturdays working in the main Facilities office, and **both** RFAs on duty Saturday nights spend 9 am – 12 pm on Sundays working in the main Facilities office. Duty RFAs are to have no other obligations that will interrupt their availability to respond on duty or perform scheduled tasks (such as being at work for another job, being in class, choir rehearsal, etc.). Duty RFAs must be on campus for the entirety of their shift.

Communication

Each on duty RFA **must** be carrying a duty cell phone. These phones are the primary method of communication that Public Safety will use to inform RFAs of a call. As needed, direct communication among on-campus scheduled shift Facilities staff members is encouraged. Public Safety can provide information on available staff as needed.

Reporting for Duty and On Duty

RFAs are to report to the **on watch person** at Facilities and/or Regents promptly at 4:15 pm on days the office is open to pick up the duty phones and any work orders in the RFA mailbox. After retrieving their duty equipment, RFAs are expected to check-in with the Public Safety dispatcher, identifying themselves as being the RFAs on duty. RFAs will be required to show ID (Facilities Hang Tag) when asking to sign out any keys from Public Safety and may be required to write down their name and ID number. On the weekends or holidays, RFAs must contact each other to hand off the duty equipment. The duty phones must be physically handed off to another RFA, they **cannot be left in a location** for another RFA to pick up. An RFA is not relieved of his or her duty responsibilities until someone else is actually in possession of the duty equipment.

Duty officially begins at 4:20 pm and RFAs should be ready and available for calls at this time. The duty cell phones can never be turned off and must always be at a volume that is 'fully noticeable' to the staff member (i.e. not on silent). While on duty, you are to always be wearing your Facilities ID and RFA jacket or t-shirt. Before using the RFA truck for duty an inspection form needs to be filled out to document the current condition of the truck. If you find anything in the truck that doesn't belong in there, you should remove it then.

Good care should be taken with all of the duty equipment. This includes the duty cell phones, chargers, the RFA truck, and all equipment and tools in the RFA Regents office. The duty cell phones are to be returned to Regents or Facilities by **10 am**.

When you use any of the equipment and/or tools in the RFA office during a call, make sure you return them to where they belong so they can always be found when they are needed, do not leave items in the truck. If you need to use any duty equipment while **NOT** on duty, make sure you return everything promptly and post a message in the RFA Facebook group so an item can be quickly tracked down when needed.

If you happen to break something or you notice we have run out of something, let Jessica know so she can order replacements/refills. You don't want to be the RFA that's on duty and unclogging toilets after we've run out of gloves.

Source: University of Hartford, Hartford, CT.

University of Hartford's Resident Facility Assistant Training Materials

RFA Duty Response Protocol (cont.)

Reporting for Duty and On Duty (continued)

When you are not completing work orders or responding to calls, RFAs on duty are to be inside the RFA office in Regents Park from 4:30 pm until 7 pm. RFAs may bring laptops and work on homework during that time, but must physically be inside the RFA office until 7 pm. RFAs may briefly leave in order to go get food, but must check in with the on watch person when you leave and when you return.

If another RFA is covering a portion of a duty shift for you, no matter how big or small the time frame, they must also follow all the guidelines outlined in this document, including but not limited to: being in possession of the duty phone, wearing the appropriate duty apparel, and being in the Facilities or Regents Park office during the designated time frames.

Responding to Calls

When a call comes in on the duty phone, RFAs should answer the phone identifying it as being the RFA duty phone ("*Hello, RFA duty phone*"). If you happen to miss a call from Public Safety, be sure to call them back promptly. If there is a voicemail on the phone, also be sure to listen to it and act on it as necessary. You should never be handing off the duty equipment with an unlistened to voicemail still on the duty phone.

