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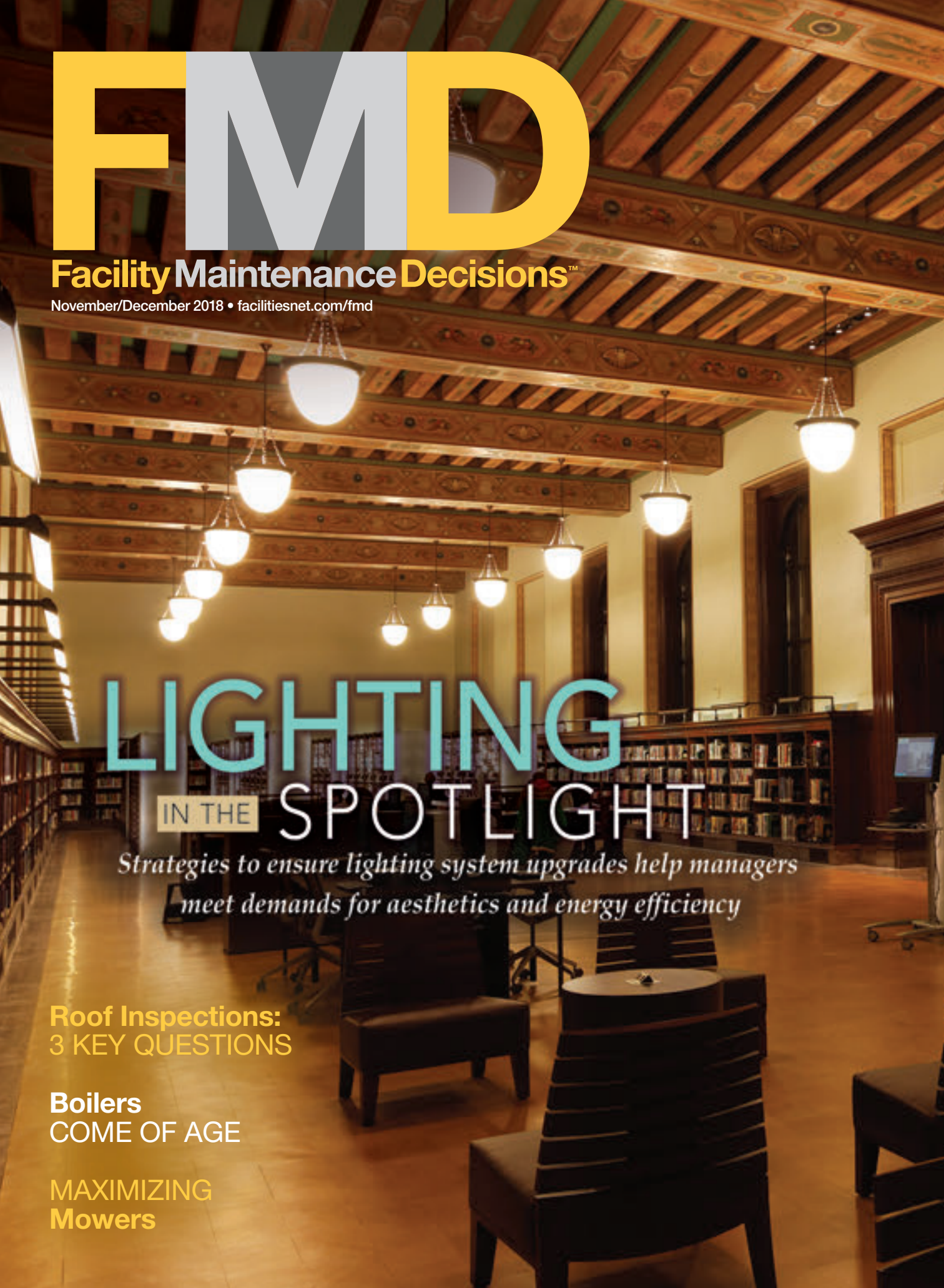

LIGHTING IN THE SPOTLIGHT

Strategies to ensure lighting system upgrades help managers meet demands for aesthetics and energy efficiency

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contents

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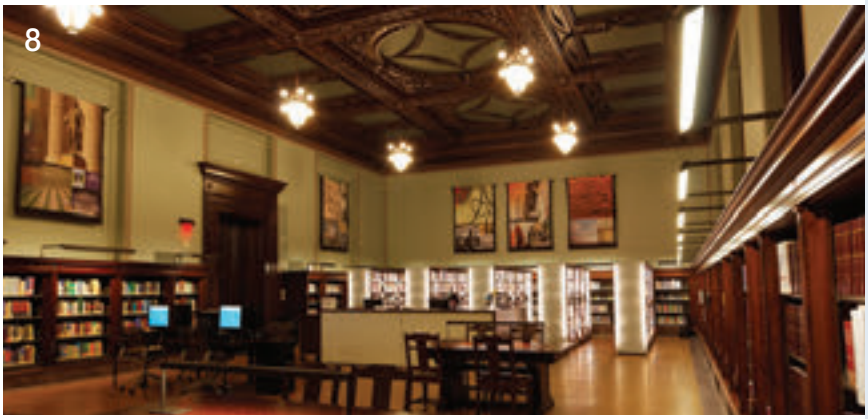

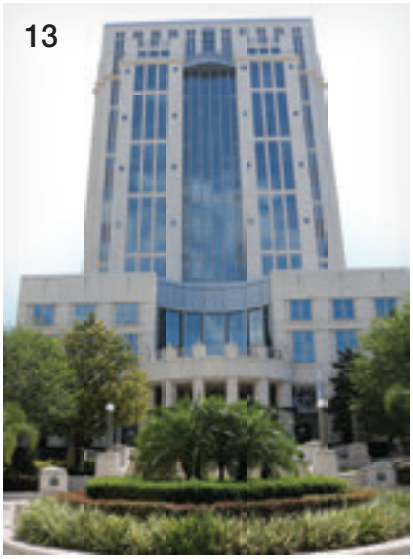

features

8 Spotlight on Lighting Upgrades
Managers who understand facility needs can improve energy efficiency and aesthetics
More: facilitiesnet.com/lighting

13 Big Challenges, Bigger Benefits
Multiple facility upgrades in Orange County, Fla., have led to increased savings and efficiency
More: facilitiesnet.com/maintenanceandoperations

16 Boilers Come of Age
Advances in modular and condensing units give managers opportunities for savings
More: facilitiesnet.com/hvac

20 Roof Inspections: 3 Key Questions
A comprehensive roof inspection program can help managers limit repair costs and extend performance
More: facilitiesnet.com/roofing

28 Green Spaces as Showplaces
Utility vehicles, water use and security issues shape manager's decisions in maximizing parks' appearance
More: facilitiesnet.com/groundsmanagement

33 Mowers: Safety First
Manufacturers address key features and functions to ensure safe and effective mower use
More: facilitiesnet.com/groundsmanagement

4 Editorial
Dan Hounsell, Editor-in-Chief, says managers can learn from crises to move toward resilience

6 Management Insight
Columnist Laurie Gilmer says IoT can help with facility resilience, safety and security

40 Access Points
Ryan Berlin, Managing Editor, discusses the importance of the Americans with Disabilities Act

products

38 Ad Index

39 Product Pipeline

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The Winding Road To Resilience

A natural disaster — whether fire, flood or hurricane — can take lives, destroy buildings, and leave a long path of destruction. Commercial and institutional facilities go to great lengths to anticipate and prepare for such events in order to protect occupants from harm and protect buildings and other assets from damage and destruction.

But for everything these events take away, they also offer maintenance and engineering managers something — opportunities to learn. Which measures worked in protecting occupants and facilities? Which didn't? What weaknesses in preparation and protection did the disaster expose? What can we do better next time? The lessons of emergency preparedness are difficult, and the road to success in this area is never a straight line. But learning from experiences is essential.

The recent hurricanes that struck the Southeast United States are only the most recent examples of natural disasters wreaking havoc on communities and facilities. In her Management Insight column on page 6, columnist Laurie Gilmer recounts the 2017 wildfires in Northern California and the experiences of her and her co-workers in staying safe and connected via Internet of Things (IoT) during and after the fires.

She writes, "The IoT way of connecting enabled us to stay informed and keep working relatively seamlessly."

The next step in emergency preparedness for facilities is to take the lessons of emergency preparedness, combine them with available technology, including IoT, and use the results to move toward resilience — the ability to quickly adapt to disruptions, protect people and assets, and maintain continuous operations.

The road to resilience is likely to be just as winding and challenging as the road to emergency preparedness, but Gilmer's experiences and recommendations offer managers the opportunity to learn and eventually find their way.

