JUL/AUG 2019

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FACILITIES manager

+

Using FPI to Improve FM Performance

Impact of Facilities on Student Retention

Benefits of Biophilic Design

New Technologies

Serving the Mission

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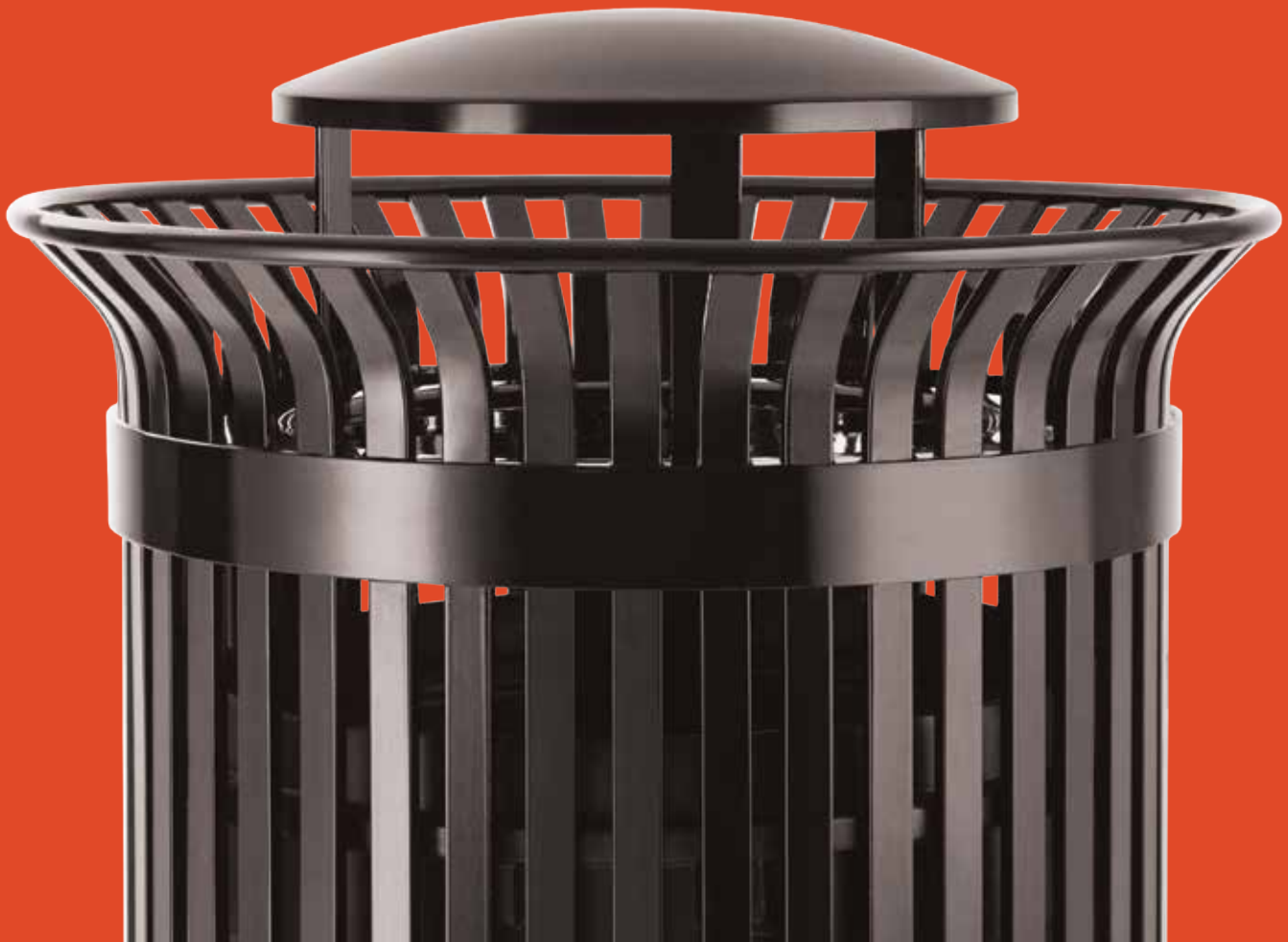

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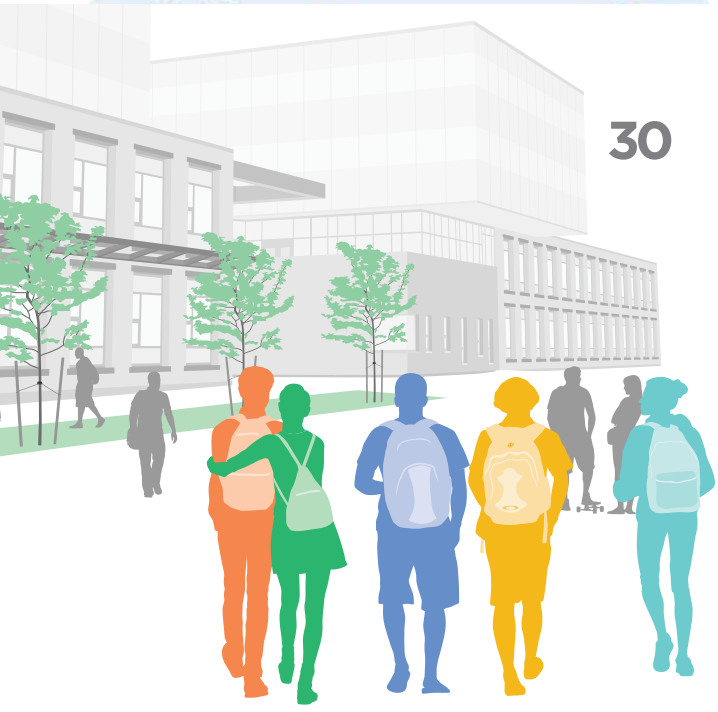

NEW TECHNOLOGIES SERVING THE MISSION

14 Case Studies in FM Technologies

Compiled By Steve Glazner

Included are a baker's dozen of short reports on the creative use of technology in FM: GIS, climate sensors, gaming software, space management tools, and more.

- Adelphi University
- Auburn University
- Clinton Prairie School
- Liberty University
- Northwestern University
- Pennsylvania State University
- Stony Brook University
- University of Georgia
- University of Miami
- University of New Mexico
- University of Tennessee Knoxville
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24 Understanding and Improving FM Performance Using APPA's FPI Data

By Duane G. Hickling

It isn't enough to control costs and provide value. The author discusses the "third generation" of FM performance measurement and explains how the Facilities Performance Indicators help facilities managers to strategize and communicate more creative solutions with institutional leadership.

30 Measuring the Impact of Facilities on UCCS Student Retention

By Brad Johnson, MPA

Both private and public educational institutions are competing with one another to recruit and retain the same students. Student retention and graduation rates are currently among the most discussed topics in higher education. The author shares a case study from his research at the University of Colorado Colorado Springs.

columns

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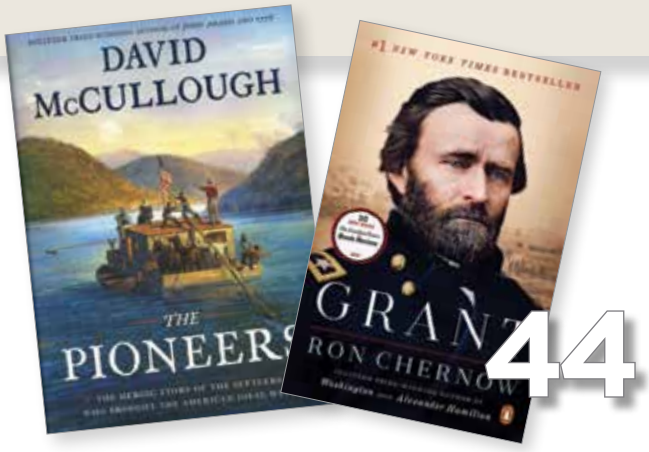

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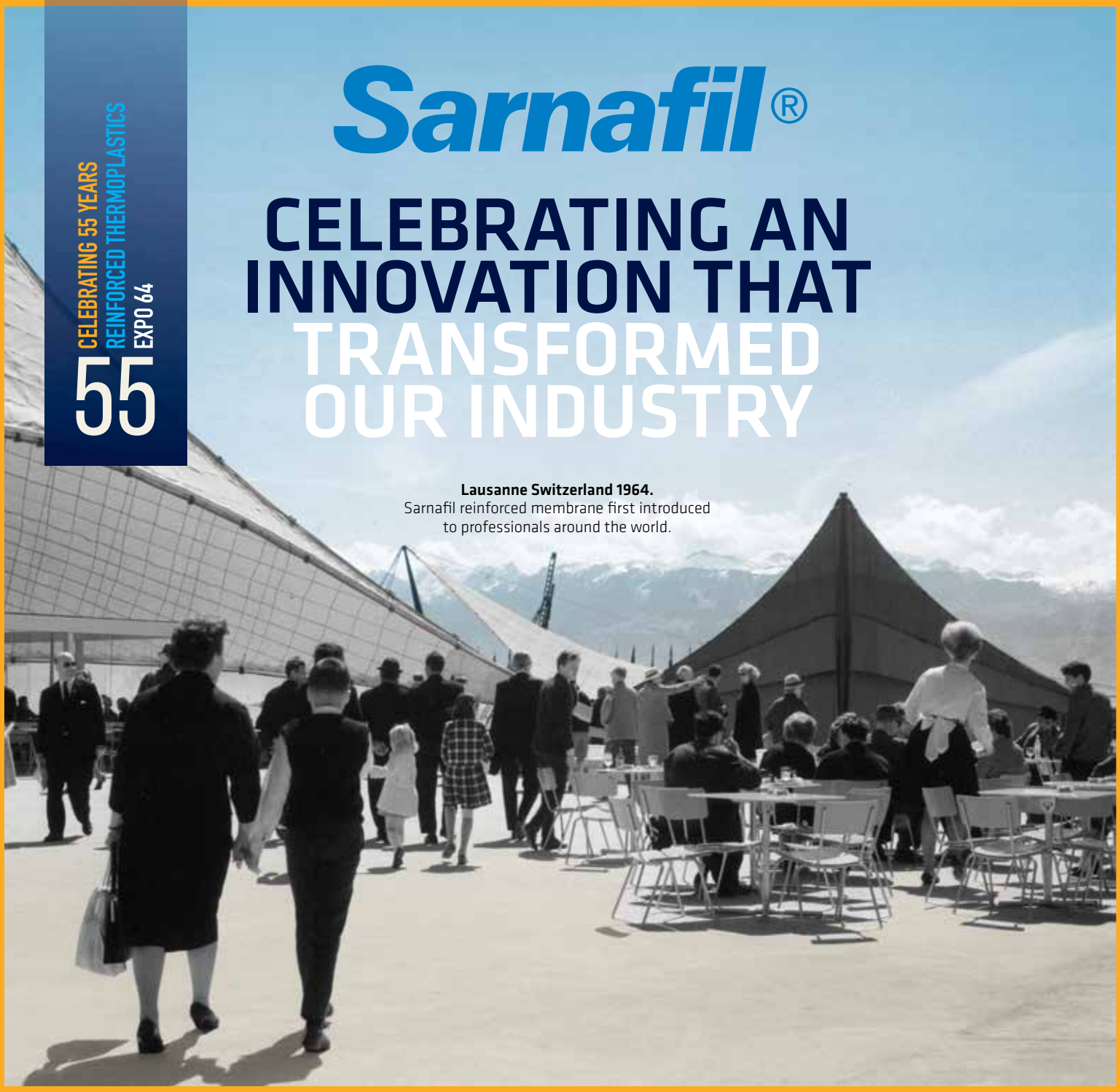

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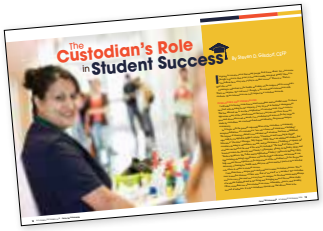
Steve Gilsdorf is the 2019 Recipient of the Rex Dillow Award

We are happy to announce that the 2019 recipient of the Rex Dillow Award for Outstanding Article is Steven D. Gilsdorf for his article, "The Custodian's Role in Student Success," originally published in the November/December 2018 issue of *Facilities Manager*. APPA's Information and Communications Committee, led by Vice President David Handwork of Arkansas State University, made its selection from the seven eligible articles published in the six issues of *Facilities Manager* within the past year.