RFAs are to never be responding to calls alone, especially when you have to enter someone's living space. Two (or more) RFAs are on duty together for a reason, so all work orders and calls are to be completed together. Make sure that you are representing Facilities in the best way possible when you are on duty and interacting with others.
When you are on duty, you are to respond to every call promptly. Sometimes a call that is communicated as power being out is actually an electrical fire. On the flip side, a report of an overflowing toilet may just be a clogged toilet, but it is always better to be safe than sorry. RFAs are expected to communicate with the residents that are home when responding to a call; not just go in, fix something, and leave. You should explain the situation, inform them of the status of the issue, when it will be addressed if you couldn't fix it, how to prevent it from happening again, etc.
RFAs are to respond on scene to every call; **even if there isn't anything you can do for the situation**. In these cases, RFAs are responding to verify the reported conditions to provide accurate information to Jason or trades, post signs as needed, etc.

RFAs will typically be called in for the following situations:

- To any scene to which an off-campus tradesperson has been requested. This is typically to verify the situation and to serve as a conduit of information between staff members and affected residents. It is possible that minor service of the RFAs will be requested.
- To serve as a first responder to situations when another, more appropriate staff member is not available. In these cases, containment, stabilization and evaluation will be required.
- To assist other staff members in any way with a more major situation that arises on campus, such as a pipe break, fire, or power outage.
- As an after-hours representative of the Facilities Department, providing information and minor service as needed.
- Position of strength: Respond to everything, and ask questions later.

Source: University of Hartford, Hartford, CT.

University of Hartford's Resident Facility Assistant Training Materials

RFA Duty Response Protocol (cont.)

Keys

If you have a work order or get a call for an apartment and there is no one there, master keys are available to be signed out at Public Safety. These keys should be returned to Public Safety promptly. If you have them still signed out after midnight, Public Safety will be calling you. **Not completing a work order or a call because "no one was there" is not acceptable.** Public Safety also has a 21 key available for RFAs to sign out while on duty, this will let you in to mechanical rooms. Each RFA can only sign out up to two keys at a time from Public Safety.

After-hours Facilities Staff Members

There are some Facilities staff members available on campus after hours for various service needs:

- Custodial Supervisor/Leads – Will typically be the "First Responder" to major situations, especially for the academic side of campus, can help with pretty much anything. (Schedule for them is on the whiteboard.)
    - Monday through Friday:
        - From 3-6 pm: Call Fidel
        - From 6-9 pm: Call Orville
        - From 9-11:30 pm: Call Fidel or Orville
- Custodians – Available for any emergency custodial needs, will be dispatched to help by custodial supervisor
- Power Plant – Can be called for any heating/AC problems or leaks all over campus. (They are here until 11 pm Monday – Friday. NEVER on the weekends)
- On Watch Point Person –Liaisons between RFAs, Jason, trades, and Public Safety to communicate information and help troubleshoot further to prevent trade call-in.

For problems that require service beyond what the on-campus staff can provide, contact the 'on watch' person or ask Public Safety to call Jason. RFAs on duty should not call Jason themselves. Even though the duty phones have contact numbers for all the trades, **RFAs should only directly contact employees who are on campus for their regularly scheduled shift.**

Duty Log

Each day a duty log must be sent out with a complete report of the previous night's activity. It is not an official rule that RFA2 does the duty log. As duty partners, both RFAs should be working equally and contributing to its completion. Duty logs should contain every interaction, call, etc. you have as an RFA on duty, even if it's something you immediately refer to another, more appropriate, person/trade. The more details you provide in your duty log the better. Some RFAs find it helpful to initially type up the duty log in a word document as the duty night unfolds, and then copy and paste the information into the official form. The duty log should be sent out within 2 hours of the end of the duty shift. Additional information on formatting the duty log and the online form can be found in the "Duty Log Formats" handout.

Duty Switches

All switches need to be communicated via email to the entire staff. RFAs should also submit a duty switch form if another RFA will be covering a portion of their shift, specifying the time range in the 'Notes' section of the online form. It is the switching person(s) responsibility to ensure that all necessary parties are informed of switches. The official duty switch form is available online here: www.hartford.edu/facilities/current_rfas.aspx . This site also contains links to the duty calendar, duty log form, Maximo, and the office hours absence form.