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Laurie Gilmer *is vice president and chief operating officer of Facility Engineering Associates. She is a published author and has co-authored the International Facility Management Association's (IFMA) second manual in the Sustainability How-To-Guide series, EPA's Energy Star Portfolio Manager. Laurie is serving a term on IFMA's board of directors. She also serves on the Northwest Energy Efficiency Council's Building Operator Certification program advisory committee and the National Visiting Committee of Building Efficiency for a Sustainable Tomorrow Center.*

Laurie Gilmer

The IoT-Resilience Link

When my nephew got his first smartphone, he downloaded a beverage app that made his screen look like a full glass of liquid. So when he tilted his phone as if to take a drink, the app would drain the glass down. He was 10 years old and to him, this app was hilarious.

In 2008, if there wasn't an app for something, there soon would be. Apps were fun and sometimes useful, and they introduced us to a whole new way to connect – social media, games, music, weather. Non-entertainment-based companies were getting into the game as well, launching apps to engage people with their services.

Fast forward to today, and the world is connected. It is highly connected, in fact. Since 2014, we have broadly acknowledged the Internet of Things, which is fondly shorthanded to IoT, embracing into our everyday cultural experience.

We are now at a point where it is no longer exciting for companies to simply have a digital way for us to integrate with them. It is expected.

The world of facility management offers countless examples of this connectivity: monitoring building energy consumption, controlling energy use, monitoring equipment condition, monitoring fire and life safety devices, controlling building access, communicating safety and security messages, and the list goes on.

Now, maintenance and engineering managers pull up this information not just on work computers, but also on remote devices that include laptops, tablets, and cell phones. It is much easier to get information that it ever has been before.

Spotlight on resilience

From a business resilience perspective, connectedness can be a great thing. I saw its benefits firsthand last year, but the story starts before that. Several years ago, my team worked on a business continuity plan, which included emergency preparedness, communication protocols, training, and forethought on what we could do to keep moving forward should an event occur.

We thought about the ways we could stay digitally connected, the best ways to reach people, and strategies to keep going and maintain business operations. And then one day, something did happen.

The weather was hot and dry last October, typical for that time of year in Northern California, and the winds were blowing strong. Early on the morning on Oct. 9, 2017, wildfires carried by fast winds moved quickly through Sonoma and Napa counties, destroying populated areas.

It would come to be known as the worst fire season in California history. People were evacuated from their homes in the early morning hours, not knowing if they would have homes and businesses to return to. My Santa Rosa-based team was no exception.

It was almost a week before we received news of any level of fire containment, and it was two weeks before my team could go back to the office building, which had miraculously survived. During that time, we used our IoT connectedness to monitor safety messages from local law enforcement, assess our network status, monitor utility service status, set up remote work areas, and stay in touch with one another. The IoT way of connecting enabled us to stay informed and keep working relatively seamlessly.

Leveraging IoT

As we consider the benefits of being highly connected, we must also manage our systems in order to be sure we are balancing the risks with the benefits. The interoperability of systems — along with the ability to link traditionally non-integrated systems to one another to gain a more holistic picture of conditions within facilities — can be helpful and powerful.

But we need a plan, and we need to understand our expectations of the technologies we are using, as well as the risks they might invite. In the case of facility management, think of the challenge in terms of four main categories: safety and security, operations and maintenance, utility management, and workplace environment. Here are several positive ways we can leverage IoT in each of these categories:

Safety and security:

- Technologies such as video analytics, sensors, and alarms can be linked to provide early warning of potential issues.
- Fire and life safety devices can be monitored centrally and programmed in order to initiate messaging and controlled responses.

- Personnel management can allow or limit access to areas within the building.
- Notification systems can be set up through social media or texting platforms to notify groups of people of emergency conditions or threats.

Operations and maintenance:

- Devices can be used to monitor status and condition of equipment.
- Records can manage and prioritize operations and maintenance activities.
- Sensors can control and/or monitor building system processes through algorithms and setpoints.

Utility management:

- Meters can be used to monitor building energy consumption at an interval level.
- Energy consumption data can be linked to interior environment needs to control energy use based on need.

Workplace environment:

- Occupant feedback systems can help identify problem areas and respond more quickly to occupant needs.

Spotlight on safety

While convenient and now essential, IoT also can make us vulnerable to risks such as hackers and malware if we do not manage it properly, which begs the question: What considerations must we make in terms of safety and security for the facilities we manage and the people in them? Consider these issues:

- Understand the devices that are allowed onto the network. Evaluate carefully whether and how we link building systems to personal and portable devices.
- Work with the information technology department to separate critical and non-critical functions, perhaps using separate networks to isolate based on business criticality and risk.

'The interoperability of systems — along with the ability to link traditionally non-integrated systems to gain a holistic picture of facility conditions — can be powerful'

- Determine alternate plans for maintaining continuity of service should a connected device fail or become compromised.
- Implement two-factor authentication for programs and service accounts.
- Change default and weak passwords.

The rise of IoT technology has opened up our world in a very short span of time, and through our various devices, we now can transmit increasingly plentiful data on performance, status, and safety. Our ability to get the data quickly and respond immediately can be our best tool in managing through small disruptions and large events. ■

LIGHTING IN THE SPOTLIGHT

Strategies to ensure lighting system upgrades help managers meet demands for aesthetics and energy efficiency

By Mark de la Fuente

Lighting systems are an integral part of every institutional and commercial facility, and they change and improve fairly regularly to meet the changing needs of building occupants. Given the myriad options and unique constraints inherent to every renovation or retrofit, determining the optimal way to upgrade lighting systems can prove quite challenging for maintenance and engineering managers, who typically are not lighting experts.

By understanding product options and carefully considering installation strategies, they will be better able to quantify project results that meet the top executives' goals and benefit the organization's bottom line.

Researching products

When starting the research and product selection process for a lighting upgrade, it is vital to not lose sight of the larger picture. Lighting serves a purpose — namely, supporting the organization's mission. Many product options exist, and managers need to appraise them compared to the organization's long-term goals. A lighting professional can help narrow down the product options to a manageable few.

Another critical first step is to become fully informed on current code requirements affecting the project. For example, in the Midwest, where energy code adoption has been considerably slower compared to other parts of the country, managers often are stunned to discover the practical implications of new code requirements. They might be accustomed to minimal analog automatic lighting controls, while new codes essentially require multiple layers of digital automatic lighting controls in most space, including the exterior.

When evaluating lighting product options, managers tend to compare first costs. Unfortunately, these costs represent only a part of the bigger picture. The life-cycle cost or total cost of ownership are much more thorough metrics for comparing the value of various systems. At the very least, a proper life-cycle cost will include the initial upgrade cost,

By understanding lighting product options and carefully considering installation strategies, managers will be better able to quantify upgrade results meet organizational goals.

PHOTO: MARK DE LA FUENTE

energy costs, and the maintenance costs over the system's performance life.

Where applicable, managers should include utility rebate programs in the life-cycle-cost analysis. It is worth noting that rebate programs have rules that organizations typically must follow carefully. For example, buying products before the rebate program has reviewed and accepted a project could disqualify the project. Submitting a project too soon or too late also could disqualify the project. Finally, someone needs to provide the required rebate documentation associated with the rebate program, and the project manager needs to ensure the designated parties are aware of their responsibilities.

Utility cost structure also affects a life-cycle-cost analysis. While it is tempting to use a simple cost per kilowatt-hour (kWh) when calculating energy costs, rate structures sometimes are more complicated. For large services, the cost per kWh typically is the sum of several costs, including base fees, taxes, gradated energy costs, and demand charges. Gradated fees and demand charges deserve special attention.

On the plus side, lighting upgrades typically reduce the overall electrical demand on a service, while on the downside, lighting energy savings typically skim off the top on a gradated cost structure where the kWh are worth less. What matters is that the team clearly understands the rate structure in effect so managers can calculate realistic savings.

The life-cycle-cost analysis also needs to address maintenance reduction. Having a conversation with the design team about this issue is invaluable because the facility manager has firsthand knowledge of the cost of replacement products.

One study for an Illinois college offers a good illustration of this issue. The sports facility used metal halide high-bay fixtures and was equipped with an expensive floor. While the owners were paying a premium for obsolete replacement ballasts — which was the reason the study was conducted — it took a minimum of eight hours to replace a lamp or ballast

because of difficulties accessing the lights. Without a dialogue with the owner about the replacement process, the life-cycle-cost would have overlooked these replacement costs.

Facility managers also must be careful they do not overstate maintenance costs for existing systems and understate them for new systems, particularly with the new misleading adage that LEDs last forever, which is not true.

One aspect of lighting often overlooked during renovations is emergency lighting. Typically, existing emergency lights are in poor condition or were never designed to meet current life safety codes. When upgrading lighting in a space, managers should include emergency lighting in the review so it is part of the renovation not just a costly change order later.

Installing a small emergency lighting inverter rather than separate standalone batteries or emergency lighting units offers additional cost savings and aesthetic benefit. Not only is one inverter easier to maintain compared with many scattered batteries, but with added functionality, these inverters can tie into the building automation system (BAS) to communicate alarm conditions.