Since 1987, APPA has presented the annual Rex Dillow for Outstanding Article in *Facilities Manager* to the feature article deemed most relevant, readable, and valuable from the previous year's eligible articles. Gilsdorf, director of custodial building services at Western Michigan University in Kalamazoo, received his award during the Awards Reception at the APPA 2019 conference in Denver, Colorado.

With greater pressures on students and their well-being, Gilsdorf sees the custodian as a key ally in an institution's accountability to the student and the campus community. An excerpt follows:

> The custodian works in every place and sees every face on campus, in the classrooms and hallways of academic buildings and in the living and lounging areas of the residence halls. Often, custodians see where students are more vulnerable, open to, and possibly in need of influence. It is the custodian's special role that allows them to be overlooked—as well as placing them in a unique position to help students in need.

To read the entire article, visit *https://www1.appa.org/FacilitiesManager/article.cfm?ItemNumber=4268&parentid=2731*. Congratulations to Steve on receiving the 2019 Rex Dillow Award. If you have an article, case study, or ideas to share with fellow APPA members and readers of *Facilities Manager*, please contact me directly at *steve@appa.org*. I welcome your contributions.

INNOVATION AND ENTREPRENEURSHIP ARE FOCUS OF 2019 THOUGHT LEADERS REPORT

APPA has just published the 2019 Thought Leaders report, entitled *Innovation in an Age of Disruption*, and made it available first to attendees of the July 15-17 APPA conference in Denver. The free PDF of the report will be available to all members following the conference via the APPA Bookstore and at *https://www.appa.org/thought-leaders-series/*.

Contents of the new TLS report include:

- Key takeaways about innovation and entrepreneurship
- Common approaches to higher education challenges
- Using innovation and entrepreneurship to tackle adaptive challenges
- Applying an innovative and entrepreneurial mindset to higher education's challenges
- Applying the mindset to facilities' adaptive challenges
- Questions for campus discussion

Many thanks to Thought Leaders sponsors Jacobs and Johnson Controls Inc. for their continued support and helping APPA provide the valuable Thought Leaders reports to all at no charge.

COMING IN SEP/OCT 2019

- Profile of President Ruthann Manlet
- APPA 2019 Conference Highlights
- Managing Trees on Campus

FACILITIES manager

President
Donald J. Guckert, University of Iowa

Executive Vice President
E. Lander Medlin, *lander@appa.org*

Editor
Steve Glazner, *steve@appa.org*

Managing Editor
Anita Dosik, *anita@appa.org*

Design & Production
www.touch3.com

Digital Printing
Corporate Communications Group

Editorial Office
703-542-3837
Fax: 703-542-3782

Advertising and New Products
Gerry Van Treeck, 847-347-7851
gvtgvt@earthlink.net

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About APPA
APPA promotes leadership in educational facilities for professionals seeking to build their careers, transform their institutions, and elevate the value and recognition of facilities in education. Founded in 1914, APPA provides members the opportunity to explore trends, issues, and best practices in educational facilities through research, publications, professional development, and credentialing. Formerly the Association of Physical Plant Administrators, APPA is the association of choice for more than 20,000 educational facilities professionals at more than 1,500 learning institutions throughout the United States, Canada, and abroad. For more information, visit us at *www.appa.org*.

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By Anita Dosik

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- University of Alabama
- University of California San Francisco
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- Stanford University Residential and Dining
- University of California Davis
- University of Texas at Dallas
- Virginia Polytechnic Institute and State University

2019 MERITORIOUS SERVICE AWARD

- David Handwork (CAPPA)
- Christopher M. Kopach (RMA)
- Ruthann Manlet (MAPPA)

2019 PACESETTER AWARD

- Ian Hadden
- Kevin Mann
- Thomas Polansky
- Connie Simmons

2019 REX DILLOW AWARD FOR OUTSTANDING ARTICLE

- Steve Gilsdorf

2020 APPLICATIONS DUE NOVEMBER 30

Nominations and applications are now being taken for APPA's 2020 institutional and individual awards. Awards nominations submitted after November 30, 2019 will be held and considered in the 2021 award cycle. To find out details and particulars about each award, visit *https://www.appa.org/institutional-awards/* or contact Kristin Witters at *kristin@appa.org*.

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APPA's Webinar Series

APPA's free monthly webinar series keeps its members informed and connected in the world of facilities. APPA began offering the 1-hour webinars in the summer of 2017, and have had over 12,000 people attend them so far!

Additionally, APPA has issued over 2,000 continuing education certificates to attendees, and is an AIA Continuing Learning Units (CLUs) provider for AIA credentialing programs when appropriate.

APPA offers the following continuing education credits for these webinars:

- .1 CEU
- PDH
- LU
- 1 APPA Credential Unit

If you have questions regarding certificates, or past and upcoming webinar sessions, please contact Billie Zidek, standards & codes administrator, at *billie@appa.org*.

Upcoming Webinars

July 11, 2019 – *Proactive vs. Reactive – Building Envelope Maintenance*

August 22, 2019 – *APPA Grounds Guidelines*

September 10, 2019 - *Carbon Monoxide Detection: Frequent Question and Code Updates*

September 19, 2019 – *Z358.1 – Emergency Shower and Eye Wash Station Requirements*

October 10, 2019 – *Cybersecurity on Campus*

October, 2019 – *APPA Maintenance Guidelines*

December 12, 2019 – *Design-Build: What education facility officers need to know*

December 19, 2019 – *APPA Custodial Guidelines*

Visit *https://www.appa.org/webinars/* to get details and register for any of these upcoming events!

CALENDAR OF EVENTS

APPA Events

Sep 8-12, 2019
APPA U—Institute for Facilities Management, *Nashville, TN*

Sep 10-12, 2019
APPA U—Leadership Academy, *Nashville, TN*

Sep 25-27, 2019
Academy on Campus: Level 2, *Rhodes College, Memphis, TN*

Oct 15-17, 2019
Academy on Campus: Level 1, *Aims Community College, Greeley, CO*

Nov 12-14, 2019
Academy on Campus: Level 2, *Woodward Academy, College Park, GA*

Regional Events

Sep 16-18, 2019
RMA 2019 Regional Meeting
Banff, Alberta, Canada

Sep 29-Oct 2, 2019
ERAPPA 2019 Regional Meeting
Erie, PA

Sep 29-Oct 1, 2019
PCAPPA 2019 Regional Meeting
Las Vegas, NV

Sep 30-Oct 3, 2019
CAPPA 2019 Regional Meeting
Winnipeg, Manitoba, Canada

Oct 6-9, 2019
SRAPPA 2019 Regional Meeting
Hosted by Northern Kentucky University, Covington, KY

Oct 13-17, 2019
MAPPA 2019 Regional Meeting
Mall of America, MN

For more events and programs, visit *www.appa.org/events*.

Making the Most of Your Membership and Professional Development

By Timothy P. Dobson, CEFP

Programs that give back to the APPA membership have been the central focus of the Membership + Community Engagement Committee in our recent meetings. We have dedicated quite a bit of time to reviewing the programs that add value to our members, and the APPA professional development offerings were at the top of our list. We recognize that the professional development of our employees is and should be a high priority for all of our member institutions. Our challenge as facilities professionals is to balance professional development expenditures with other institutional financial priorities.

APPA has many professional development offerings that can help mold members into seasoned facility management professionals. Facilities professionals can attend a wide variety of training opportunities including:

- The APPA Institute for Facilities Management
- The Leadership Academy
- Supervisor's Toolkit

APPA also has a credentialing program called the Certified Educational Facilities Professional (CEFP), and is able to pair new members with seasoned professionals for mentoring. Each of the APPA programs can work as a stand-alone, or you can group them together to develop a professional development plan. The APPA Institute and CEFP credentialing program complement each other.

In the Institute, you obtain the fundamentals based on the sessions given in each of the four tracks: General Administration, Operations & Maintenance, Energy & Utilities, and Planning Design & Construction. Instructors refer back to the APPA Body of Knowledge, which is the guidebook for the 13-week online CEFP examination cohort groups.

All regional chapters offer scholarships to the Institute and discount coupons for the CEFP credentialing program. APPA is committed to helping members obtain the CEFP credential. If you are unable to pass the exam, you are allowed to sign up to participate in another cohort session and retake the test for free, provided you do so within 30 days of the fail date. You can even take the test more than once—more information is available on the credentialing website at *https://www.appa.org/credentialing-examination-faqs*.

My background was in federal government facilities management, and while I already knew something about facilities, attending the Institute definitely helped me become proficient in managing higher education facilities. The CEFP credential is the "icing on the cake." This program is taught by APPA members who share their knowledge and experience with other facility management professionals. I have benefited from these programs and recommend that anyone with aspirations of advancing in education facilities work these courses into their professional development plans. The CEFP credential adds credibility to my decisions and demonstrates my commitment to higher education facility management.

The Leadership Academy is designed for APPA members who are committed to improving their leadership skills. The program is divided into four, three-day tracks that focus on (1) individual effectiveness, (2) interpersonal effectiveness, (3) managerial effectiveness, and (4) organizational effectiveness. Committing to improving your leadership skills is the first step to success in the Academy.

Actively participating in the group exercises and discussions will help you grow as a leader. As they do for the Institute, many regions offer scholarship opportunities for the Academy. For institutions interested in taking larger numbers of their leadership team through the program together, APPA has developed the Academy on Campus program to provide a local training opportunity. Hosting an Academy on Campus lowers the registration cost and eliminates the travel expenses for each participant. The Academy can be held only for your team members, which allows for a team-building opportunity, or it can be cohosted with another nearby school, which can provide an opportunity to network

with other institutions in your area. Cohosting is away to split the expenses and give your personnel exposure to other institutions. Currently, I am investigating this option in New Mexico. Our institutions are located within 70 miles to 400 miles of each other. Collaborating with other institutions to host a track and split the number of attendees offers a great professional development opportunity for both institutions.

Professional development also includes developing our technical skills and the technical skills of our team members. But factory training comes with a premium price tag and limits the number of personnel an institution can send. One way to bring professional development to your campus is host a Facilities Drive-In Workshop. These are local events conducted by an APPA Business Partner that furnish an opportunity to engage your state chapter or APPA region. Our business partners are integral members of the APPA team; they will step up and customize a training course that meets your needs.

Finally, professional development can be delivered in the form of mentoring. What better way to improve your skills than by talking with a seasoned facilities professional? We all face similar challenges, and there are many members who are willing to share their experience. I have had some great learning experiences working for Glen Haubold, past CAPPA president, and interacting with David Turnquist, past RMA president, during my short career in higher education facilities management. These gentlemen have made a profound impact on my career and helped guide my APPA journey. Their influence was also instrumental in my decision to sign up as an RMA Fourteener and to become a mentor.

Active participation in APPA's international, regional, and state levels will help our organization grow. We are fortunate to belong to an organization that wants to give back to the membership. The professional development opportunities are reasonably priced and designed to help participants succeed. I encourage everyone to take full advantage of these opportunities.