Source: University of Hartford, Hartford, CT.

University of Hartford's Resident Facility Assistant Training Materials

Assigning Work Orders – Typical Calls

Carpenters: (CARP)
- Patching holes (larger than a baseball)
- Repairing/replacing screens
- Repairing broken windows
- Repairing/replacing tiles in bathrooms in brick dorms
- Putting up walls
- Door repair
- Replacing shades/blinds

Electricians: (ELEC)
- No power
- Outlet installations & repairs
- Repairs to smoke detectors
- Repairs to most cafeteria equipment
- Repairs to card swipes on exterior doors

Plumbers: (PLUMB)
- Overflowing/clogged toilets, tubs, and sinks
- Hot water issues
- Sprinkler problems
- Fire extinguisher issues
- Garbage disposal issues
- Dishwasher issues

Locksmith: (LOCK)
- Keys/locks not working
- Making keys
- Lock changes
- Door closer repairs
- Crash bar repairs
- Battery changes in door locks

Utility Services (aka Power Plant or HVAC or PowerHouse: (UTIL)
- Hot/cold complaints
- Hot water issues
- Broken heating pipes
- Gas smells

Painters: (PAINT)
- Painting
- Graffiti removal (from most surfaces)
- Minor hole repair (smaller than a baseball)

Grounds: (GROUNDS)
- Grounds maintenance – mowing lawn, caring for plantings
- Snow removal
- Delivery and/or disposal of boxed items, furniture, etc.
- Building to building moves
- Trash removal in areas outside of buildings
- Graffiti removal from brick, concrete, asphalt

Mechanics: (MECH)
- Repairs to/maintenance for university vehicles

Building Services: (CUST) (*For immediate needs call AND enter work order*)
- Cleaning
- Water/biohazard clean ups
- Floor maintenance
- Changing light bulbs in academic buildings
- Moves within buildings
- Providing toilet paper/paper towel/soap in bathrooms on academic side
- Providing toilet paper and cleaning in brick dorms
- Trash removal in areas inside of buildings and within 10 – 15 feet of buildings

Transportation: (TRANS)
- Shuttle bus reservations
- Rental car reservations

RFAs: (RFA)
- Changing light bulbs in residential buildings
- Replacing shades in residential buildings
- Minor exterminator services (deliver glue traps, spray raid)
- Minor plumbing issues if plumbers are busy
- Minor custodial service (wet vac, neutralize biohazards)
- Inspections/investigations
- Perform a variety of tasks during off hours including unclogging toilets, sinks, and tubs, resetting breakers, checking heater issues and providing space heaters, etc.

Exterminator: (C-PEST) *(Contractor that comes to campus once a week)*
- Ants, bees, spiders, other bugs/insects
- Mice

Source: University of Hartford, Hartford, CT.

University of Hartford's Resident Facility Assistant Training Materials

Assigning Work Orders – Typical Calls (cont.)

Important work order notes:

When submitting a work order for a key request:
- Name and number of person the key is for
- Where keys are needed to
- Account number
- A supervisor/dept head must make the request in writing

When submitting a work order for key sign-out:
- Person's name
- Company name
- Phone number
- Where access is needed to
- Photocopy license/ID if this is their first time getting keys here

When submitting a work order for a shuttle bus reservation:
- Person's name and number
- Date shuttle is needed for
- Number of people travelling
- Initial pick up time and location
- Destination
- Return pick up time and location
- Account number

Source: University of Hartford, Hartford, CT.