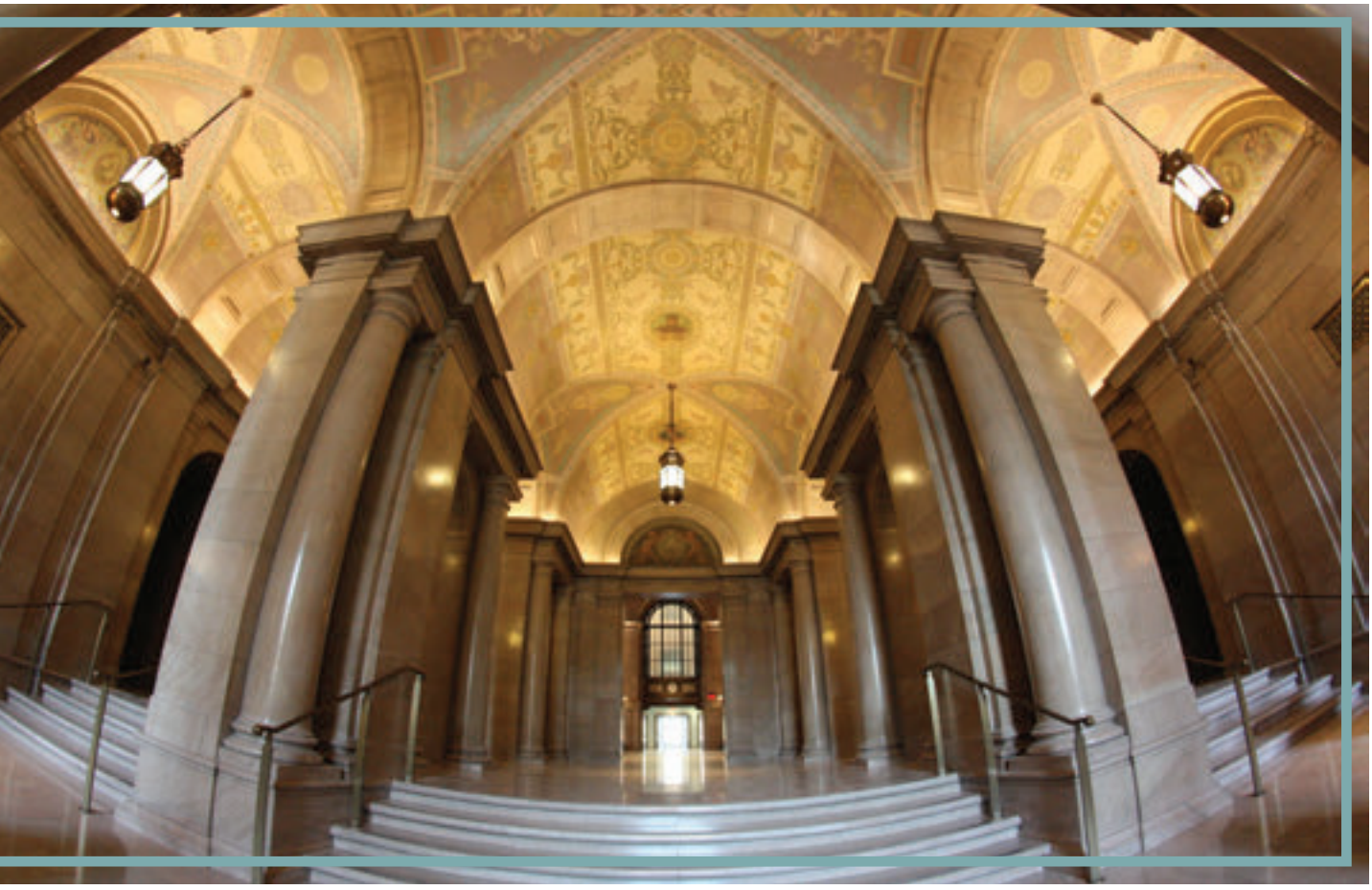
Lighting plays a crucial role in the way building occupants and visitors perceive a space, but it is impossible to quantify soft costs associated with one product or lighting system over another in any life-cycle-cost analysis. The clear winner on paper might leave occupants unhappy for a reason that managers cannot quantify on paper. Light fixtures often look different after installation than in the marketing brochure or on the website.

Once managers have narrowed the options, they should put aside the numbers and construct mockups to make side-by-side comparisons of products. Typically, lighting representatives are willing to provide samples of light fixtures so a manager can mock them up to help make the final purchase determination.

After this comparison review, fixture costs often become much less important. This issue is especially true when the ultimate goal is user satisfaction with the installation and avoiding subsequent complaints. A mock-up is a proven strategy for getting decision makers into the process who otherwise might not be fully engaged. This facilitates evaluation based on appearance is a critical metric for a successful lighting upgrade.

Installation insights

Once a lighting upgrade project is bid and the contract is awarded, the challenging task of making it a reality begins.



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To help managers determine the performance of a lighting upgrade, technicians can use handheld meters to measure the energy use of individual light fixtures before and after the upgrade.

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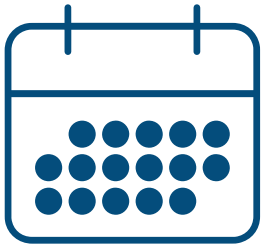

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Often, with lighting upgrades, these projects must proceed while the facility remains in operation. Depending on the facility, this makes phasing and planning more difficult than with wholesale renovations.

Managers need to set project schedules realistically. Careful consideration of space availability, project magnitude, and product lead times must be part of this process.

When evaluating lighting product options, managers tend to compare first costs. Unfortunately, these costs represent only a part of the bigger picture.

Keep in mind that some lighting products can have lead times as long as 12 weeks. And since lead times do not start until the manufacturer has approved shop drawings, obtaining lighting products might require elongated timelines, especially when the initial shop drawings are rejected and resubmitted for review.

For projects that need to be completed quickly, managers should consider using only products on manufacturers' quick-ship programs. These products often have limited options but can arrive in less than two weeks after approved submittals.

Quantifying upgrade results

Paradoxically, quantifying the upgrade results is both the most difficult and easiest part of the process. If the installation looks good and operates as intended, and if the users appear satisfied, then managers can chalk up the project as a success.

But determining if a lighting control system is really operating as intended can take time, and if the project was predicated on energy savings, confirming and documenting the performance can be a challenge. For this reason, a good commissioning agent can be a vital part of project close-out. The agent can document the way the building is performing and identify issues or deficiencies to address prior to the contractor's departure.

To aid in determining the lighting upgrade's performance, technicians can use handheld meters to measure the energy use of individual lighting fixtures before and after the lighting upgrade. Since the lighting controls and their effect on the mechanical systems affect overall building energy consumption, a more wholistic approach to evaluating energy consumption is to add electrical submetering, which can be logged over time. With a more thorough picture of the way the building is operating, it is possible to assess the true energy performance of current and future system upgrades.

Successful lighting upgrades require accurate and complete design documentation from the start, realistic expectations about the results prior to construction, and having open communication during construction to work through issues that arise.

In some cases, managers can deliver more successful upgrade projects with the help of outside experts. When children are sick, parents take them to the doctor. When people plan for retirement, they talk to a financial advisor. And when a roof incurs a hole from the neighbor's fallen tree branch, the response is to call a roofer.

Likewise, when a lighting upgrade is in consideration, not contacting a lighting professional would be a mistake. Lighting professional services range from simple studies to full-blown plan and spec projects thru construction. Certified lighting designers and registered professional engineers typically are unbiased and sell knowledge, not products. ■

Mark de la Fuente, P.E., is a lighting designer with Mazzetti, www.mazzetti.com. His 18-plus years of experience include interior and exterior lighting analysis and design for function and aesthetics, daylighting analysis, LEED lighting design, and power systems design. He has designed for a variety of building types, including airport, educational, medical, commercial, and cultural facilities.

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Institutional Facilities Projects

Big Challenges, **Bigger Benefits**

Upgrades to Orange County, Fla., facilities overcome scarce resources and geographic challenges to deliver financial benefits

By Dan Hounsell, Editor-in-Chief

Orange County, Fla., faced a dilemma in 2012 that is familiar to maintenance and engineering managers: Many of its more than 400 facilities were showing their age, maintenance costs were rising, and resources to address the issues were getting thin.

"Rising energy consumption, increased utility demand charges and rates, and excessive wear and tear on (mechanical, electrical and plumbing) systems were causing a major drain on finances," says Richard Steiger, the county's facilities manager. One option was to 'do more with less,' as many departments have had to do. Steiger and his department looked for answers elsewhere.

"A decision was made to create a plan to determine a course of action to both contain these rising expenses and build a long-term solution for sustainability," says Steiger, adding that the results of the upgrades have been heartening. "The success rate is greater than we ever thought it could be in that the utilities were reduced so much."

A sizeable challenge

While managers might be able to identify with many challenges facing

PHOTO: RICHARD STEIGER

The 23-story Orange County Courthouse in Orlando was among the high-profile county facilities that underwent upgrades in recent years to improve energy efficiency.

Steiger and his department as they began their upgrade program, Orange County presented one challenge that was particularly tough — distance.