Tim Dobson is executive director of operations at New Mexico State University in Las Cruces, NM, and the PCAPPA rep to the Membership + Community Engagement Committee. He can be reached at *tdobson@nmsu.edu*.

Next-Generation Environments for Learning: The Benefits of Biophilic Design

By Paula Meason

An indirect experience with nature can be achieved through the selection and placement of materials to mimic elements of nature.

Technology reigns supreme in today's society. In fact, according to a 2018 Nielsen Report, the average adult interacts with a television, computer, tablet, or phone for 11 hours each day, streaming video content, scrolling through social media, browsing the Internet, communicating with family and friends, and more.

As technology becomes an ever-increasing presence in our daily life, questions surrounding the potential negative impacts from excessive exposure continue to surface. Prolonged screen time is associated with lower cognitive function, depression, impaired vision and headaches, irregular sleeping patterns, and higher rates of obesity.

Technology's influence on education is more apparent than ever, affecting students' personal and learning environments. College lecture halls are often tech-enabled, allowing students to interact with their teachers through online programs on their laptops, tablets, and smartphones. While the effectiveness of technology in the classroom is still up for debate, its prevalence is undeniable.

Although overexposure to screen time is inevitable for students, facility managers can help negate some of its negative side effects by reconnecting students to nature through the use of biophilic design elements on campus.

WHAT IS BIOPHILIC DESIGN?

Despite the modernization of the built environment, all human beings have a "built-in" connection to nature, called "biophilia," or a love of life or living systems. The practice of biophilic design takes this innate connection into consideration, drawing upon natural influences to provide the end user with the psychological and physical benefits of connecting with nature.

Designing educational facilities with nature in mind results in increased student health, productivity, and well-being, improving performance and creativity. Nature's restorative properties create a positive habitat for end users, making the classroom a place that students want to be in.

A recent study found that built spaces that include natural elements improve end user well-being by 15 percent, productivity by 6 percent, and creativity by 15 percent. In addition, student attention span is greatly improved, allowing for increased concentration. Students' speed of learning increases by more than 20 percent when they are exposed to daylight; optimizing daylight exposure is an easy design element that can be incorporated into almost any space.

When the elements of biophilic design are successfully established, end users experience sustained

Windows can provide students with a direct experience to nature and natural light.

Interface's Simple Abstraction collection carpet tiles support wayfinding to ease navigation.

engagement with nature, an emotional attachment to particular settings and places, and positive interactions between their community and nature.

ACHIEVING BIOPHILIC DESIGN

Finding success with biophilic design can be achieved through three design strategies: Direct experience of nature, indirect experience of nature, and the experience of space and place. These three design strategies can be applied in any built environment.

A direct experience with nature can be achieved through the use of water, light, plants, and air. Implementing the practice of biophilic design can begin with the simple steps of adding plants to learning environments and integrating natural light. Classrooms can also be adapted to expose students to the natural world through the creative use of windows.

An indirect experience of nature can be achieved by incorporating nature photography as well as nature-inspired materials, colors, patterns, and forms. Integrating products that take on biomorphic forms,

including natural variance such as leaves on a forest floor, or those that utilize natural geometric patterns, such as spirals, fractals, or tessellations, creates comfortable spaces that establish a connection to the natural world. These patterns can be incorporated through pathway and hallway design, structural design, and fabric, flooring, and other finishes, easily integrating nature into built environments.

SUPPORTING THE STUDENT EXPERIENCE

Educational facilities can support a student's connection to their learning environment by taking cues from the school's surrounding geography and integrating the outdoor space into the overall facility design, layout, and material selection. Through these considerations, the barriers between the students and their outside environment are removed. Students are then able to interact with their environment depending on their needs, allowing for space that is more conducive to studying, working, and interacting with others.

For example, the concept of organized complexity, which is based on the theory of intelligent design, is associated with feelings of connection and coherence. Wayfinding, or spatial problem solving, brings feelings of comfort when users can understand how to freely flow between connected spaces. When the two principles of organized complexity and wayfinding work together, end users feel they have opportunities that allow for organized exploration.

Following these steps, universities can create spaces that foster student growth and positive experiences across all facets of campus life, encouraging productivity, creativity, overall wellness, and increased interaction between students. Through biophilic design strategies, educational facilities can offer their students the flexibility to collaborate with other students, embrace creative ideas, and expand their knowledge of new topics that pique their interest.

Paula Meason is an education and corporate segment expert at Interface, located in Atlanta, GA. She can be reached at *paula.meason@interface.com*. This is her first article for *Facilities Manager*.

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Case Studies in FM Technologies

From geographic information system (GIS) applications to climate sensors for library collections, from innovative HVAC and greenhouse gas (GHG) upgrades to space management tools and the use of gaming software and artificial intelligence, the breadth and depth of technologies available to educational facilities professionals has grown exponentially in recent years. APPA members are applying incredible technology and ingenuity to address facilities issues both old and new, and they are evolving to find the best solutions to serve their institutions' mission and goals.

Following are just a few case studies related to the use of technology in the campus or school setting. These pieces have been submitted by campus innovators as well as our leading business partners in technology, and they barely scratch the surface of the innovation and creativity occurring right now within the education enterprise.

Compiled by Steve Glazner

ADELPHI UNIVERSITY

Garden City, New York

Submitted by Laziza Rakhimova, Regional Marketing Manager, Ecosystem Energy Services
lrakhimova@ecosystem-energy.com

CREATIVITY IN ENGINEERING

Educational institutions across North America are looking for ways to upgrade assets and reduce their campus energy consumption and GHG emissions. Many have set ambitious targets, such as 50% GHG reduction by 2025. Achieving these goals within tight financial constraints is challenging. However, there are solutions. Adelphi University is located on Long Island, New York. With a single project, the Adelphi campus was able to reduce their GHG emissions by 30%, increasing resiliency and energy independence. After project completion, campus yearly energy bills were reduced by 40%, resulting in an eight-year payback period on the project. Adelphi University had aging equipment in need of replacement. In addition, Hurricane Sandy had underscored that the municipal electrical grid could not always be relied upon. The project addressed these asset renewal and resiliency issues. All of this was accomplished (GHG reduction, asset renewal, resiliency, and energy bill reduction) by considering and improving Adelphi's entire energy system through implementation of combined heat and power (CHP) technology within the deep energy retrofit project.

AUBURN UNIVERSITY

Auburn, Alabama

Submitted by Dan Whatley, P.E., Director of Maintenance *(wdw0013@auburn.edu);* and Shanda Foster, Director of Information Technology *(slf0015@auburn.edu)*

DATA ANALYTICS INCREASE SPEED AND ENHANCE SERVICE

For years, the facilities management team at Auburn University has been working toward becoming increasingly data driven. Recently, the operations team has made great strides with the implementation of a data analytics tool, Qlik. With Qlik, zone and shop supervisors can produce dashboards providing up-to-the-minute information that can be filtered in hundreds of combinations with a click of the mouse. Qlik users can quickly search and manage hundreds of work orders, easily identifying and assigning work based on age, priority, building, status, technician, trade, and many other categories. The convenience and speed with which data can be obtained has helped eliminate work orders from being lost in the system and allows supervisors to balance workloads and track performance. In addition to reporting on work order data, the facilities team is leveraging Qlik to visually report on campus outages, construction projects, facility condition assessments, and many other data points. Although the team has been inputting these same data points for years, Qlik has empowered them to use this data to make informed business decisions, resulting in increased service levels to the campus community.

CLINTON PRAIRIE SCHOOL

Frankfort, Indiana

Submitted by Jennifer Payne, Performance Infrastructure Account Executive, Johnson Controls
jennifery.payne@jci.com

CREATING A BETTER LEARNING ENVIRONMENT WITH DISTRICT-WIDE TRANSFORMATION

Like many school districts, the Clinton Prairie School Corporation (CPSC) recently faced the daunting task of addressing aging infrastructure on a limited budget. To address necessary district-wide exterior and interior building updates that would provide a more efficient, productive, and comfortable environment for students and staff, CPSC turned to Johnson Controls. Improvements totaling $4.7 million included the installation of LED lighting, building control optimization, and a new energy dashboard monitor, among other upgrades. These upgrades were enabled by an energy performance contract, allowing the district to utilize the guaranteed savings realized through the energy and building efficiency updates to offset the cost of the projects. With final project components completed in March 2019, CPSC can make an immediate, positive impact on their environment and bottom line. Implementing energy-efficient and connected building systems ensures that the district will continue on a successful path far into the future.

LIBERTY UNIVERSITY

Lynchburg, Virginia

Submitted by Andrew Pack, Vice President, Athletics and Education Practice Leader, Woolpert
andrew.pack@woolpert.com

USING GAMING SOFTWARE FOR STADIUM RENOVATION

Woolpert used gaming software to create visualizations to help the client better understand the firm's 2017 renovation of Liberty University's Williams Stadium. The software allowed stakeholders to experience design options, make informed decisions, and reach a consensus on the proposed $32 million project. The visualizations provided a sense of realistically moving through the finished space by enabling the client to judge the widths of the concourse and plazas. Architects for the project said they used three types of software to illustrate how design changes impacted sightlines and circulation, two crucial aspects of stadium design. Lumion provided fast and intuitive animations as well as 360-degree panoramas, which could be easily sent to the client. Fuzor created an avatar to walk through spaces and visualize what it would be like to sit in any seat. Revizto allowed the client to click on a drawing or detail for a 3D view. Because the software resembled a video game, the design process was accessible to the client and contractors. The format also allowed collaboration through the Internet in real time, enabling the client to virtually walk with engineers and the construction manager through the building rendering.

NORTHWESTERN UNIVERSITY

Evanston, Illinois

Submitted by James Abbott, Facilities Manager, University Libraries
james.abbott@northwestern.edu

TECHNOLOGY PROTECTS THE UNIVERSITY'S COLLECTIONS

Hygrothermographs and data loggers have long been used in libraries, museums, and elsewhere to monitor temperature and humidity levels in archival storage environments. More recently, sensors that connect to building WiFi networks have been introduced to the market. Along with the capability of storing data for staff to review, these new sensors can be accessed by computer or smartphone 24/7, and they offer notification services when user-defined ranges are exceeded. At Northwestern University Libraries, with help from our IT department, temperature and humidity sensors were recently purchased, configured, and installed in collections storage spaces to help with maintaining our more critical areas where rare books and other one-of-a-kind

items are housed. Multiple employees have been given access, and in a few cases, notifications have been delivered when temperatures creeped up a bit in certain spaces. The related software allows for a high level of customization for our particular requirements. When a notification goes out, connected staff receive text messages and/or emails. Upon receiving a notification, fast communication with our campus facilities units ensures that prompt attention is given to HVAC or other issues.

PENNSYLVANIA STATE UNIVERSITY

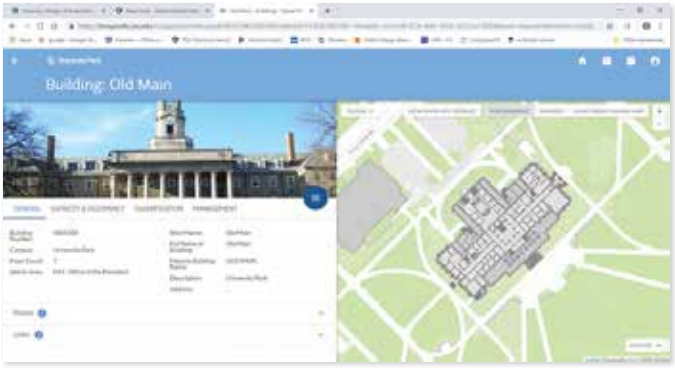
University Park, Pennsylvania

Submitted by Pamela Garbini, CEFP, LEED-AP, Assistant Director Space Management, Penn State (*pwg3@psu.edu*); and Richard Koochagian, R.A. FMP, COO, PenBay Solutions, LLC (*rkoochagian@penbaysolutions.com*)

USING TECHNOLOGY TO GET THE MOST OUT OF YOUR EXISTING SPACE

Penn State's Space Planning & Management (SPM) division has the responsibility for planning and managing facility use and needs so that the university can provide the necessary environments for its campus community. To enable both a better understanding and more effective utilization of the university's 90,000-plus academic spaces across its 24 campuses, SPM decided to implement a scalable enterprise system that would support the sustainment and sharing of accurate facilities data. Branding the platform LionSpaceFIS, SPM implemented PenBay Solutions' InVision enterprise software to serve as the system of record for all university spaces. An intuitive web-based application, LionSpaceFIS allows staff to easily update, analyze, and report on space data, as well as access floorplan, building, occupant, and ADA information. With 300-plus active users, university facility coordinators use the system to maintain the official space inventory within their respective administrative unit, which is then used to track key performance metrics and feed roll-up reports for management review, planning, and decision-making.