University of Hartford's Resident Facility Assistant Training Materials

End-of-Semester Residence Hall Closure Instructions

Buttoning Up Residence Halls

1. Remove trash or any unnecessary items from the bedrooms, hallways, storage closets, stairwells, lobbies, basements, etc.
2. Push in chairs and organize the bedroom and lounge furniture
3. Clean any dirty light covers in bedrooms, bathrooms, hallways, stairways, and lobby
4. Replace broken shades
5. Replace lights that are out
6. Lower shades all the way down on the first floor (except in the village) and approximately halfway down for other floors
7. Cut runs in carpet
8. Clean any dirty surface areas
9. Reattach heater covers
10. Vacuum rooms as needed
11. Check that all shower curtains are present, clean, and cut to an appropriate length
12. Clean dirty windows
13. Create punch list for trades
14. Unprop all doors
15. Make sure suite doors are locked, close and lock bedroom doors
16. Check mirrors, sinks, toilets, showers, etc for cleanliness
17. Remove tape from windows, doors, walls, mirrors, etc

Don't forget about –

- Go up/down each stairwell all the way to the basement and all through the basements, including any common areas rooms that are left open/unlocked
- Towel hooks in complex bathrooms (and other areas)
- Check behind bathroom stall doors
- Check closet ceilings in complexes for mold
- Write down red suite doors that need paint
- Check that screens are there and have no rips/tape

Source: University of Hartford, Hartford, CT.

Build a Culture of Stewardship

SECTION 4

- Practice 10: Behavior-Reinforcing Metrics
- Practice 11: Mission-Focused Town Halls

Battling the 'White Knight' Complex

Struggling to Maintain Staff Engagement Amid Increased PM Focus

Increasing preventive maintenance work is crucial, but it can have unintended consequences on staff engagement. In particular, staff may find the PM work less rewarding than responding to reactive needs. The table below illustrates this tension. When Facilities operates in a largely reactive mode, staff perform "white knight" tasks. Staff enjoy the recognition from customers and the unpredictability of their day-to-day duties.

WIKIMEDIA COMMONS.

Maintenance Workers to the Rescue

- My job is rewarding and I save the day.
- I'm doing different things everyday.
- I never know where my day will lead.
- I get regular positive recognition from customers.

A Whole New World of Recognition

- My job is less interesting now.
- I'm doing the same things all the time.
- I don't get to save the day anymore; my schedule is highly structured.
- I get less recognition than I got before.

SIGHTLINES.

On the other hand, staff may perceive a fully scheduled work day with relatively straightforward preventive maintenance tasks as less interesting and more invisible than a day shaped by reactive maintenance. Staff perceptions can be a barrier not only to completing more preventive work, but also to achieving the transformation that most Facilities shops seek to accomplish. To overcome this, Facilities leaders must better engage staff in the changes.

Source: Sightlines, "Don't Leave Your Facilities Needs to Chance," http://www.sightlines.com/insight/dont-leave-your-facilities-needs-to-chance/; Facilities Forum interviews and analysis.

Winning Hearts and Minds

Engagement Linked to Increased Productivity, Persistence

Cross-industry research across the past decade highlights that engagement is critical not just for employees, but also for entire organizations. At the individual level, highly engaged employees display 57% more effort than their disengaged colleagues and are 87% less likely to turn over. At the organizational level, companies in the top quartile of engagement are 17% more productive, 70% safer, and have clients who are 10% happier than those in the bottom quartile.

The Power of Employee Engagement

57%

Highly engaged employees exhibit **57% more effort** than disengaged employees

87%

Highly engaged employees are **87% less likely to leave** their company compared to disengaged employees

Businesses in the top quartile of engagement are…

17% more productive

70% fewer safety incidents

10% better customer service ratings

…than businesses in the bottom quartile of engagement

To fully solve the maintenance challenge facing most campuses, Facilities leaders must fully engage frontline staff and supervisors performing preventive work. The two practices in this section focus on quantitative and qualitative strategies to increase staff support for the broader transition to a more preventive maintenance-centric Facilities shop.