"Not only do we have buildings that range from 10-50 years old," he says. "We also cover 1,000 square miles." The challenges of maintaining and upgrading 5.5 million square feet of space in facilities spread over that many square miles include the logistics of getting people and materials when and where they need to be, as well as the amount of windshield time technicians must put in.

The 163-person department — which has a $35 million operating budget and a $10-14 million capital budget depending on annual approvals — divides the county into five geographical districts, with facilities in each zone offering the department different demands. The zone that includes the county's corrections facilities is especially daunting.

"One of the challenges is the aging infrastructure," he says. "It's a 24/7 operation, and the inmates are really hard on the facility, so we're constantly responding to broken fire sprinklers and clogged toilets. (In the) downtown (zone) with the courthouse, the challenge with that is that the building gets 8,000 visitors a month."

PHOTO: RICHARD STEIGER

Benefits of facility upgrades in Orange County, Fla., included lower utility costs and less overall maintenance, as well as enhanced satisfaction among building occupants as a result of fewer equipment failures.

Taking stock of facilities

With that many facilities over that much space needing so much attention, Steiger and his team faced the task of fully assessing upgrade needs and determining priorities, given their limited resources. They broke the upgrade plan assessment into several components:

Needs analysis. What is the current energy consumption for county facilities greater than 20,000 square feet? "Of the 400-plus buildings, only 14 percent are larger than 20,000 square feet, but they make up 72 percent of the total conditioned space," Steiger says.

Energy assessment. Perform energy audits and sustainability studies for these facilities.

Controls analysis. "Are current building automation systems (BAS) operating at peak efficiency and effectiveness?" Steiger asks. "Does the county have BAS specifications that meet the needs of the buildings?"

Certification and compliance. "Is the department working toward Leadership in Energy and Environmental Design (LEED) certification of facilities? Is the county meeting local, municipal and state codes and recommendations for energy efficiency?" he asks.

Costing and recommendations. How much will the initiative cos short- and long-term? Provide a detailed plan for incremental implementation of the recommended actions.

"First, we took on the high-profile districts to make sure they are where they need to be," he says, referring to county's five buildings over 50,000 square feet, including its courthouse, administration center and internal operations centers.

"Then last year, the city of Orlando passed a new ordinance that required all buildings within downtown Orlando over 50,000 square feet to report their Energy Star ratings," he says. "Immediately, we had to come up with a plan to make sure they were above (a) 50 (rating), which is average."

Projects that produce

The department's upgrade plan assessment resulted in a roster of facility upgrades to Orange County facilities that were designed to maximize the buildings' energy efficiency while judiciously using available resources. The projects included:

- Replace fluorescent fixtures with energy-saving interior and exterior LED fixtures, and seek rebates from utility providers for Energy Star upgrades.
- Establish BAS specifications and criteria, and work with system engineers to tweak HVAC and lighting systems' start-stop times to maximize efficiency and effectiveness.
- Retrofit plumbing fixtures with low-flow devices, as well as automated hands-free sensors.
- Perform life-cycle replacements of chillers, AHUs and other critical HVAC components in facilities with high-efficiency devices.
- Implement computer-assisted facility management software that enables data mining, trend analysis, project forecasting, and asset life-cycle costing, as well as establishing a facility condition index for each county building.

"By 2014-2015, cost savings realizations began to become apparent," Steiger says. "Return on investment indicators showed up in the form of reduced utility bills, meeting budgeted expenses without requesting additional funding for shortfalls, and the utilization of savings to accomplish additional projects.

"Since 2013 the division has received over $15,000 a year in rebates from energy providers. This year, over

$50,000 in rebates will be earned which is the largest the division has ever received."

The bottom line tells the success of the upgrades. As a result of the projects, building utility expenditures fell from $8.7 million in 2012 to $6.9 million in 2017, Steiger says, adding, "We're very pleased with the results. You can see those in the utility data that we've reduced expenditures."

The benefits have gone beyond the bottom line, however.

"An intangible realization came by way of increased customer satisfaction due to a decrease in equipment failures," Steiger says. "And as additional square footage was added to the maintenance inventory, utility costs remained low."

Presentations and projects

Making the case for facility upgrade projects has become more efficient and effective for Steiger, based in part on data he and his team have been able to collect on the success of past projects.

"When I present my capital improvement requests, I have assessments done by engineers, and I use data to justify my projects," he says. "Because I have this available, it makes the process easier.

"From the time I started making budget presentations, they've gone from an hour down to five minutes because I'm prepared. I have my studies that I've done, and usually it sails right through. I work hand in hand with capital projects, which handles our bigger projects. We present our budgets together, and they trust what they're doing."

Steiger also emphasizes the importance of comprehensive product specification in the success of upgrades.

"I have multiple vendors come in for presentations, and I always ask for references," he says. "Then I make the decision with the team. I don't say, 'This is what we're going to do.' All my supervisors get together to see these presentations.

"The new (project) we're doing is magnetic bearing chillers. We've seen some presentations, and we've made some site visits to buildings that have installed them, such as our Orland Science Center. We went out there and personally saw them and looked at the data they gave us."

Broader benefits

In addition to benefiting the organization overall, the upgrade projects in Orange County's facilities also have affected several key aspects of Steiger's department. For starters, in-house staff have been performed some of the work.

"We try to do lighting retrofits in-house as much as we can," he says, adding that in-house staff has handled about 30 percent of the upgrade work, depending in part on workload and project size. "We're just swapping out fixtures and incandescent lamps for LEDs lamps. That's easy for my guys to go in and do. When I get into the larger stuff with mechanical systems, that's where I have to contract it out."

The projects also have enabled the department to address the county's deferred maintenance.

"We have reduced the deferred maintenance backlog, but we still have $6-10 million projected over the next five years," Steiger says. "Deferred maintenance continues to grow, so I needed to find the quickest way I could get work done and pay myself back. In other words, if I did a lighting retrofit, I would see reduced utility bills. So if I save $10,000 a month in utilities, that directly impacts my budget. That's $120,000 a year, and I take that difference to get other work done."

Steiger says he has the data that demonstrate progress.

"I think we're in good shape, and how I know we're doing well is because when I first started with the county, we had a direct labor rate of 40 percent, which means 40 percent of the time we were turning a wrench," he says. "Now we're at 65 percent wrench-turning time. And that's even in the districts that have all that square mileage to cover. That's the barometer I use." ■

As a result of the upgrades, building utility expenditures fell from $8.7 million in 2012 to $6.9 million in 2017

Energy Strategies

Boilers Come of Age

Modular and condensing units, along with advances in controls and remote monitoring, give managers opportunities for savings

By James Piper, P.E.

Boilers represent one of the most significant investments in institutional and commercial facilities. They affect budgets through their first costs, as well as their energy costs and ongoing maintenance and repair requirements. Because of these issues, it is essential that maintenance and engineering managers specify the most appropriate boiler system for the application.

Not long ago, boilers were large units that took up massive amounts of space in mechanical rooms. Some were so large that the building was constructed around them after installation. When these boilers failed, managers had no choice but to have them cut up for removal and walls removed to install new boilers. The resulting costs and disruptions to operations motivated many managers to keep their old boilers operating well past their normal service lives.

Today, managers have options when selecting boilers for new construction and replacements. To make the most appropriate choice, managers first must understand new-generation of boilers.

Making it modular

Building heating systems traditionally have been driven by one large fire-tube boiler. If planners needed redundancy, they added a second boiler of the same size. Large facilities might have used two or more of these large boilers in a central plant, but the concept was the same — large, central boilers.

In single-boiler systems, the practice was to let the boiler cycle on and off as needed to match the building load. It was a simple strategy to set up and operate, but it was not energy efficient. When a boiler — particularly a large unit — cycles on and off, it takes time to bring the boiler up to the desired operating temperature. During this warmup time, the operating efficiency of the boiler drops, wasting energy. Similar losses occur during the cooldown portion of the cycle.

To help overcome these losses, manufacturers installed modulating burners, which allowed output to drop as the heating load on the system decreased. The difference between the maximum boiler output and its minimum output is called its turndown ratio. For example, a boiler whose minimum output is 25 percent of its full load output has a turndown ratio of 4:1. For large, older-generation boilers equipped with this type of control, this rating was fairly typical.

Today, the concept of the large single boiler has been replaced with use of multiple smaller boilers that are no

When specifying new boiler technology, managers should not overlook the importance of technician training to ensure the investment performs and delivers as intended.

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larger than a standard refrigerator. They are easier to install because they are small and light enough to fit through doorways and on elevators to higher floors.

Installing multiple boilers also offers managers the advantage of redundancy. The failure of one boiler or the need to take a boiler offline for maintenance does not mean the entire heating system must shut down.

While redundancy is good, operating efficiency is the most important advantage of installing modular boilers. All boilers are most efficient when they operate at or near full load without cycling. Modular boilers allow the heating control system to bring on only as many boilers as are needed to meet the heating load.