Processes and reporting that used to take months and could not guarantee accurate information can now be performed on demand and provide reliable data from which to efficiently manage existing space as well as support capital planning efforts.



STONY BROOK UNIVERSITY

Stony Brook, New York

Submitted by Joan Behan-Duncan, University Media Relations Coordinator
joan.behan-duncan@stonybrook.edu

STONY BROOK LAUNCHES NEW INSTITUTE FOR ARTIFICIAL INTELLIGENCE DISCOVERY

In May, Stony Brook University officially launched the new Institute for AI-Driven Discovery and Innovation to advance AI research and apply the transformative power of innovation driven by AI across disciplines. The AI Institute will focus on four grand challenges: healthcare, infrastructure, education, and finance. It will also focus on five foundational research areas: automated and scalable knowledge acquisition, predictive intelligence, explainable AI, trustworthy AI, and ethical AI. The institute will support efforts centered on the overarching vision of human–machine symbiosis, based on the idea that AI technology should amplify human intelligence instead of replacing it. In this way, it will serve as an intellectual hub to coordinate and encourage faculty AI research and educational initiatives across the university and beyond. "The goal of this initiative is to foster innovative collaboration across departments and verticals to bring together teams of students who are early in their educational journey—from engineering, humanities, and a wide range of other disciplines—to tackle important and challenging projects that will have real societal impact through technology and entrepreneurship," said Samuel L. Stanley Jr., president of Stony Brook University.

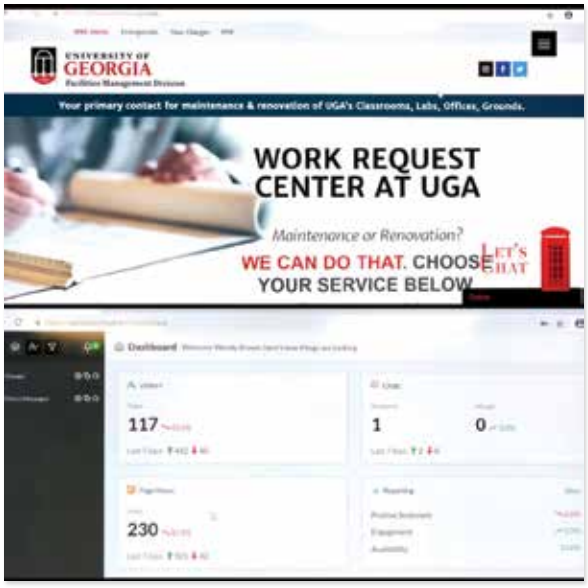
UNIVERSITY OF GEORGIA

Athens, Georgia

Submitted by Daltavion Almond, Work Management Specialist (*daltavion.almond@uga.edu)*; Wendy Brown, Work Management Specialist (*wendy.brown@uga.edu*); and Kimberly Thomas, Director of Facilities Management (*kjohnson@uga.edu*)

TAWK CHAT FEATURE FOR IMPROVED WORK CONTROL

Tawk (*www.tawk.to*) is an online chat feature used in the Work Request Center at the University of Georgia (UGA). The chat feature is used to free up communication lines so the maintenance dispatchers have more time to respond to calls with more urgency. We went live with this feature on September 3, 2018 and have had 172 calls. Two customer service representatives monitor the chat line during normal business hours, and the average time spent on chats is four minutes. The customer service representatives can monitor and track a customer's navigation of the site, which results in quicker response times. It also saves a transcript of the interactions between the customer and staff member to be used later for analysis purposes. It offers the ability to add notes to chat tickets that prompt staff members to know when an issue has been resolved, helping to avoid duplication of work. There are both free and paid versions of this feature; however, our targeted goals with the online chat system can be met using the free version. Since implementing this feature, Housing Work Control at UGA has reached out to us inquiring about executing their own unique chat system.



HARNESS THE POWER OF IOT TO ENHANCE LEARNING FOR LEADERS OF TOMORROW

Submitted by Gloria Rose, Director, Enterprise & Channel Partnership Sales, Tapdn
gloria.rose@cort.com

Connected devices have changed the way we live, work, and learn. The ever-evolving tech landscape has created a barrier-free, connected world, simplifying our day-to-day lives in ways we couldn't have imagined just a decade ago. In fact, new technologies have emerged that use sensors to provide unbiased data to help facilities managers understand their current space and asset needs on campus.

With these advancements, they can make informed decisions based on objective data regarding their furniture and real estate, enabling professors and students to get the most out of their learning environment. Investing in IoT (Internet of Things) platforms that use minimal-footprint wireless sensors helps acquire and analyze real-time data—including space utilization, utility, and asset usage.

Students, by using an app, can see availability of study rooms and meeting spaces and book them in real time. New technologies provide hard data on which spaces and assets are being utilized and how. To optimize operations, colleges and universities now have the ability to make confident, data-based decisions on how to allocate key resources.

UNIVERSITY OF MIAMI

Coral Gables, Florida

Submitted by Eli Stephan, Associate Director, Facilities & Operations; Dennys Bayona, Manager, Facilities & Operations; Ana Quintana, Senior Business Systems Analyst; and Joseph Westwright, Business Systems Analyst *(jwestwright@miami.edu)*

CONNECTING TEAMS WITH MICROSOFT TEAMS

The Facilities & Operations department at the University of Miami is guided by four service standards: Safety, Caring, Responsiveness, and Professionalism. Recognizing that communication is critical to each of these standards, Facilities & Operations recently began to review its existing communications protocols. In partnership with the Business Systems team, the department identified the greatest areas of opportunity and decided to implement the Microsoft Teams communication platform to realize those opportunities. Within a one-year period, Teams was rolled out to over 150 employees in facilities across the university. On a day-to-day basis, each individual maintenance team from general building mechanics to fire technicians communicate with one another, their managers, and the Facilities Work Control center quickly, discretely, and effectively. In addition to daily use, the platform has been integrated into the university's hurricane response plans and has been deployed during multiple large-scale building exercises. With a 24/7, 365-day-a-year staffed operation, it is critical to have a reliable platform that allows facilities to better serve the university community in a timely, fruitful manner. Microsoft Teams has made our teams nimbler and more interconnected with one another and has allowed the operation to not simply strive for service excellence but define it.

UNIVERSITY OF NEW MEXICO

Albuquerque, New Mexico

Submitted by Donald Swick, Facilities Engineer (*dswick@unm.edu*); and Steve Howe, Public Information Representative (*showe@unm.edu*)

SUSTAINABLE MAKEOVER OF FARRIS ENGINEERING CENTER

Housed in the 50-year-old Farris Engineering Center, the School of Engineering at the University of New Mexico (UNM) faced a steep challenge in keeping up with aggressive sustainability goals and competing for advanced research grants. The aging facility lacked adequate classroom space and had an inefficient HVAC system unable to maintain consistent temperatures and air quality in offices and laboratories. During the 18-month renovation project, UNM Facilities Management engineers worked closely with designers to incorporate the latest technologies in lighting and HVAC systems. Utilization of electrochromatic window glazing helped reduce the need for interior lighting, which, when combined with LED fixtures with wireless occupancy monitors, significantly reduced electricity usage. The enhanced HVAC system utilizes demand control ventilation, a dedicated outdoor air system, and a high-efficiency steam heat exchanger, all leading to improved air quality and thermal comfort throughout.

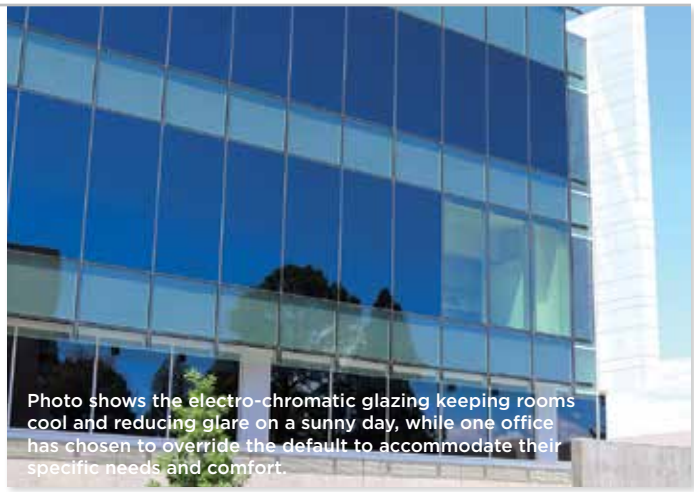


Photo shows the electro-chromatic glazing keeping rooms cool and reducing glare on a sunny day, while one office has chosen to override the default to accommodate their specific needs and comfort.

Photo by Steve Howe

The project has become a benchmark for campus sustainability efforts and has provided an improved work environment for students, faculty, and researchers. The use of the latest technologies helped achieve a 70% reduction in electricity usage and an overall energy cost savings of 32% in the first year, earning the Farris Engineering Center a Leadership in Energy and Environmental Design (LEED) Gold rating.

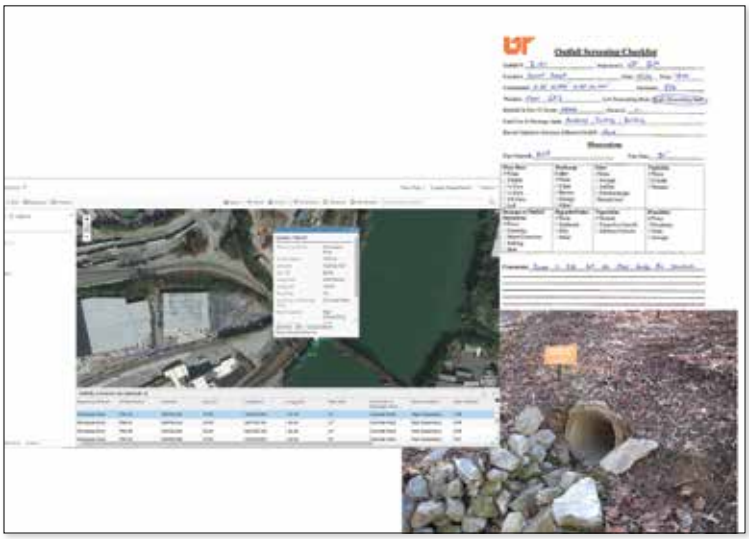
UNIVERSITY OF TENNESSEE KNOXVILLE

Knoxville, Tennessee

Submitted by Maria I. Martinez, GIS Coordinator
mmarti85@utk.edu

IMPROVING THE FIELD DATA COLLECTION PROCESS USING COLLECTOR FOR ARCGIS

The University of Tennessee Knoxville (UTK) Stormwater staff completes a biannual visual inventory of 88 outfalls that discharge into four waterbodies that surround the campus. This inventory is required in order to comply with our small municipal separate storm sewer system (MS4) permit as mandated by the Tennessee Department of Environment and Conservation. During the inventory, staff collects information about conditions at the outfall, such as damage, odor, deposits, blockage, or flow. UTK is using ArcGIS and Collector for ArcGIS to streamline this task in the field by removing the manual process of collecting field data on paper forms that must be returned to the office and then translated into other formats. A map for the project



was first created using ArcGIS, which included a form designed to complete the outfall screening checklist by stormwater staff in the field. This map was then loaded into our ArcGIS Online administrative account, which allows the information to be accessed in the field using smart devices. This process increases accuracy, helps eliminate recording errors, and reduces the time needed to collect the information, while increasing the speed at which that information can be put to work.