Source: Corporate Executive Board, "The Role of Employee Engagement in the Return to Growth", Bloomberg Businessweek, http://www.bloomberg.com/news/articles/2010-08-13/the-role-of-employee-engagement-in-the-return-to-growth; Gallup, "State of the American Workplace", http://www.gallup.com/services/176708/state-american-workplace.aspx, September 2014; Facilities Forum interviews and analysis.

Practice 10: Behavior-Reinforcing Metrics

Practice in Brief

Institutions track and communicate metrics that better encourage desired preventive maintenance behaviors.

Rationale

Most Facilities leaders track metrics to measure staff performance on maintenance tasks and inform management decisions. As Facilities units increasingly look to build out their preventive maintenance functions, the traditional suite of metrics, like cost per work order, can unintentionally incentivize undesired behaviors. By tracking and rewarding staff for performing well on metrics that reinforce preventive maintenance tasks, institutions can begin to transform the Facilities unit's focus from fixing failures to preventing them.

Implementation Components

Component 1: Track metrics that reinforce the importance of preventive maintenance tasks

Institutions establish clear and observable performance metrics that incentivize timely and accurate completion of preventive maintenance tasks.

Component 2: Communicate select metrics to Facilities staff

Institutions publicly post and circulate metrics to the Facilities team to reinforce their importance and encourage staff to focus their improvement efforts on the right behaviors.

Component 3: Clearly link performance on select metrics to recognition triggers

Institutions establish clear performance targets to provide tangible, realistic goals for staff. These triggers allow leaders to recognize staff for performing well on preventive maintenance tasks and provide concrete rewards to staff who meet or exceed performance targets.

Practice Assessment

This practice is recommended for all institutions. While the proposed metrics both advance preventive maintenance goals and help inform management decisions, institutions do not need to track all of them. Instead, they should select the metrics that incentivize behaviors important to support their institutional priorities. For institutions that are not in a position to add new metrics, Facilities leaders can still use the guidance provided here to review current metrics.

Source: Facilities Forum interviews and analysis.

Some Metrics Unintentionally Incentivize Bad Habits

Most institutions already track metrics to evaluate staff performance on maintenance tasks and inform management decisions. While these metrics are important for Facilities leaders to track, some metrics may unintentionally incentivize the wrong behaviors if widely broadcast. This table lists four common metrics that Facilities units track. While each one is principled in theory, in reality each may produce unintended consequences on staff behavior.

Sample Metrics Eliciting Wrong Behaviors

Metric	Desired Outcome	Reality
Response Time to Service Calls	Reduce time to resolve customer complaints and improve service	Staff prioritize customer calls over completing PM tasks
PM Completion Rates	Ensure staff complete all assigned PM work for compliance	Staff may occasionally mark work orders as completed when only some work (typically the easiest) is done
Time to Close	Ensure work orders are completed in a timely manner	Increased focus on closing, not completing, PM work orders, leading to rushed or incomplete work
Cost per Work Order	Minimize number of parts and materials used	Staff apply quick, cheap patches, re-logging more expensive tasks as separate work orders

For example, tracking response time to service calls focuses staff on improving customer service. However, Facilities leaders have found that this metric also incentivizes staff to prioritize service calls over preventive maintenance work. While customer satisfaction may spike in the short term, the long-term focus on reactive rather than preventive maintenance may lead to sustained deficits that negatively impact the campus experience, like frequent HVAC failures.

Source: Facilities Forum interviews and analysis.

Choose Metrics That Incentivize Desired Behaviors

Component 1: Track metrics that reinforce the importance of preventive maintenance tasks

The first component of leveraging behavior-reinforcing metrics is to track metrics that highlight the importance of and increase engagement with preventive maintenance tasks. The table below offers twelve principled preventive maintenance metrics. The metrics are divided into two categories: operational and strategic. Operational metrics track the volume and type of Facilities work, like maintenance mix, which is the ratio of preventive to reactive maintenance tasks completed.