Most modular boilers use operating controls that can modulate boiler output to match the heating load. Staging boilers can roughly match the load, reducing cycling, but modulating the load of one or more boilers that are online can nearly eliminate it, further improving operating efficiency. Conventional, large boilers offer a typical turndown ratio of 4:1. Proper staging and modulation of a bank of modular boilers can produce turndown ratios of up to 100:1.

In facilities using a bank of modular boilers, managers can decide on the boilers that will come on first, those that will be disconnected first during times of reduced load, the way the remaining boilers will be sequenced, the minimum cycle time for each boiler, and the way supply temperatures should fluctuate depending on heating demand and occupancy.

Installing modular boilers requires major changes to the mechanical space in which they are located. Installers will have to change supply and return water piping, and they will have to modify exhaust flue connections and update materials. The resulting improvement in efficiency and redundancy will make the effort worthwhile.

Condensing considerations

In conventional boilers, hot gasses produced by combustion pass through the boiler's heat exchanger and exhaust to the atmosphere. One byproducts of combustion is water vapor, which exhausts from the boiler with the other combustion gases.

Condensing boilers extract additional heat from this water vapor by allowing it to condense to liquid form. Recovering this latent heat of vaporization energy that otherwise would be lost improves the operating efficiency of the condensing boiler to 90 percent or more, which is a full 10-12 percent increase over the efficiency of conventional boilers.

The condensate produced by condensing boilers is slightly acidic, so materials that come in contact with the flue gases must be acid-resistant. In high-temperature applications, aluminum and stainless steel are the most common materials used. In low-temperature applications, plastics such as PVC or polypropylene are used. Both systems require the installation of a heat-exchanger condensate drainage system.

Most modular boilers now are condensing boilers. By using condensing boilers in a modular boiler system, managers can expect an overall increase in operating efficiency of at least 20 percent. While condensing boilers and their installation requirements drive up costs compared to conventional boilers, organizations can recover those additional costs in one to two years in most applications.

By using condensing boilers in a modular boiler system, managers can expect an overall increase in operating efficiency of at least 20 percent

Taking control

Improved operating controls also offer major improvements in boiler performance. Automated staging of multiple boilers, combined with modulating boilers from a central station, ensures that capacity matches the heating load without the need for operators to intervene.

Operators also can use hot-water temperature reset to reduce energy use. By basing the supply-water temperature provided by the boiler system on either the outside temperature or the return water temperature, operators can reduce overall system losses and the frequency of overheating internal spaces.

Small, modular boilers also feature more precise air-fuel ratio controls. To maintain energy efficiency and proper operation of the boiler, it is important that operators maintain the proper air-fuel ratio over the boiler's full operating range. If the air-fuel ratio is too high, the system loses energy through exhaust gases. If the ratio is too low, the combustion produces soot on heat-transfer surfaces that reduces operating efficiency.

Large conventional boilers typically use mechanical linkages to regulate the air-fuel ratio. While they might produce efficient operation under full or near full-load operating conditions, they are not as efficient under part-load operation.

Control systems on today's modular boilers have replaced mechanical linkages with sensor-driven servos that allow more precise control over the entire operating range of the boiler.

Managers should not overlook the importance of training when investing in new boiler technology. Modular boilers, condensing boilers, and new boiler control systems will change the operation and maintenance of a boiler system. For the investment to have its intended impact, those who operate and maintain the boilers must have the necessary training to do so properly. ■

James Piper, P.E., is a national facilities consultant with more than 30 years of experience with facilities maintenance, engineering and management issues.

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Roof inspection programs can be more effective if technicians perform regular roof management, which includes removing debris and cleaning around drains.

Roofing

3 Key Questions on **Roof Inspections**

A comprehensive roof inspection program can help managers hold down repair costs and extend long-term performance

By Michael Spach

Developing and implementing a comprehensive roof inspection plan is absolutely crucial to ensuring the longevity of any roof system. Regular roof inspections will save money over time, and they will prevent unwanted disruptions and downtime.

Such programs can benefit maintenance and engineering managers responsible for deploying workers and materials to keep roof systems in good condition, as well as owners top executives concerned with long performance life and bottom-line benefits. Managers can address the keys to developing effective roof inspection programs by answering three essential questions.

What activities are essential?

Roof inspection programs will be more effective if managers and staff practice effective roof management year-round. Roof management includes such tasks as removing debris, cleaning around drains, cleaning out scuppers, and cleaning the surface of the membrane once a quarter. It is important that workers keep the roof clean throughout the year. Achieving this goal means removing leaves and other detritus that collect on the roof surface, checking for misplaced maintenance materials — tools, screws, fasteners, etc. — and removing foreign materials. Cleaning is especially important for any system that has a reflective surface because dirt and residue can affect the energy impact of the system.

Roofing manufacturers, consultants and contractors can provide facility technicians with key training on the most effective ways to perform basic inspections of different roof systems so workers know what to

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Making Infrared Work

Infrared technology has had a tremendous impact on facilities maintenance, including roof inspections. But as successful as infrared technology can be at detecting roof areas affected by moisture, maintenance and engineering managers must be aware of the limitations of thermal imaging. Variable weather conditions and differences among roof types can make it difficult to use the technology effectively. Working with the right environmental conditions is essential. A lack of solar loading, cloudy night skies, winds, or heavy dew can make it difficult to detect thermal patterns.

On cloudy days, the roof surface does not absorb enough thermal energy to make a capacitance-based inspection possible. Cloudy night skies impede a roof's ability to radiate energy to deep space, making it harder to identify thermal differences. Any wind during the inspection window increases convective cooling of the roof's surface and masks thermal patterns technicians are trying to detect.

As for types of roofs, heavily ballasted single-ply roofs and systems with a second layer of insulation can be challenging because of their complex thermal relationships. Inverted membrane roofs typically are not inspected using thermography.

Perhaps the most insidious limitation is that some single-ply membranes reflect long-wave infrared radiation. Unfortunately, the thermal imager most commonly used on facilities is a long-wave thermal imager, which sees this same wavelength of infrared energy. As a result, heat signatures of warmer adjacent buildings, trees and even the colder atmosphere can make it more difficult for the operator to discern if the thermal pattern is coming from the roof or is a false reflection.

Formal training, combined with support and experience, makes all the difference between success and failure. Roofs are complex structures, and inspections are often performed in less-than-ideal conditions. Technicians must understand the way conditions affect the thermal images they see.

Following proper inspection procedures is essential. Managers should review the standard for conducting roof-moisture inspections, ASTM C1153-97 (2003) the Standard Practice for Location of Wet Insulation in Roofing Systems Using Infrared Imaging. It addresses types of infrared surveys and is available online at www.astm.org.

Managers have many options for thermal imagers, and it is hard to go wrong with most systems. Still, it is important to do the homework, make sure to consider the right equipment specifications, and test several cameras before making the purchase.

— Matt Schwoegler is a building thermographer and infrared instructor with The Snell Group. Don Thurmond joined The Snell Group in 2005 after spending over 35 years with Ford Motor Co., where he established a world-class infrared thermography inspection program, including using infrared technology for roof-moisture inspections.

look for during routine inspections. Unfortunately a roof inspection is ineffective if the person performing the inspection is not familiar with the roof system.

Another central element of effective roof management is to enforce a roof access plan that monitors and controls individuals who have to access the rooftop. By using sign-in sheets, observation records, and follow-up reports after work is completed, managers can ensure that any potential damage to the roof is discovered and quickly addressed. In too many cases, surprises such as cuts, punctures, and tears show up months following the occurrence and effects of water intrusion into the roof system.

These problems can be prevented easily by conducting a follow-up inspection after the technician has completed the work. Technicians should make any such repairs immediately and document the work to prevent further system damage.

How often should we inspect?

Managers need to keep track of four annual milestones that are critically important to the success of any roof inspection program. Trained facility personnel should perform two of these inspections, and experienced personnel with years of professional training in the roofing industry should perform the other two.

The first of these milestones is the monthly roof walk, which should be performed by trained facility personnel and entails a thorough visual inspection of all roof sections. During this inspection, the technician should inspect the condition of each roof section, looking for cuts, punctures, tears, and other physical damage.

The inspector should observe and photograph the general appearance and cleanliness of each roof section, documenting the conditions and noting needed repairs. Immediately addressing any problems reduces the amount of damage to the roof, insulation and decking below.

Keeping a record of every roof walk is an important part of the monthly inspection. Also, as the weather changes, monthly roof walks

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need to include observations regarding ice and snow loads, as well as additional cleaning to ensure drains and scuppers remain free of obstructions.

In addition to monthly roof walks, a technician should perform the same inspection procedure after every heavy thunderstorm or tropical storm, checking the condition of the membrane for damage from blowing debris or high winds.

During this inspection, it is highly probable that any damage may be covered under the owner's builders risk policy, but many insurance carriers have time limits from the date of the storm.