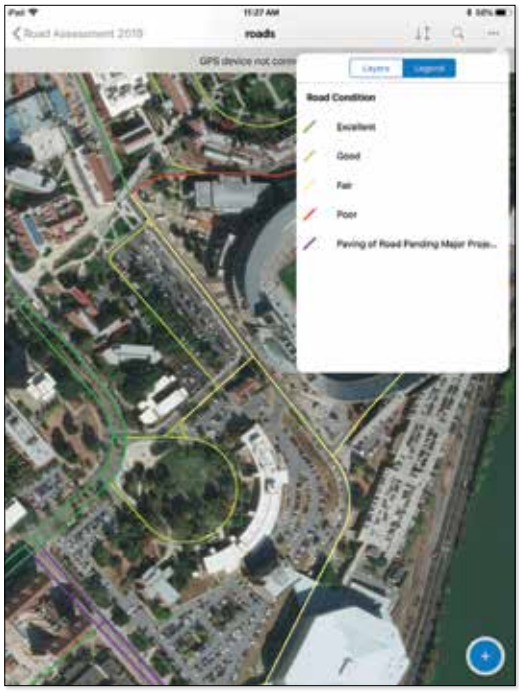
UNIVERSITY OF TENNESSEE KNOXVILLE

Knoxville, Tennessee

Submitted by Maria I. Martinez, GIS Coordinator
mmarti85@utk.edu

ASSESSING CAMPUS ROADS USING COLLECTOR FOR ARCGIS

The UTK campus is located on the outskirts of downtown Knoxville, bounded by city-owned properties. The 15 miles of roads running through campus, however, are owned by the university. Traffic on campus is continuously increasing due to the rising number of students attending UTK as well as the large number of athletic and cultural events that occur on campus weekly. Increased traffic has an impact on road conditions; during the last three years, the university has been assessing the surface conditions of roads to establish a program for road maintenance and paving. Facilities Services staff is using Collector for ArcGIS to facilitate this process in the field. Criteria ranging from excellent to poor is assigned to each segment of pavement on campus. We use factors such as the existence of potholes, patching, or cracks to determine the condition of each segment of road. Information is loaded into an ArcGIS map before field collection; this map is accessible through mobile devices using the Collector for ArcGIS map. Data is collected in real time, processed, and sent to the university administration in a timely manner. This technology makes the data collection and decision-making process faster and more effective.



UNIVERSITY OF WASHINGTON

Submitted by Aaron Cheuvront, MAPS Systems Manager, University of Washington (*aaronch@uw.edu*); and Richard Koochagian, R.A. FMP, COO, PenBay Solutions, LLC (*rkoochagian@penbaysolutions.com*).

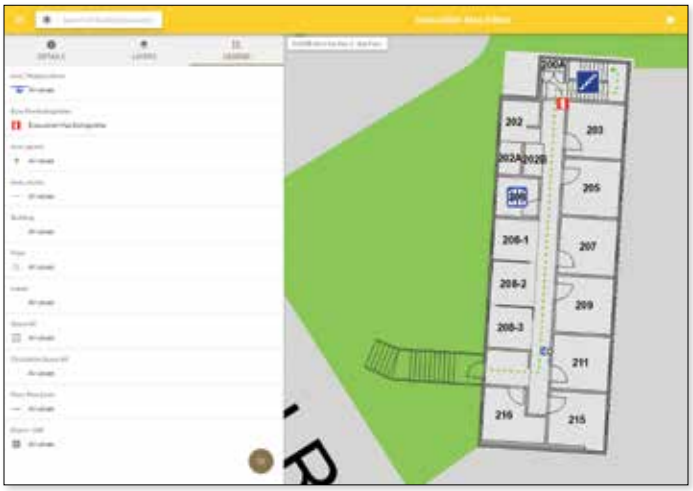
USING TECHNOLOGY TO AUTOMATE EMERGENCY EVACUATION MAP PRODUCTION

Emergency Evacuation Maps are critical to the safety of building occupants but also expensive to produce and difficult to maintain. When the existing evacuation map processes became too inefficient and costly, the University of Washington (UW) Environmental Health & Safety office contacted the UW Facilities GIS team to see if their indoor mapping system could help create a new map standard and reduce the cost.

The GIS team was able to leverage their InVision enterprise software platform from PenBay Solutions Inc. to collect, manage, and print the authoritative evacuation map contents, indoors and out. By collaborating through this singular system, associated data owners from across campus need only curate their map content, which minimizes redundant effort and increases data accuracy.

To gain further efficiencies, the GIS team configured a custom print tool that enables the printed maps to be correctly oriented relative to the wall they are hung on. Users with proper permissions can reprint one or all maps for a building from live data with a click of a button for placement in their respective wall frames.

This simple yet effective innovation has eliminated manual and time-consuming evacuation map publishing processes, reduced cost, and increased timeliness and data accuracy.



Steve Glazner is APPA's director of knowledge management and editor of *Facilities Manager*; he can be reached at *steve@appa.org*.

Many thanks to the schools and business partners who submitted case studies for this feature.

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By Duane G. Hickling

Understanding and Improving FM Performance Using APPA's FPI Data

For more than two decades, the annual APPA Facilities Performance Indicators (FPI) survey has been used by higher education institutions to measure facilities management (FM) performance. APPA has seen the measurement of FM performance in higher education evolve significantly over that time. Many institutions are now in the third generation of FM performance measurement.

FIRST-GENERATION FACILITIES MANAGEMENT PERFORMANCE MEASUREMENT

In the 1980s, the initial level of performance measurement saw institutions asking the question, *"Are we spending enough on our facilities portfolio?"* To answer this question, institutions would look at the spending of peer group averages and measure their own level of spending in comparison to them. Often, spending at the average of a peer cohort group was viewed as adequate.

SECOND-GENERATION FACILITIES MANAGEMENT PERFORMANCE MEASUREMENT

By the late 1990s, progressive institutions were moving into a second level of performance measurement and asking a different question: *"Are we getting full value from the resources committed to sustaining our facilities portfolio?"* To answer this question, institutions compared their facilities less to peer group averages, and instead leaned more toward identified *best practices*. This led FM departments to look at workflow processes and lean management principles. Sophisticated work

"...the exact same...actions that allow the workforce to be more productive are the same things that delight customers."

COMING SOON.....FPI 2.0

APPA is in the final stages of updating its popular Facilities Performance Indicators (FPI) survey and report. The new survey will be powered by Qualtrics, while the report will be powered by Tableau. This powerful combination will offer participants ease of navigation and data entry when completing the survey; and dynamic filtering options enable both mirco and marco results when generating dashboards. Look for the new survey at *www.appa.org/fpi*.

management systems and the implementation of mobile technology could significantly improve the productivity of a workforce by redesigning work processes to eliminate activities that weren't contributing to the accomplishment of that work.

THIRD-GENERATION FACILITIES MANAGEMENT PERFORMANCE MEASUREMENT

The questions driving the first two levels of FM performance measures are valuable and should be addressed, but many institutions are now realizing that it isn't enough to control costs and provide value. The third-generation approach currently being used is entirely different. Education institutions are now asking the question, *"Is our facilities portfolio appropriately sized and adequate to support our institutional mission?"* This question recognizes that the *quality* of building space is likely more important than the *quantity* of space in supporting the academic mission of instruction and research. Maintaining less space can offer significant savings.

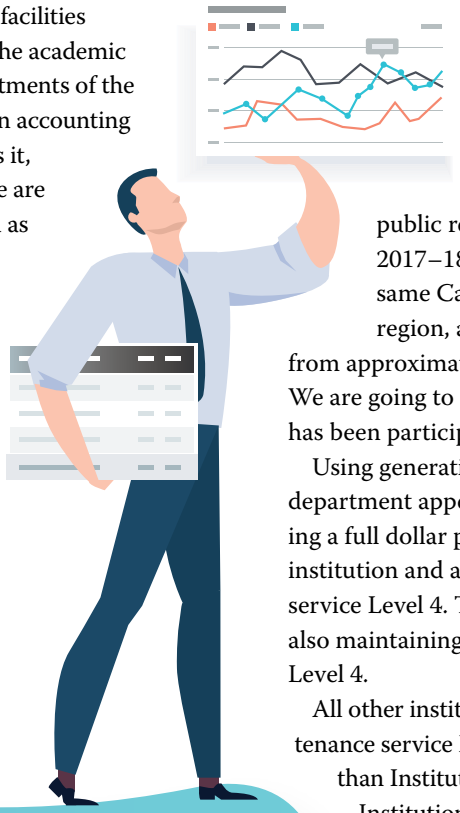
The discussion of identifying alignment of the facilities portfolio (amount of space and its quality) with the academic mission is a discussion that reaches across departments of the institution. The facilities department may keep an accounting of the amount of space on campus, who occupies it, and identify the condition of that space, but there are other departments that assign those spaces, such as offices and laboratories, and schedule classrooms.

The senior facilities officer (SFO) is an important contributor to this conversation. Being able to accurately inform academic leadership regarding the implications and cost of building additional space that may not be extensively used, versus renovating and upgrading existing space, is an important element in the capital decision process.

The FM performance measurement progression to generation three doesn't mean that generation one was wrong. Instead, it suggests that institutions may be requiring a deeper, more sophisticated look at the complexities of measuring the resources needed to own and operate the facilities portfolio. It is becoming necessary to be more analytical, by comparing metrics and even triangulating multiple data points, in order to reveal accurate information regarding the condition and use of the facilities portfolio.

The FPI has a wide range of metrics that can be analyzed and can give a great deal of information about the facilities portfolio and the institutional resource commitment required to support it. It is possible to drill into the data to gather underlying information about the facilities portfolio that may not be initially obvious. We can use an example from this year's APPA FPI database to demonstrate the value of working through the various levels of facilities performance measurement.

GENERATION-ONE PERFORMANCE METRICS ANALYSIS



In our first example, we can start with a generation-one approach in evaluating an institution's funding level to support their facilities portfolio. This is the approach that the FPI database is most commonly used to depict.

Figure 1 is a similar group of large public research institutions selected from the 2017–18 APPA FPI database. They are all in the same Carnegie classification and in the same APPA region, and they range in size of maintained space from approximately 6 to 17 million gross square feet (GSF). We are going to look most closely at **Institution 1**, which has been participating in the FPI for several years.

Using generation-one analysis, Institution 1's facilities department appears to be underfunded. They are spending a full dollar per GSF less than the nearest comparative institution and are delivering only at APPA maintenance service Level 4. The nearest comparative institution is also maintaining the campus only at maintenance service Level 4.

All other institutions are delivering at building maintenance service Level 3, and have 40% or more funding than Institution 1. With this information, the SFO of Institution 1 could make a compelling argument that they are underfunded. Over a period of time, an institution delivering APPA Level 4 maintenance service will likely see frequent systems failures and unscheduled outages, because they will have difficulty completing preventive maintenance on mission-critical equipment. They will also likely be stretched thin enough that service response time for minor repairs will be long and campus personnel may be dissatisfied.