Operational Metrics
Tracking volume and type of Facilities work

Strategic Metrics
Tracking progress toward becoming a less reactive maintenance shop

Number of Service Calls
Number of customer-initiated work orders

Compliance Completion Rate
Percentage of required PM completed

Maintenance Mix (PM/RM)
Ratio of preventive maintenance to reactive maintenance tasks completed

Rework
Number of work orders submitted as a result of an error in recently performed maintenance

Follow Up Work Orders per 100 PM Checks
Number of work orders for repairs submitted during 100 PM checks

Work Order Queue (Backlog) per Employee
Number of open PM work orders in an employee's queue

Number of Preventable Service Calls
Number of customer-initiated work orders that could have been prevented through PM

System Runtime/Downtime
Number of days running without failure or time and extent of system shutdown

Proactive Maintenance
Number of work orders submitted by staff for issues observed in the field

Failure Code
Indicator of why an asset failed to facilitate better maintenance interventions

Normalized Investment
Money spent on new equipment due to inadequate PM

Customer Satisfaction
Customer responses on work order satisfaction questionnaires

Strategic metrics gauge the Facilities unit's progress transitioning toward a less reactive model. These metrics also provide insight into where interventions would be beneficial. For instance, institutions could track the number of preventable service calls or the most common equipment failure codes. Ultimately, these metrics align staff behavior with departmental priorities by reinforcing the value of preventive maintenance to Facilities unit operations.

Source: Facilities Forum interviews and analysis.

Publicize Realigned Priorities

Three Ways to Communicate Preventive Maintenance Metrics to Staff

Component 2: Communicate select metrics to Facilities staff

The second component is to communicate the selected metrics to Facilities staff. Circulating preventive maintenance-centric metrics ensures staff are aware of their current performance and understand where to focus improvement efforts. Additionally, a public display demonstrates to staff that the metrics matter, further incentivizing them to improve their performance.

There are three ways to communicate critical metrics and current performance to staff. Facilities units can display current performance in a highly visible location, like a break room. Facilities leaders can also send a monthly email listing current performance, highlighting top-performing staff members or teams. Finally, the most technology-intensive option is to create a dynamic dashboard.

Source: Facilities Forum interviews and analysis.

Tie Recognition to Performance on Metrics

Sample Recognition Mechanisms to Encourage Employee Efforts

Component 3: Clearly link performance on select metrics to recognition triggers

The final component of behavior-reinforcing metrics is to link both individual and unit performance to recognition triggers. Though Facilities leaders may find it most beneficial to learn from staff what reward they would find most appealing, the list below can help Facilities get started.

Options	Capsule Description	Example
Public Recognition from Supervisor	Supervisors provide public accolades to staff, either verbally or posting on recognition board	Supervisor recognizes employee who oiled 50 bearing sets each day for an entire week at following week's staff meetings
Raffle	Staff who exceeded performance on a specific metric are entered into a monthly or quarterly raffle	Staff who complete more than 95% of assigned PM tasks are entered into monthly drawings for gas cards
Prize	Staff who exceeded performance on a specific metric are rewarded with a prize	Staff with 100% completion rate of code or life-safety PM are rewarded with a small gift card each quarter
Team Celebration	Staff are incentivized to hit targets through group rewards for overall unit or team performance	Staff are provided with monthly pizza lunch if performance on one metric, such as system run time, meets or exceeds target

The Right Outcome, the Wrong Way

"Even if the outcome is positive, the process matters. Celebrating a positive outcome attained through the wrong processes encourages undesired behaviors. That won't take us where we want to go. If we continue providing accolades to staff who remedy failures at the expense of PM work, that's all they'll want to do."

Facilities Leader
Public Masters University

While this may seem to be an obvious solution, some leaders express concerns about the costs of rewards. However, a study conducted by a Duke University professor found that free pizza and compliments from a supervisor were more effective motivators than a cash bonus for employees of a semiconductor factory. Employees are more productive when they feel their work is appreciated, which does not require a large investment of time or money.