The next milestone occurs later in the calendar year at the six-month mark after the initial inspection. A certified industry professional with extensive experience in the roofing industry, such as a registered roof observer or a registered roof consultant, should conduct this more thorough and intensive inspection. The inspector provides a detailed condition observation, notes trends, and presents a written report with photos. The report provided by the professional roof inspector includes a brief summary of the roof system's condition.

The last milestone occurs at the end of the 12-month period from the initial inspection. A certified industry professional with years of diagnostic experience should perform this inspection, which focuses on the same condition observations as the semi-annual inspection. But the written documentation for this annual inspection should be much more comprehensive and include a five-year budget forecast plan with a detailed report on recommended corrective action.

How do inspections vary by type?

The most effective way to inspect any roof system, according to the National Roofing Contractors Association, is to start around the perimeter of the roof section, looking closely at the outer edge of the roof section, including edge metals, base flashings, and tie-in details. The next step is to focus on rooftop penetrations, which include curb flashings, pipe penetrations, pitch pockets, and hot stacks.

Finally, the inspector should check the field of the roof system from two different directions because while roughly one-half of roof deficiencies occur at the perimeter of the roof system, 30 percent occur around the penetrations, and 20 percent are associated with the field of the roof system. Experts have determined that focusing attention on the most common potential problem areas will lead to a more accurate inspection.

All roof systems share problems, such as physical damage, cuts, punctures, deteriorated sealants, separated seams, loose or open metal flashings, open coping joints, displaced fasteners, and open transition details. But developing a broad understanding of how various types of roof systems differ will improve the accuracy of the inspection.

Built-up. Since all built-up roof systems rely heavily upon the integrity of the ultraviolet (UV) protection of their surface, inspectors should closely examine the following components:

- Check for gravel displacement, where the surface plies are worn or where plies of the membrane are exposed.
- Check the thickness of the surface coating if the system is a smooth surface built-up roof system, looking for coating voids or deterioration.
- Check for splits in the plies of the system where the felts might be exposed.
- Look for any ridges within the system's field where the interplay adhesion has been compromised.
- Inspect the edges of rooftop penetrations and associated flashing.

Modified bitumen. Since all modified bitumen roof systems rely heavily upon the integrity of the granule surfacing to provide UV protection, inspectors should check the following items:

- Check for thin or deteriorated sections of granules.
- Check for staining that might indicate pockets of ponding water.
- Note areas of isolated ponding water, since it is extremely detrimental to modified sheets.
- Check for membrane splits.
- Check for open seams in flashing or field of the roof, as well as low or deteriorated pitch pockets.
- Check for vertical displacement on walls.

Single-ply. Since the integrity of the actual single-ply membrane is very rarely affected, the primary focus of this inspection should be small areas where the bond between the different sections of membrane have separated.

EPDM and thermoplastic:

- Check for open seams in the field membrane.

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Focusing attention on the most common potential problem areas of a roof will lead to a more effective inspection.

- Check for open seams at edge details and flashings.
- Check for low or deteriorated pitch pockets
- Check for damage to the surface from contaminates or any discharge that could affect the membrane.

EPDM:

- Check for deteriorated flashing sealants.
- Check for bridging or vertical displacement on walls.
- Check for signs of membrane depilated elasticity
- Check for deteriorated exposed edge sealants.

Thermoplastic:

- Check for cold open welds.
- Check for damage along membrane seams.
- Check for debris under the membrane.

The most important part of roof maintenance is having an inspection program in place. Large facilities or multi-facility managers will find a roof asset management program especially invaluable in scheduling inspections, maintenance, and overall budget forecasting. Through proper forecasting, managers can project capital needs well into the future, avoiding unexpected expenditures and delays.

A roof system over a building is a valuable asset, though it is often overlooked. Once a roof starts to fail, the repairs can be costly, and the interruption to the facility can be expensive. By inspecting each roof system regularly and providing for as-needed repairs, managers can extend the service life of the existing roof systems and greatly reduce capital expenditures. ■

Michael Spach is a roofing and building enclosure specialist with Smith Seckman Reid in Nashville. He has been in the roofing industry for more than 30 years and has worked as a roofing contractor and a roof consultant. He is a registered roofing observer and a certified level 1 infrared thermographer.

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Green Spaces as **Showplaces**

Utility vehicle use, water conservation and security issues shape manager's decisions in maximizing the appearance and health of parks

By Dan Hounsell, Editor-in-Chief

California is a world away from Michigan in many ways, as Gerald Dobbs found out quickly five years ago.

"It's a very different climate," says Dobbs, park services superintendent with the Cordova Recreation and Park District in Rancho Cordova, Calif. "I'm dealing more with the public because the pubic wants to know what's going on in the parks, and they alert us when they see issues in the parks. That wasn't happening before."

"Before" refers to his previous position as landscape services manager with Michigan State University. The transition from the temperate climate of an Upper Midwest campus to the sunshine of the West Coast has presented Dobbs with unexpected challenges, including a soil challenge created by the Gold Rush and issues familiar to most grounds managers, such as cost-effectively managing an aging fleet of utility vehicles and other equipment as the department's workload expands.

Spotlight on utility vehicles

The grounds equipment issues that Dobbs faces are partly a function of the size of the district, which covers 75 square miles. The district's 38 parks have a total of about 400 acres. To maintain an area this size, the department relies on a fleet of 35 trucks — primarily pickup trucks that move staff and materials among jobsites — and five utility vehicles.

"The utility vehicles are dedicated to specific parks," Dobbs says. "At our major sports center, we have two or three vehicles out there, where it has about 15 acres. We have two (vehicles) here at Hagan Park, which is more than 80 acres, and these guys are responsible for picking up litter, cleaning restrooms and drinking fountains, and servicing all the picnic table areas." The department's equipment arsenal also includes two backhoes and front-end loaders, one farm tractor with various attachments, a compact trencher, two large riding mowers and six trim mowers.

Besides the parks, Dobbs also oversees an 18-hole golf course.

"We have a fleet of about 40 golf carts, and the maintenance shop there has four more utility vehicles for use in maintaining the golf course," he says. "We like the utility vehicle concept. They're fuel efficient and maneuverable.

"We want to add at least two or three more units because our district is growing. Since I've been here, which is five years, we've added five new parks. One park we added is about 20 acres, so we're trying to get a utility vehicle to help service that park and keep it dedicated out there. It's not only for our (maintenance) detail guys but for the recreational sports folks because there are four sports fields out there that need to be striped and so forth."

Grounds managers in all types of facilities — but especially those facilities that rely on public funds — understand very well the challenges that Dobbs faces in being forced to extend the performance life of big-ticket equipment as long as possible.

"We've been trying to replace equipment since I've been here, but it's been difficult because of other priorities. So I've been asked to keep these pieces of equipment running for three or four more years. So we'll have to increase

Utility vehicles help technicians with the Cordova Recreation and Park District more efficiently maintain 38 parks covering more than 400 acres.

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our budget for service and supply costs because the older equipment gets, the more expensive repairs become. The equipment just wears out."

The cost of big-ticket equipment often puts new purchases nearly out of reach for many departments.

"To buy (a riding mower) outright, you're talking over $100,000 in California," Dobbs says. "If we look at leasing one on an annual basis with a service contract, it's more cost-effective over a 10-year period versus buying it outright.

"We found out through one of our vendors that we can lease large mowing equipment, as well as smaller units, and have a service contract to go along with it. I currently have only one mechanic. I used to have three mechanics, but we were downsized. That has made repairs very challenging, and we're looking at using outside vendors for things like tire changes and oil changes in order to free up our current mechanic for more technical types of repair work."

Battling vandals

Along with K-12 public schools, public parks face a rash of security issues, including the ongoing battle with graffiti.

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"Graffiti is often used out here as an art form, and some of them are gang-related, whether it's restrooms or barrier walls," Dobbs says. "What we try to do is paint over them by the following day or wash them down. But we have other security issues where we have people breaking into restrooms just to have a place to stay overnight. Many times, they'll damage the doors, and we have to replace the locking mechanism. Or they'll do some damage inside the restrooms, such as to the commodes and the sinks, and then we have to replace those."

To help with graffiti and related issue, the department has brought in outside help.

"What we've done is hire a night security service to come out seven days a week, and they give us a report on what's been happening in the parks. Many times, they'll work with the police department, and if they see something doing down, they'll call the police to make sure we get the situation taken care of.

"That's been a godsend for us. We'll get reports from the security service, and we'll also send our detail guys out — our seasonal employees — and they're responsible for litter control and restroom cleanup. If they see graffiti, they have their cleaning supplies with them. If it's a fairly large piece of artwork, we'll bring out our trailer-mounted steam washer to steam-clean the wall."

Water woes

Many areas of the country have been experiencing water shortages in recent decades, but nowhere it the issue more acute than in California. For Dobbs and his staff, public expectations about the appearances of parks makes the challenge especially tough.

"A lot more people are moving out here, and they expect their lawns to look like they do in the East. We can't have that," he says. "So irrigation is a very big challenge. We've gone through a series of droughts in California, and we're having to monitor our water supply so that we're more effective and efficient. The park district deals with three different water companies. In Sacramento alone, we have about 15 different water companies."