Looking deeper into the data, Figure 2 is a table

DEFINITIONS:

AFOE = Annual Facilities Operating Expenses (does not include any capital expenses).

PU = Purchased Utilities.

Maintenance = Cost of the labor, benefits, parts, materials, and contracts needed to maintain the campus facilities buildings.

APPA Maintenance Service Level = Service levels 1 through 5 as defined by APPA's *Operational Guidelines* publications (1 is best; 5 is worst)

Large Public Research Institutions

Institution	AFOE + PU ($/GSF)	Maintenance ($/GSF)	APPA Maintenance Service Level
1.	$6.63	$1.16	4
A.	$8.39	$3.61	3
B.	$7.94	$2.06	3
C.	$10.34	$1.71	3
D.	$9.36	$2.70	3
E.	$7.63	$1.88	4
F.	$8.07	$1.79	3

Figure 1. Comparison of Annual Facilities Operating Expenses + Purchased Utilities (AFOE + PU), Maintenance Funding, and APPA Maintenance Service Levels.

Large Public Research Institutions

Institution	AFOE per Student ($/FTE)	AFOE + PU per Student ($/FTE)	APPA Maintenance Service Level
1.	$1,673	$2,655	4
A.	$1,059	$1,431	3
B.	$1,299	$1,856	3
C.	$1,296	$1,650	3
D.	$1,314	$2,368	3
E.	$1,282	$2,081	4
F.	$1,281	$2,151	3

Figure 2. Comparison of Annual Facilities Operating Expenses (AFOE) Per Student, AFOE + Purchased Utilities (PU) Per Student, and APPA Maintenance Service Levels.

of the same institutions comparing their AFOE and AFOE plus purchased utilities on a per-student basis. This table gives some insight as to what financial burden each student carries for maintaining and operating the campus facilities.

This data implies a more difficult situation for Institution 1. Here each student's tuition commitment to sustain the facilities portfolio is larger than any of the other institutions in the selected cohort group, in spite of the low per-GSF spending level. This lower cost per GSF and higher cost per student is often a leading indicator that a campus is sustaining too much building space.

This situation is challenging on a number of levels in that a sustained lower level of operations and maintenance services is not going to improve the campus's long-term ability to recruit and retain students. If the students are dissatisfied with their living, learning, and recreational environment, the dissatisfaction will quickly be expressed publicly on social media. That will make it even more difficult to recruit students—particularly in our current environment of overall shrinking enrollment.[1]

A common solution to the problem of poor campus facilities is to build new buildings. Shiny new instructional or recreational space is often seen as necessary to support student recruitment and retention efforts. But, unless an equal amount of older building stock is removed, the additional space will exacerbate the operations and maintenance challenges for institutions in the same category as Institution 1.

The circumstances of Institution 1 are not unique. It is easy to go through the APPA FPI database and find similar instances in other APPA regions and Carnegie classifications. Anyone using the FPI database and looking at only one set of metrics is vulnerable to seeing only part of the problem. Their observations and understanding may be incomplete.

GENERATION-TWO PERFORMANCE METRICS ANALYSIS

Institution 1 has been attempting to address their challenges and has made significant progress. Eight years ago, their investigation into the FPI data led them to understand that even though they were "underfunded" on a GSF basis, their energy consumption was nearly 25% more British Thermal Units (BTUs) per GSF than their public research university peers. This data point brought them to a "generation-two" performance measurement realization—they were likely not getting full value from the resources committed to their facilities portfolio.

Given the size of Institution 1's campus, energy conservation measures could conservatively generate savings in excess of $2 million per year. They have been aggressively pursuing energy conservation to address this problem and have made significant progress. Energy consumption has declined nearly 20% per GSF. The energy savings have been used to improve their spending on maintenance.

Institution 1 has now realized generation three in their use of facilities performance metrics. The SFO has been active in educating campus and academic leadership regarding the cost of space and the need to accurately align the facilities portfolio with the academic mission. **The facilities department no longer refers to their situation as "underfunded." They now label the inadequate resource issue as "overspaced."**

Over the last six years, in spite of national trends showing fewer U.S. students, Institution 1 has grown student enrollment by 9.2%. But, realigning space and institutional mission is hard. The data is showing they are still lagging behind their peers.

AFOE $/GSF for Fiscal Years 2015 through 2018

	2017-18 FY	2016-17 FY	2015-16 FY	2014-15 FY
Satisfied	$6.17	$6.76	$8.02	$5.34
Very Satisfied	$5.55	$5.42	$5.04	$5.24
All APPA FPI Participants	$5.55	$5.34	$5.14	$5.00

Figure 3. Annual Facilities Operating Expenses (AFOE) [$/Gross Square Foot (GSF)] of Satisfied vs. Very Satisfied Campus Customers vs. All APPA FPI Participants

During the same six years of student growth, the maintained space on campus has grown by 19.4%.

It may be easy to suggest a large portion of the space growth was necessary to support growth in the research program. A robust, growing research program has benefits for a public research university. It is indisputable that faculty recruitment and increased prestige through discoveries, patents, publications, and related societal benefits are all important goals of a public research university. But expecting the research program to fully fund campus facilities growth may not be a good strategy. One only has to look at the wide variation in research indirect overhead rates across institutions in the same APPA region to wonder if research overhead reimbursement fully funds research facilities and other related costs.[2]

This discussion in no way questions the value of any portion of the academic mission of an institution. As facilities managers, our role is to fully participate in supporting the institutional mission. We can "fall in love" with our buildings to the point that we lose sight of whether they are providing full value in supporting the mission. The role of FM in managing the institutional physical built environment is much more than construction followed by operations and maintenance funding to support whatever is constructed. **FM needs to provide executive leadership with the information necessary to help avoid a situation where their institution ends up with costly surplus space. Looking deeper than initial cost comparisons is a requirement for understanding the entire situation.**

WHAT IS THE COST OF IMPROVING THE LEVEL OF FACILITIES CUSTOMER SATISFACTION?

Another significant challenge facing FM leadership is responding to the campus's desire to improve customer satisfaction. Almost every FM team has heard complaints from faculty, staff, or students at some point that necessitate the department improve overall customer satisfaction. And often the facilities department's response is, "We would very much like to improve services, have quicker response times, and provide better communication, but we don't have the resources to do so."

The FPI provides cost metrics based on customer satisfaction levels. Many institutions do not complete the customer satisfaction module in the category of "satisfied," so it is worthwhile to also compare the "very satisfied" customer responses to the costs of services across the entire database. What is interesting about this data is how it shows that providing services for "very satisfied" campus customers is consistently less expensive than doing so for merely "satisfied" customers, and is comparable to the *average* of all the APPA FPI participants.

This data feels counterintuitive. How is it possible to improve services without an increase in costs? The answer is that the exact same activities and management actions that allow the workforce to be more productive are the same things that delight customers. Most customers want to know the status of their work orders; they want reliability and predictability from the services they are provided; and they don't want surprises.

Communication can usually be automated (think ability to track work orders in the same way a FedEx package is tracked); and having documented work processes that have been subjected to lean management analysis will allow workers to perform more productively and accomplish work without interruptions. The consistency of a documented workflow will allow maintenance and repairs to be performed in a reliable, predictable manner.

Tracking customer responses and designing service delivery to satisfy customers' desire for work status information and work consistency is one of the best ways to assure that the FM organization is getting full value from their operations and maintenance resources.

Elevating the use of the APPA FPI data analysis from generation-one comparisons to a more complex, sophisticated level of investigation can enable facilities managers to strategize and communicate more creative solutions with institutional leadership.

ENDNOTES

1. U.S. higher education student enrollment decreased from 18.1 million students to 16.8 million from 2010 to 2017. *https://nces.ed.gov/programs/coe/indicator_cha.asp.*
2. "Taking a Hard Look at University Research: Without Transparency, Can We Expect Funders to Foot the Whole Bill?" *https://ssir.org/articles/entry/taking_a_hard_look_at_university_research.*

Duane Hickling is president of Hickling & Associates LLC, Chicago, IL. He can be reached at *dhickling@hicklingassociates.com*. Learn more about APPA's FPI at *www.appa.org/facilities-performance-indicators-fpi*.

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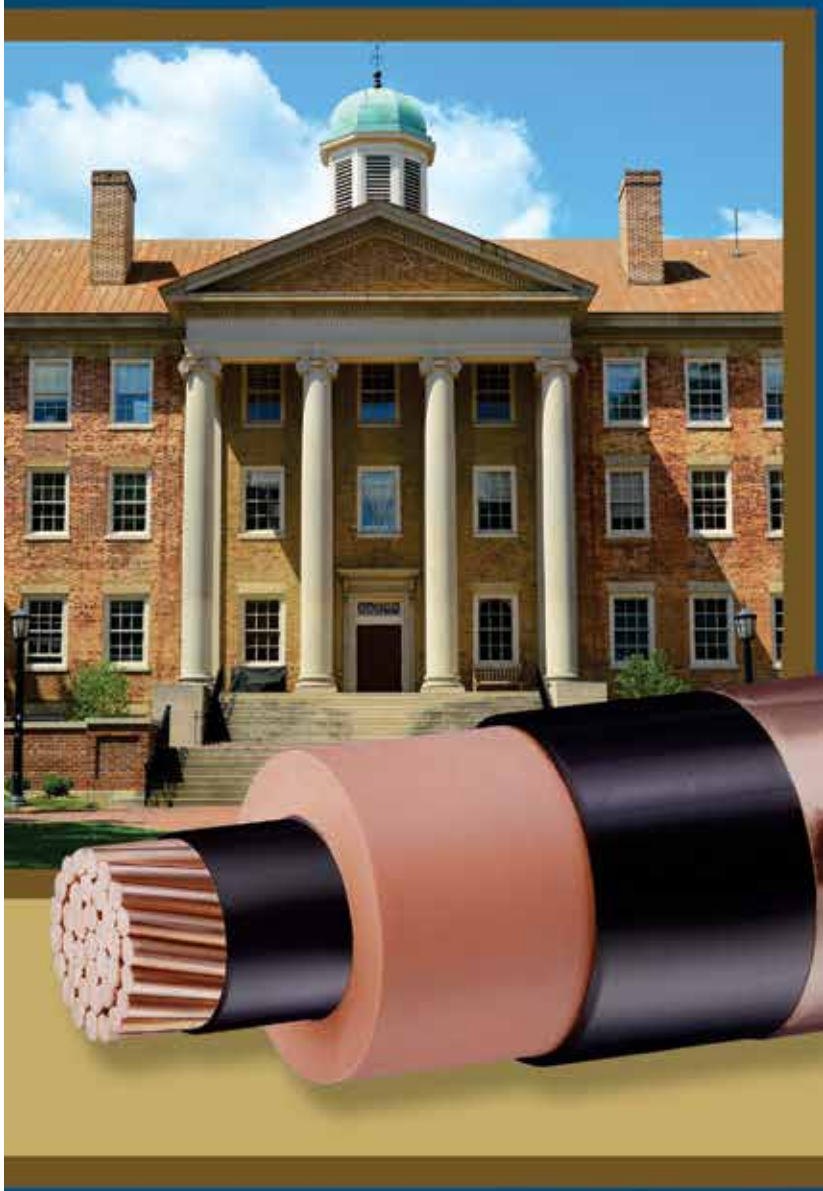

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By Brad Johnson

Measuring the Impact of Facilities on UCCS Student Retention

Today, higher education institutions face competitive challenges that are similar to competitive challenges found in any other market sector. Both private and public higher education institutions are competing with one another to recruit and retain the same students. Student retention and graduation rates are currently among the most discussed topics in the field, and they are critical measures of the quality of higher education institutions. This article summarizes my much larger capstone project conducted as part of my work toward earning a Master's of Public Administration (MPA) at the University of Colorado Colorado Springs (UCCS), where I also work as a facilities services planning, design and construction project manager.