Source: Dahl M, "How to Motivate Your Employees: Give Them Compliments and Pizza", *New York Magazine*, August 29, 2016, http://nymag.com/scienceofus/2016/08/how-to-motivate-employees-give-them-compliments-and-pizza.html; Facilities Forum interviews and analysis.

Practice 11: Mission-Focused Town Halls

Practice in Brief

Facilities leaders hold annual meetings with employees to communicate and reinforce the value and contributions of Facilities to the broader mission of the institution.

Rationale

In the normal course of the work day, few opportunities exist for frontline maintenance staff to see the link between their work and the broader mission of the institution. As a result, maintenance staff may view their daily tasks as mundane and invisible, rather than recognizing the value of their preventive maintenance work. Without this link, staff lose sight of how their work connects to broader institutional mission and positively impacts the functioning of the campus. By developing and communicating the connection between daily maintenance work and the larger mission of the institution, Facilities leaders can deepen the relationship between employees and the broader institution, increasing staff engagement and preventive maintenance task completion rates.

Implementation Components

Component 1: Develop a mission statement that highlights staff value

Institutions develop an action- and outcome-oriented mission statement that defines Facilities' roles on campus and highlights the contributions that Facilities staff make to the success of the institutional mission.

Component 2: Reinforce mission statement regularly

Institutions regularly reinforce the mission statement through town halls, small group meetings, and other public venues to show the impact of maintenance work on student education, research efforts, and other institutional priorities.

Practice Assessment

While this practice is somewhat time-intensive, it is not resource-intensive, making it a critical win. Developing a mission statement and hosting town halls are low-cost solutions and can often be incorporated in existing staff meetings. All Facilities organizations should pursue this practice to consistently reinforce staff contributions to the mission of the institution.

Source: Facilities Forum interviews and analysis.

Making an Emotional Pitch

Since higher education is a mission-driven industry, failing to connect the role of Facilities staff and the success of higher education is a missed opportunity for Facilities leaders. Clearly demonstrating staff's connection to the success of the education and research missions of the institution is a critical lever to increase engagement and ultimately encourage staff investment in preventive maintenance work. One institution that has done this particularly well is Emory University. This final lesson explores how Emory links maintenance work with their broader educational and service mission.

The Missing Link

"We don't do a good enough job communicating how our daily work supports the larger institutional mission. If we can't show our employees how important and meaningful their jobs are, then I'm not doing justice to their role supporting a mission-driven environment."

Facilities Leader
Private Baccalaureate College

Recognizing the Power of Preventive Maintenance

"We do a lot of cancer research at Rutgers. Everyone has been affected by cancer, whether it's something they've experienced or someone they know and love. I let my staff know that their work enables that research to happen; they're helping to cure cancer."

Tony Calcado
Executive Vice President
Strategic Planning and Operations & COO
Rutgers University

Source: Rutgers University, New Brunswick, NJ; Facilities Forum interviews and analysis.

Rolling Out New Mission Statement at Emory

Link Facilities Stewardship with Institutional Priorities

Component 1: Develop a mission statement that highlights staff value

The first component of mission-focused town halls is to develop a mission statement. In 2012, Emory developed a mission statement for Campus Services[1], which includes Facilities: "Doing the right thing, the right way, for the right reasons." This mission statement, particularly the final clause, makes the connection between staff duties and Emory's larger educational and service mission.

Emory brings this mission statement to life for staff through a number of different strategies. Matthew Early, the Vice President of Campus Services, holds weekly walks to connect with staff in a more informal setting. Leaders also circulate customer impact stories to showcase staff influence on the campus community.

Emory University's Mission Statement for Campus Services

"Doing the right thing, the right way, for the right reasons."