In response to the water shortages, the state of California has imposed tight water restrictions that complicate the issue further for Dobbs and his staff.

"Mandates and restrictions on water use have presented quite a few challenges," he says. "Most of the water that's available goes to agriculture, and the percentage that is left over is shared among businesses and residential areas.

"What the parks have been asked to do is reduce our water use. Three or four years ago, we were under a mandate to reduce water use by 35 percent, which is pretty significant. We were able to do it, but we had to educate the public that the grass in the parks might not be what you're used to seeing all the time. We did prioritize that our recreational fields have more water, and other areas would be downsized in terms of water application."

Dobbs also has turned to technology to help with the water conservation issues.

"The nice thing about (the water shortage) is that it caused us to rethink how we irrigate," he says. "We started to put in flow meters and master control valves, wireless

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Ask the Drain Brains

By Marty Silverman
General Pipe Cleaners

How to clear grease clogs – FAST!

Q: I handle maintenance for a fast food chain and the grease clogs are wearing me out. I clear it with my snake but the clog comes right back. Is there a better tool to clear grease clogs for good?

A: Nothing clears a clog for good, but the best tool to clear grease clogs quickly and easily is a Water Jet. Grease creates what's called a self-healing stoppage. The grease sticks to the walls of the pipe. So when your snake punches a hole in grease to get the water flowing, you haven't really cleared the clog completely.

Water jets are ideal for clearing grease, as well as flushing sand, and melting ice. Jets use a stream of high pressure water that cuts the grease off the walls of the pipe and flushes it away. The thrust of the nozzle drives the hose down the line for wall-to-wall cleaning action.

Electric jets typically offer a maximum of 1500 psi. Trying to get more pressure from an electric motor runs the risk of pulling too many amps and popping breakers. It's better to use a gas powered jet. You get twice the pressure and flow rate of electric jets to handle larger and longer lines.

But beware of trying to convert your pressure washer into a water jet. Jets use vibration to overcome the friction in the pipe and help the hose glide around bends and farther down the line. If you don't have pulse, the hose could get stuck in the pipe.

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controls on each one of our controllers, and we communicate with laptops and iPads or cell phone.

"My irrigation techs can be at home, and they can receive a call that there's a water line breakage. They can isolate the water line and turn off the water via their phone without having to spend an hour or two coming in and then searching for the problem."

Soil strategy

While many of the challenges facing Dobbs and his department are relatively recent developments, one especially tough challenge has its roots — literally — in California's Gold Rush.

"This part of California has some of the poorest soils in the state due to the gold mining that took place here two centuries ago," he says, adding that miners used huge amounts of water to wash away lighter soil components, revealing any gold but leaving cobble stone and gravel. "There might be a little bit of clay in there, but all the topsoil was washed out toward the Bay Area. The soil is definitely the worst in terms of fertility and cation exchange capacity. Every time we irrigate, the water goes straight down into the water table or evaporates, so we lose about 90 percent of the water."

The strategy that Dobbs came up with arose from his time at Michigan State University.

"I worked with a researcher in Michigan to improve the cation exchange capacity of the soil structure to hold the water in place, as well as any nutrition that we put down," he says. "Over the years, we've been aerating the soil and putting down a charged-carbon product and a hemate product and add nutrition on top of that, and we've improved the soil structure."

After four years, the strategy is paying off for the topsoil and for the area's parks and residents.

"Initially, root penetration for the grass was about 1 inch," Dobbs says. "Now, it's down to about 12 inches. We're starting to see the charged carbon go all the way down to the bottom of the root system. We're getting a better stand of turf. In a drought that we had earlier this year, in those areas we treated with charged carbon, 80-85 percent of the park was green compared to the parts that were not treated. Those were totally brown." ■

In recent years, manufacturers have introduced and improved mower safety features that include roll-over protection structures, seatbelts, four-wheel steering and ergonomics.

Supplier Perspectives

Safety First: Ensuring Proper Mower Operation

Mower features and functions can provide safety — but only if operators use them

By Ryan Berlin, Managing Editor

Mowers are the workhorses of many grounds departments in commercial and institutional facilities, where the appearance of turf and landscaped areas go a long way in creating a positive image for occupants and visitors. While many grounds managers understandably focus on such considerations as first cost, versatility, and durability when purchasing mowers that will help them achieve these goals, the safety of operators and mechanics using the equipment daily also should be a high priority.

By focusing on mower features and functions related to safety and understanding training options and needs, managers can provide staff with equipment that ensures their safety and improves their comfort and productivity.

Safety and specification

Over the last several years, manufacturers have made a concentrated effort to introduce and improve features and functions for mowers that address operator safety. Two of the most common safety features incorporated into mowers are rollover protection structures (ROPS) and seat belts.

"Recently, there has been an increased focus on rollover protection," says Tom Vachal wit Kubota Tractor Corp. "Properly installed ROPS and seat belts are critical for operator safety. For the safety equipment to work as intended, the ROPS and seat belt should always be used."

In addition to ROPS and seat belts, manufacturers also emphasize four-wheel steering and ergonomics to address the overall comfort and safety of operators.

"Four-wheel steering improves side hill stability because it allows the operator control of the front wheels," says Josh Sooy with Cub Cadet. "By utilizing 4 wheel steering, combined with the dual rear wheels, an operator can mow slopes all the way up to 25 degrees."

On your standard zero turn mower, "front casters wheel follow wherever the front of the machine wants to go," he says. "If you're on a slope, you're basically using your rear hydros to keep the nose of the machine from drifting downhill because the only control of the machine you have is in the rear. With four-wheel steering, you are actually steering all the wheels together, so it keeps your

front wheels on track instead of letting gravity pull the machine downhill."

Seat belts, ROPS, and four-wheel steering are designed to keep operators safe while operating mowers, but the grind of a full day of mowing can lead to fatigue, which can compromise safe equipment operation. To address this issue of fatigue when operating a mower for up to eight hours day, mower manufacturers are taking steps to address ergonomic and comfort. Their goals go beyond these two issues, though.

"According to the American College of Occupational and Environmental Medicine, Cumulative Trauma Disorders (CDT) contribute to absenteeism and increased healthcare costs," says Brian Schoenthaler with Grasshopper. "Such disorders may include tendonitis, carpal tunnel syndrome and lower back pain.

"Mowers are now designed to increase operator comfort and productivity while reducing repetitive motion, posture vibration, hand exertion and lifting," he says. "Seat features include lumbar support, padded armrests and a footrest. Dual-steering-lever design eliminates foot pedals to push reducing foot and ankle fatigue and provide up to 9 inches of adjustment fore and aft to fit all sizes of operators."

As manufacturers target safety, comfort and ergonomics turn out technologically advanced mowers and grounds equipment, keeping up with the technology and making smart purchasing decisions can be challenging. For these reasons, managers can compare products based in part on national standards designed to improve equipment safety and performance.

"The mower's safety features should not only be reviewed at the time of training but should be checked for proper operation and that all shields are in place before each day's mowing."

"Every mower that is purchased should meet American National Standards Institute (ANSI) regulations and be equipped with a fixed roll-over protective structure (ROPS), including a seatbelt," Schoenthaler says. "The ROPS should never be removed. If a mower is equipped with an optional foldable ROPS, it should never be operated with the ROPS in the folded position. It should also never be operated in that position while wearing a seatbelt. The foldable ROPS is only intended to assist in storage where overhead space is minimal.

"Managers should also look for dampened steering levers that smooth out the ride. Steering levers should return to neutral when the operator lets go of them. When this happens, the mower will safely come to a full stop. The low center of gravity design on some mowers provides

Even after managers have made certain operators and mechanics are familiar with a mower's safety features, they still must ensure their staff use the equipment the way manufacturers intended.

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better handling and stability allowing operators to mow comfortably at all speeds."

Training in the spotlight

While seat belts and ROPS are essential mower safety features, managers focusing on safety and comfort when purchasing new mowers also need to understand the training needs of their operators and mechanics and explore the options for providing staff with the needed training.

"Training should be of paramount importance to the facilities manager," Schoenthaler says. "Every employee should be properly trained, and that training should be documented before operating any mowing or other equipment. Mowers are shipped with an operator's manual that covers training, fuel handling, operating safety and maintenance safety."

Providing the materials is only the first step in ensuring the safe operation and maintenance of mowers. Hands-on experience is essential.

"Managers need to review these items with the employee to assure that they understand how to safely operate the mower for the first time," he says. "Employees should be allowed to practice with the mower in a controlled environment before heading out into the field.

Once the operators and mechanics are comfortable with the mower and its features and functions — especially those specifically related to safety — their next step is to make sure all safety features are functioning properly prior to use.

"The mower's safety features should not only be reviewed at the time of training but should be checked for proper operation and that all shields are in place before each day's mowing," Schoenthaler says. "Take steps to assure that the employee reviews and understands the recommended maintenance schedules. Accurate records need to be kept of all training and maintenance schedules."