APPA's Center for Facilities Research (CFaR) was established in 2002 to organize and consolidate research in educational facilities management. CFaR is interested in exploring whether the physical campus can help universities achieve their student retention objectives. In 2006, CFaR undertook a study to determine the importance of campus facilities relative to other institutional characteristics and explored various influences exerted by university facilities. This study, entitled *The Impact of Facilities on Recruitment and Retention of Students*, examined the relationship between physical assets and certain outcomes.

This report sought to answer questions such as:

- What factors influence a student's choice to attend a particular higher education institution?
- When and how do students obtain their information about an institution?
- How do institutions' physical facility assets (buildings, grounds, landscape, and other tangible resources) help to recruit students?
- What is the impact or benefit of facilities in the recruitment process?
- What factors influence a student to stay at their original institution of choice?
- What, if any, impact or benefit do facilities have on retaining students?
- Are there demographic differences in the impact of facilities on recruitment and retention?
- Can the physical environment's impact on student outcomes be measured according to a defensible set of hard data?

Other studies have examined the relationships between student performance and classroom size, seating arrangement, acoustics, external noise, indoor air quality, lighting, and temperature.

RESEARCH PROBLEM AND QUESTIONS

APPA wants to update the findings of the 2006 CFaR study and plans to create a longitudinal study using a large sample population of students attending various colleges and universities in the United States and Canada. Now-retired UCCS staff member, APPA Fellow, and past APPA President Gary Reynolds, primary author of the original study, was a mentor through my capstone and research project. I volunteered to help with the new APPA study by developing new survey questions for APPA's consideration and use. I presented these new questions, along with select questions from the 2006 study, to a portion of the UCCS student body.

*For the UCCS population, my **primary research question** will be to determine the following: Is an undergraduate student's decision to stay enrolled at UCCS associated with the existence, design, and condition of UCCS facilities? The **null hypothesis** is that there is no association between student retention and UCCS facilities.*

Currently, there is very little research performed on which environmental and architectural design components of a campus affect a student's decision to stay enrolled. In this research project, I examined whether there was a relationship between these factors, and also focused on the possibility of general causation between UCCS facilities' physical assets and student retention.

To determine which survey questions about classroom and campus characteristics should be asked of the UCCS student sample, I researched several areas, including the maintenance and condition of buildings and grounds, overall campus building design, ADA (Americans with Disabilities Act) accessibility, classroom lighting, classroom temperature, and exterior campus grounds. Below is a summary of each of these key areas:

Maintenance and Condition of Buildings and Grounds

First, we know that the physical features of a campus can either hinder or promote learning. The physical environment, that is the university or college campus, has many roles in the educational enterprise, and includes buildings, grounds, transportation, parking, utilities, open space, recreation, and more. The condition of these environmental factors could certainly influence whether students choose to stay or leave a campus. First impressions are vital selling points for prospective students, and the campus that fails to address them could make a grave mistake. Students seek an environment where they can study, learn, collaborate, and be successful.

Overall Campus Building Design

"Students . . . focus on whether they feel comfortable in the places where they will spend most of their college time, including the library, the student center, laboratories, and other specific buildings" (Orban, 2014). Well-designed campus buildings play a significant role in student recruitment, but creating comfortable spaces for students is not enough. Designing classroom spaces that support learning and collaborating with other students could impact academic performance.

ADA Accessibility

The *Digest of Education Statistics* has reported that of the more than 19 million students in American colleges and universities, 8.7 percent of them, or 1,669,000 undergraduate and graduate students, had disabilities. Many students with disabilities become actively engaged in campus life in a variety of ways, thus helping with the transition between high school and college and incorporation into the life of the college (Tinto, 1993).

Classroom Lighting

Today, there are many ways that a campus can provide lighting in a classroom. Across the UCCS campus, some buildings have abundant natural light, while others have traditional lighting and no windows. Newer buildings are outfitted with LED lighting, daylighting strategies, lighting control systems, and natural lighting.

After the energy crisis of the early 1970s, some schools were designed with no windows to save energy. Research conducted to determine the impact of windowless schools found no discernible impact on test scores. However, research did determine that teachers and students were very dissatisfied, but did not deem the dissatisfaction critical (Baker & Bernstein, 2012). There are buildings on the UCCS campus constructed in the 1970s and 1980s with either few or no windows.

Classroom Temperature

Achieving thermal comfort in a classroom can be complex and challenging. Classroom temperature on the UCCS campus is programmed and controlled through a building automation system. A classroom's temperature can be affected by room size, its location within the building, its temperature design parameters, and the number of occupants using the space. In addition to temperature, human thermal comfort is also affected by humidity, air velocity, radiant surfaces, and clothing and activity levels. It is difficult to work in a classroom or office that is too hot or too cold.

Exterior Grounds of Campus

UCCS is committed to sustaining its campus landscape and open space by developing and implementing practices and educational opportunities aimed at enhancing the aesthetics, function, and natural context of the landscape. Alexander's 1977 study *A Pattern Language: Towns, Buildings, Construction* identifies outdoor walkways, hallways, public gathering areas, and outdoor spaces as contributing to a sense of community.

SURVEY DESIGN

I focused on a quantitative study to produce reliable data for UCCS. I examined the relationship between independent, dependent, and control variables. Due to the limited time our students have available on campus, I created a survey with 18 questions in order to minimize the time needed to complete it. The survey was administered through SurveyMonkey.

SURVEY DATA ANALYSIS

Frequencies:

- *Students Re-enrolling for Fall 2018 Semester*

In asking whether a student intends to re-enroll at UCCS for the Fall 2018 semester, 71 percent responded "Yes." 25 percent responded, "No, because I am graduating." 1 student (1 percent) responded, "No, and I am not graduating." 3 students (3 percent) were undecided. According to the Integrated Postsecondary Education Data System, UCCS has a 67 percent undergraduate student retention rate (IPEDS, 2019). (Figure 1.)

- *Importance of Facilities in Student Decision to Continue Enrollment*

In answering whether they made their decision to continue or end enrollment due to UCCS facilities, 42 percent of respondents stated that facilities was one of their top five reasons to continue enrollment, 55 percent stated that facilities did not affect their decision, and 3 percent stated that facilities was one of their top five reasons to end enrollment. (Figure 2.)

- *Overall Maintenance and Condition of Campus Buildings*

Of UCCS respondents, 22 percent stated that the overall maintenance, cleanliness, and condition of UCCS campus build-

Figure 1: Student Retention

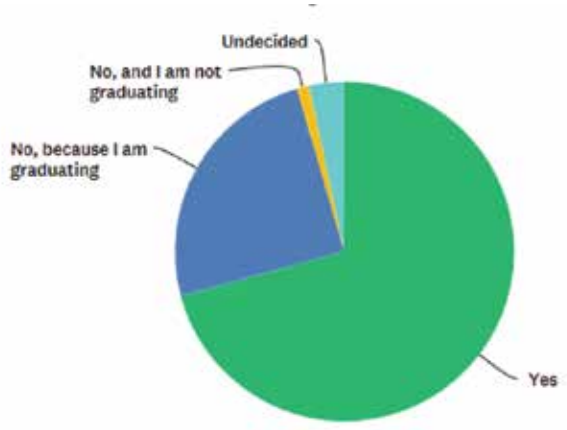


Figure 2: Importance of Facilities for Continuing Enrollment

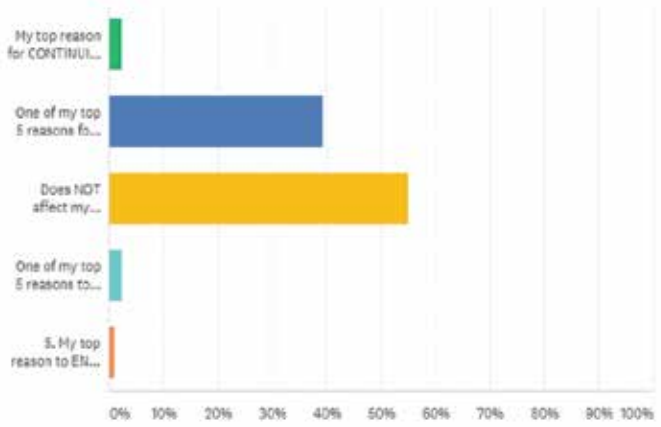


Figure 3: Overall Maintenance and Condition of Buildings

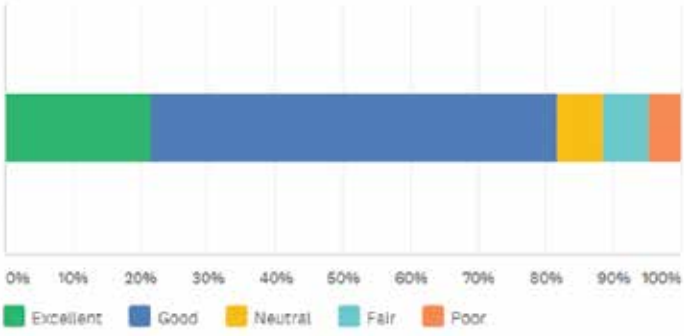


Figure 4: Overall Campus Design

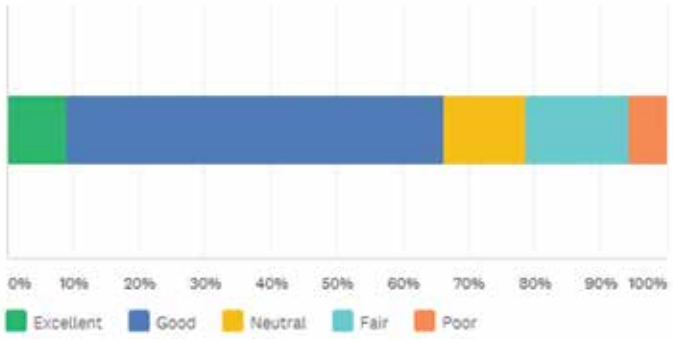


Figure 5: – Overall Appearance of Grounds

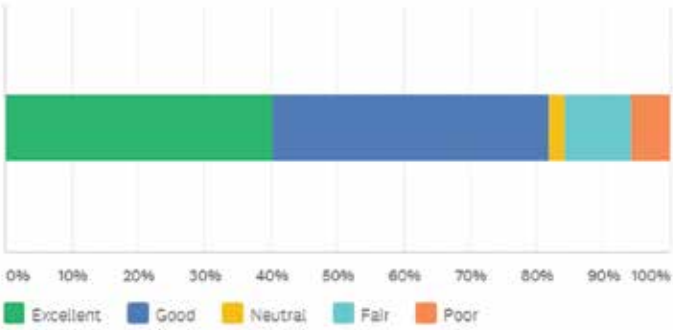
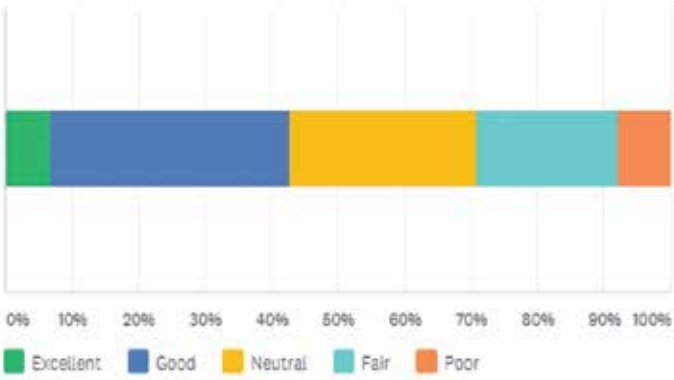


Figure 6: – Overall Campus ADA



ings were excellent, 60 percent stated that they were good, 7 percent were neutral, 7 percent stated that they were fair, and 4 percent stated that they were poor. (Figure 3)