Emory's Methods for Reinforcing the Mission Statement

Weekly "walks with matthew"

Circulating customer impact stories

Leaders model desired behaviors

Biannual town halls

Small group meetings

1) Campus Services includes Facilities Management, Design & Construction, University Architect, Public Safety, Customer Relations & Support, and Finance and Business Operations.

Source: Emory University, Atlanta, GA; Facilities Forum interviews and analysis.

Reinforce the Message with Recurring Meetings

Emory's VP of Campus Services Moderates Two Complementary Forums

Component 2: Reinforce mission statement regularly

The second component of this practice is to reinforce the departmental mission statement through town halls, meetings, and other public venues. The table below outlines the details of two types of forums at Emory. Every year, Emory hosts biannual town halls, which bring together Facilities and the rest of Campus Services to learn about new initiatives and recognize staff for their impact on advancing both service and education at Emory.

EMORY	Biannual Town Halls	Small Group Meetings
Description	Biannual meeting hosted by Emory's VP for Campus Services to communicate and reinforce Facilities' mission statement	Smaller meetings with VP for Campus Services to share experiences and connect with senior leader, institution
Format	Four presentations across two days; all Campus Services employees invited to attend	Small group meetings of 20 to 25 employees
Timing	Twice a year in fall/winter and spring/summer	Sessions spread across three weeks following biannual town hall
Sample Agenda Items	• Launch new initiatives • Celebrate good work • Share customer impact stories • Gain insight and feedback on what helps everyone to be successful	• Solicit 360-degree feedback from staff • Staff encouraged to share a positive personal or professional story • Ask if staff have everything they need to be successful in their jobs

In the three weeks following the town hall, the Vice President of Campus Services hosts a series of smaller conversations with groups of 20 to 25 employees. These chats provide a more intimate opportunity to solicit feedback and hear staff concerns. The goal is to reinforce the importance of the staff's work.

Source: Emory University, Atlanta, GA; Facilities Forum interviews and analysis.

Emory Also Connects Leaders and Staff

Using Shadow Program to Reinforce Mission

In addition to these meetings, Emory also implemented a novel shadowing program to increase recognition and visibility of junior staff's work. Each Facilities leader is required to shadow a frontline employee once a month. This reverses the traditional structure of a junior staff member shadowing a senior employee. It also transfers ownership and control of the agenda to the junior staff member, putting them at ease and encouraging an open dialogue. Emory reports this program has led to increased senior leader understanding of challenges faced by the Campus Services division and improved communication between leaders and staff.

EMORY **Elements of Campus Services Shadow Program**

Pair Leaders and Employees

Each leader within the Campus Services unit shadows an individual within Campus Services once a month for an hour

Hold Informal Meetings

Meetings are held in the staff member's office or work environment; staff member sets the agenda and discussion topics

Develop Relationships

Shadow program has been extremely successful in developing relationships between leadership and staff, resulting in more open communication and greater understanding of organizational challenges

Source: Emory University, Atlanta, GA; Facilities Forum interviews and analysis.

Developing Culture Pays Off for Emory

Emory's pursuit of these engagement strategies has resulted in a strong culture of stewardship. The quote on the left indicates that staff feel more ownership over their work. Even more impressive, Emory has seen a 24% increase in the number of work orders submitted from the field and an 85% drop in emergency maintenance.

Emory University Facilities Employees Buy In to Mission

"The biggest shift we have seen is the workforce embracing our mission. The team is empowered and they take ownership. For example, we had a water main break and the county would not be able to respond for many hours. So our pipe services group excavated the area and put a temporary clap on the line to reduce the domestic water down time. The buildings affected were very happy to have water sooner than expected."

Matthew Early
Vice President of Campus Service
Emory University

Results from Increasing Workforce Engagement with Facilities' Mission

24% ↑

increase in number of work orders submitted in the field since 2014

85% ↓

decrease in unplanned emergency maintenance issues since 2012

Source: Emory University, Atlanta, GA; Facilities Forum interviews and analysis.

Advisors to Our Work

Advisors to Our Work

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