Even after managers have made certain that operators and mechanics are familiar with a new mower's safety features, they still must be vigilant in ensuring that their staff use the equipment the way that manufacturers intended it to be used. It is not uncommon for operators to push the limits of a mower's performance and even disable safety features.

"If the specification of a mower says you should never mow above 15 degrees slope, then you should not be mowing above 15 degrees slope," Sooy says. "If the mower is equipped with a discharge chute, then make sure then chute is down. Some landscapers will flip it up because it can improve gas dispersion, but that is a safety feature that needs to be utilized. If a machine is equipped with ROPS, then they are there for a reason, and they need to be flipped up.

"Managers need to ensure that none of the safety features built into the equipment are disabled. There are industry standard safety features that are there for a reason, and a lot of times people will attempt to bypass them. A manager needs to make sure they are all intact and nothing has been modified." ■

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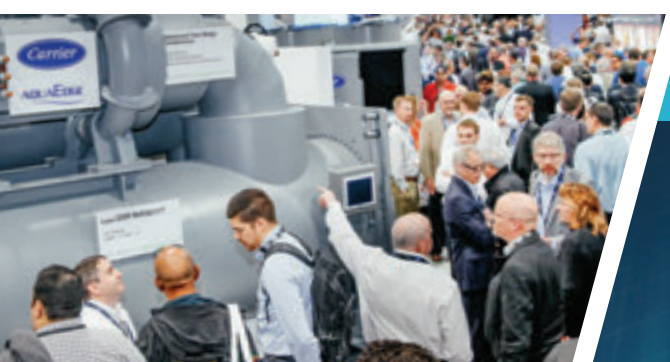

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Building Reports www.buildingreports.com 770-495-1993	19
Custom Manufacturing & Engineering www.custom-mfg-eng.com/sitelites 727-547-9799	12
Duro-Last Inc. www.duro-last.com /downtime 888-359-7365	27
Ferguson Facilities Supply www.fergusonfacilitiessupply.com 888-334-0004	C4
General Pipe Cleaners, Div. of General Wire Spring Co. www.drainbrain.com www.askthedrainbrains.com 800-245-6200	3, 32
Grasshopper Co. gov.grasshoppermower.com 620-345-8621	35
Healthcare Facilities Today www.healthcarefacilitiestoday.com	26
HeatTrak www.HeatTrak.com/FMD 800-630-8991	36
JLG Industries www.CshooseJLG.com 877-JLG-LIFT (554-5438)	C3

COMPANY	PAGE
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B GENERAL PIPE CLEANERS
Pipe thawing machine
Arctic Blast machines can thaw pipes in minutes without tearing up floors or digging in frozen ground. The Hot-Shot 320 generates 320 amps of thawing power to thaw up to 100-foot lines, while the Hot-Shot 400 features dual-level output can thaw frozen lines up to 175 feet long with 400 amps of thawing power. Dual-level output lets users switch to a lower output if a worksite only has a 15-amp breaker.

C MAKITA
Cordless chainsaw
The XCU06Tis powered by 18-volt (V), lithium-Ion, slide-style batteries and features a compact design with less weight. The purpose-built outer rotor direct drive BL brushless motor is engineered for high power efficiency. It has a 10-inch guide bar and variable speed for increased cutting speed and lower noise. For cutting dense stock, users can engage torque boost mode for faster cutting.

D GRASSHOPPER CO.
Riding mower
The 227V-EFI features; a 12cc pump-and-wheel-motor transmission; a 747cc Kohler Confidant electronic fuel injection engine; 5½-inch, extra-deep decks in 52- and 61-inch cutting widths with foot-pedal and drop-pin height adjustment; large turf-style drive tires; and fully-cushioned Cordura-covered seats with padded armrests. The mower provides zero-turn radius to help operators maneuver in tight spaces.

E HUBBELL LIGHTING
Flood lights
The Matrix series of flood and area luminaires delivers up to 60,000 lumens at efficacies exceeding 125 lumens per watt (W). It is designed to exceed the strictest municipal lighting codes. Its environmentally friendly, full-cutoff optic is available in 11 different lighting distributions. The fixture is designed to be a one-for-one replacement for 1,000W HID spider-mount fixtures.

F W.R. MEADOWS INC.
Concrete coating
Pencure OTC is a dual-action, non-yellowing, acrylic curing compound for fresh, exterior, or broomed concrete. The clear and transparent coating has been formulated to simultaneously form a membrane to cure the concrete while penetrating into the surface to prevent water and salt from entering the concrete. The coating is formulated for surfaces such as driveways, patios and parking lots.

DOOR HARDWARE

ASSA ABLOY
Door locks
The HES K20 and KP20 are AAA battery-powered and feature affordable styling and convenience for securing doors, standalone lockers, and sliding and swinging drawers. Applications include lockers at schools, gyms and amusement parks. The locks are backed by a three-year, no-fault, no-questions-asked warranty.

SECURITY DOOR CONTROLS
Electrified mortise lockset


The MLR Z7600 is designed for access control of openings in commercial and institutional facilities that require code compliance, dependable operation, and resistance to physical abuse. The lockset ensures doors stay latched even when unlocked, maintaining fire door integrity. The MLR lockset complies with national building and fire life safety codes for use on fire-rated doors

TYCO SECURITY
Card reader
The Cheetah SE high assurance smart card reader provides tiered authentication levels designed to enable the incremental rollout of PIV-enabled access points, and has the ability to read FIPS-201 based credentials. Using a secure browser connection, users can manage enterprise installations and network-based firmware upgrades from a central location. The card reader also allows users to remotely activate cameras, doors and other events.

Our Take

ADA: Compliance Challenges Remain

Ryan Berlin
Managing Editor
Facilities Maintenance Decisions

Maintenance and engineering managers play a central role in making sure commercial and institutional facilities are safe and secure for all building occupants and visitors. They also need to take steps to ensure the accessibility of buildings as required by the Americans With Disabilities Act (ADA).

I was reminded of the importance of the ADA when I saw that the legislation recently celebrated its 28th year. On July 26, 1990, President George H.W. Bush signed the ADA into law, seeking to prohibit discrimination and guarantee the civil rights of people with disabilities. Twenty-eight years later, cities, states and other affected parties took the opportunity to note their progress and identify challenges that remain.

Nearly 30 years after the law's enactment, some facilities are still not compliant. Managers and building owners often fall back on four misconceptions in seeking to justify their facilities' non-compliance: cost, grandfathering, changes, and complaints.

The life cycle of ADA compliance for institutional and commercial facilities consists of three separate and equally important components: design it right, construct it right, and maintain it right. Managers should consider these common-sense steps to ensure their facilities adhere to these components.

For more on ADA standards and building code insights, visit facilitiesnet.com/14267FMD

Quick Read

For more Quick Reads. visit *www.facilitiesnet.com/site/tips.aspx*

Hospital Boiler Explosion Kills Two, Injures 14

A boiler explosion at a hospital near Waco, Texas, recently killed two people and injured 14 others. The explosion at Coryell Memorial Hospital in Gatesville occurred in a building under construction at the rear of the hospital's campus. The deceased men were working for a subcontractor, and the explosion is being investigated as a construction accident, according to the Waco Tribune-Herald. Natural gas is confirmed as part of the cause of the explosion, according to the Killeen Daily Herald.

Read more at facilitiesnet.com/28-41933

Airport's ADA Efforts Earn Award

The Federal Aviation Administration recently honored Hartsfield-Jackson Atlanta International Airport — the world's busiest — as winner of the 2018 Civil Rights Advocate and Partner ADA/Sec. 504 Award. The award lauded the airport's efforts to enhance accessibility for passengers and guests with disabilities, according to the Atlanta Journal Constitution.

Read more at facilitiesnet.com/28-41917

maintenance alerts

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Campuses Recognized for Sustainability
The Association for the Advancement of Sustainability in Higher Education has released its 2018 Sustainable Campus Index, which recognizes top-performing colleges and universities overall and in 17 sustainability impact areas. The institutions are measured by the Sustainability Tracking Assessment & Rating Systems (STARS). Dickinson College in Carlisle, Pa., Green Mountain College in Poultry, Vt., and the University of California-Irvine were among the overall winners.

Calculator Pinpoints Roof Savings The Roof Savings Calculator was developed as an industry-consensus roof savings calculator for commercial or residential buildings using whole-building energy simulations. An annual simulation of hour-by-hour performance is calculated for the building properties provided based on weather data for the selected location. Annual energy savings reported are based upon heating and cooling loads and thus this calculator is only relevant to buildings with a heating and/or cooling unit.

WaterSense To Become Federal Law
The WaterSense program, a voluntary public-private partnership that has saved more than $46 billion on water and energy bills since 2006, is about to become part of federal law for the first time. The change is included in America's Water Infrastructure Act of 2018, which has passed the House of Representatives and is expected to be approved by the Senate before going to the White House, where the president is expected to sign it into law.

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