- *Campus Design*

Of UCCS respondents, 9 percent stated that the overall campus design of UCCS was excellent, 57 percent stated that it was good, 12 percent were neutral, 16 percent stated that it was fair, and 6 percent stated that it was poor. (Figure 4)

- *Overall Appearance of Grounds*

Of UCCS respondents, 40 percent stated that the overall appearance of exterior grounds at UCCS was excellent, 42 percent stated that it was good, 2 percent were neutral, 10 percent stated that it was fair, and 6 percent stated that it was poor. (Figure 5)

- *Overall Campus ADA*

Of UCCS respondents, 7 percent stated that the overall campus ADA accessibility was excellent, 36 percent stated it was good, 28 percent were neutral, 21 percent stated that it was fair, and 8 percent stated that it was poor. (Figure 6)

- *Classroom Lighting*

Of UCCS respondents, 9 percent stated that UCCS classroom lighting highly affects positively their ability to learn, 25 percent stated it somewhat affects positively, 39 percent stated that it has a neutral affect, 22 percent stated that it somewhat affects negatively, and 4 percent stated that it highly affects negatively their ability to learn. (Figure 7)

- *Classroom Temperature*

12 percent of UCCS respondents stated that UCCS classroom air temperature highly affect positively their ability to learn, 17 percent stated that it somewhat affects positively, 52 percent stated that it has a neutral affect, 16 percent stated that it somewhat negatively affects, and 3 percent that it highly affects negatively their ability to learn. (Figure 8)

CONCLUSION AND RECOMMENDATIONS

Many factors can influence student re-enrollment decisions. Among such factors are campus facilities impacts on student loyalty, certainty of choice, satisfaction, experiences, learning, and tests and grades. This study does suggest that campus facilities positively factor into many students' perception of campus and their ability to learn in a classroom. However, the strength of relationship between these building, site, and classroom characteristics with student retention was considered weak and not statistically significant.

Because of the limitations of this study, I am cautious about claiming causality between facilities and UCCS student retention. While a future APPA study will be an enormous undertak-

ing, this study will be a step toward helping shape the questions asked of the larger desired population.

The limitations of this study include the survey request being delivered only to those students who have joined the UCCS Connect network, and the small number of students responding. Not all students join UCCS Connect, and there may be a demographic bias toward more successful, more involved students. Getting students to quickly and voluntarily respond without incentives has been difficult. In addition, the students who take the time and effort to respond may also be biased toward the more successful and involved people, compared to the general student population at UCCS.

Another limitation of this study relates to the multitude and variation of campus facilities, a factor that also causes me to be cautious about generalization. In a short survey, it is impossible to determine which specific campus facilities actually impact a student, the frequency of the impact, and the nature of the impact amidst the many different facilities existing on campus.

This study is also limited because of the inclusion of students above the freshman level. Most students who end enrollment do so at the end of their first year. The reasoning of the prior dropouts from previous freshman classes is unknown. However, such inclusion does suggest that many students who chose to continue enrollment consider facilities as part of their decision.

I will be meeting with APPA to further evaluate the findings and how the survey questions could be enhanced for the larger study.

In addition, I would make the following recommendations:

1. Identify a "Campus Ambassador" to assist with facilitation of the survey on each campus.
2. Expand on the list of campus buildings that students take classes in, aside from solely those related to their major. This could help each campus facilities management team to further evaluate how the results affect their own campus.

Figure 7: Classroom Lighting

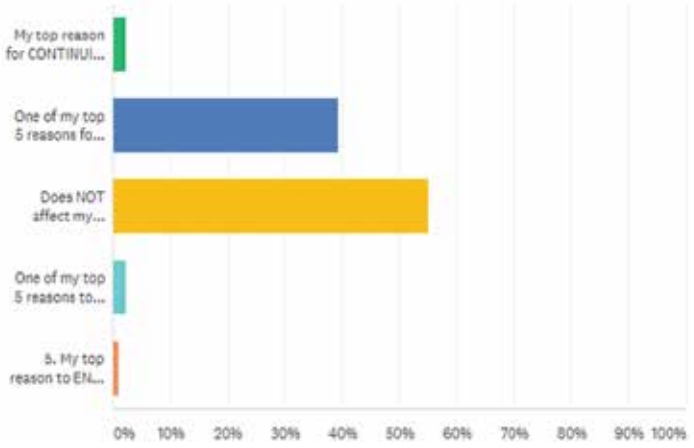
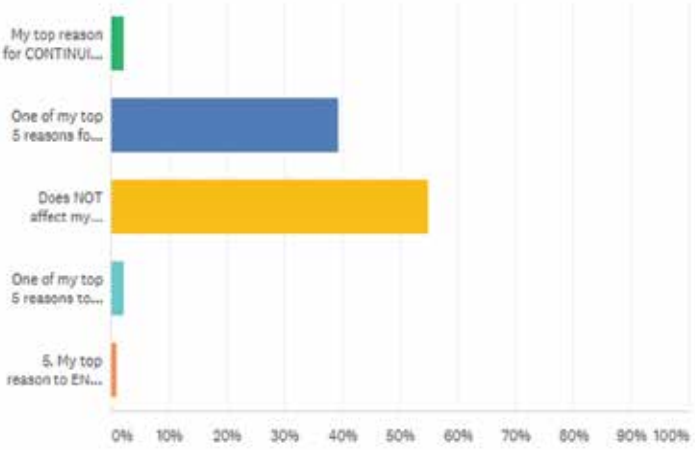


Figure 8: – Classroom Temperature



3. Rewrite a question focused on which external factors may influence student retention, including facilities, in a rank/order response.
4. Package the survey as a facilities "satisfaction" survey and send it out through the main campus student listserv.
5. To improve survey questions, provide pictures of campus attributes in lieu of written sentences, which would help convey the intent of the question to a student.
6. Provide an opportunity for qualitative feedback on the survey form.

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Brad Johnson is a facilities services planning, design, and construction project manager at the University of Colorado Colorado Springs; he can be reached at *bjohnso6@uccs.edu.* This article, his first for *Facilities Manager*, is adapted from the capstone seminar project for his MPA degree, completed in Spring 2018.

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Make a Difference: Be Part of the Team

By Brooks Baker

We are all shaped by events in our past that have been meaningful to us. While I was working as a young plant engineer in a small Alabama manufacturing company, a new law was passed called the Occupational Safety and Health Act, or OSHA. As the new kid on the block and "college boy," responsibility for plant safety and OSHA compliance became one of my roles. I remember reading the *Federal Register* to find out what was required and how to get into compliance with this new law—a seemingly impossible task.

That job was where the issue of the desirability of positive results (i.e., safety) versus the cost of safety features required for construction and operations began to register with me. Then, that issue became personal when we had a fire, which was quickly extinguished by a brand-new fire suppression system that possibly saved one life—mine.

While working at the University of Alabama at Birmingham (UAB) Hospital, we had a fire in a patient-care area that resulted in no injuries or loss of life because of all those Joint Commission, National Fire Protection Association (NFPA), and International Code Committee (ICC) requirements that we so often complained about. As these examples remind us, standards and codes do provide a valuable resource and save lives.

Unfortunately, we cannot make every negative situation end with a positive outcome, but properly thought-out and implemented standards and codes can be of significant help. Standards and codes that are not well planned can cost more than their value justifies and in some rare cases actually decrease the effectiveness of our safety systems. That is why APPA members need to lend their experience, knowledge, and wisdom to the standards and codes development process.

The APPA Standards and Codes Council (ASCC) began in 2004 as the Code Advocacy Committee and then became the Code Advocacy Task Force. The mission of the ASCC is to:

- Provide education and information to membership regarding standards and codes and their impact on facility managers and institutions
- Evaluate the impact on higher education of existing or proposed codes
- Positively influence the standards and codes development process

The ASCC and its Work Groups have been very active and are accomplishing a significant amount of valuable work for APPA membership. See the 2018-2019 APPA Standards & Codes Annual Report for some impressive information (https://www.appa.org/wp-content/uploads/2019/05/2018_2019-ASCC-Annual-Report-R1.pdf). At the same time you can

check out the new APPA website, where the Standards & Codes page can also be reached by clicking on the "Services" tab and scrolling through the dropdown menu.

But don't just click on the Standards & Codes link and then forget all about it. I would encourage you to go a step further and ask yourself, "Now, what can I do to be part of the fun?"

Here are just a few possibilities:

1. Volunteer for Work Groups and then participate. Think about what you are interested in (e.g., NFPA, ICC, etc.) and get involved.
2. Be engaged from your office by subscribing to publications, joining chats, and more.
3. Attend the APPA webinars on Standards and Codes issues.
4. Be aware of illogical or impractical requirements and contact ASCC through Billie Zidek at APPA (*billie@appa.org)* to learn about specific ways to impact the issue.
5. Learn more:
   A. Talk to your AHJ (authority having jurisdiction) to determine which codes and versions are being enforced at your institution.
   B. Ask your AHJ for advice; they are usually eager to partner with institutions.
   C. Consider a walk-though with your AHJ if advice is needed.
   D. Read about code violations if available locally or through your AHJ.
6. Be aggressive about resolving code violations on campus. No reasonable person in a position of authority wants to let a potentially hazardous situation exist that they know about. Paths of egress are the biggest issue here with blocked corridors or exits.
7. Join NFPA, ICC, the American Society of Heating, Refrigeration, and Air Conditioning Engineers (ASHRAE), or other standards- or code-writing bodies, and participate. APPA can help you get on their committees, if you are willing to serve there.

In short, try to be part of the team!

Brooks Baker is a past APPA president and emeritus member of APPA and serves as chair of the APPA Standards and Codes Council. He is based in Warrior, AL and can be reached at *bbiii@live.com.*

Building Blocks of Culture for Facilities Management—Part II, Strategy

By Matt Adams, P.E.

In our last column (March/April 2019), we discussed the definition of culture, what it means to the facilities management industry, and why it's important to us as leaders and to our staff. We discussed values as a core element of culture, and the importance of recognizing that all organizations have a culture whether they engage, nurture, and manage it, or whether they just accept it by default. In other words, our organization has a culture by design or by default—or sometimes a combination of the two.

Recently during an APPA Level 3 Leadership Academy at the University of Chicago, the class explored the benefits of culture to the organization and to themselves as leaders. One of the benefits for each leader is that culture is one of the most effective tools to enable an organization to succeed. Culture is a tool that leaders embrace to achieve results in their absence while they are home from work, on vacation, or even retired. To the up-and-coming leader, culture is the "glue" that unites the staff, even when leadership is not present. It's important to accept that culture needs to be designed, guided, and nurtured.

The critical first building block of creating culture, discussed in the previous column, is to carefully select the values that we want to represent it. The next building block is to develop a strategy for creating the culture around our selected values. This strategy is unique in that the results are not specifically a physical item like a building or a task, but a largely intangible environment that permeates our organization. Nevertheless, while primarily intangible, the basic elements of culture can be designed, measured, and implemented using many of the best practices that businesses employ today. For this strategy, we need an inclusive purpose, a method of measurement, a shared language, and a thoughtful implementation plan.

Creating culture by design is hard work. For virtually everyone in our organization, it will be the first time they have tried something like this; that will be true even for our leaders. As with most other endeavors, this work is made easier and more productive when those involved see the value in it. In the simplest sense, it's a "what's in it for me" (WIIFM) paradigm.

THE PURPOSE OF CHANGE

The reason or purpose for creating this culture should be explored with our teams and staff so that everyone sees value in this difficult but important work. This is the first step in creating cultural change. The idea is that every individual in our organization should not only understand their culture but recognize it, and hopefully, see that not only the organization and the institution benefits from it, but that they too benefit.

For example, take some of the negative factors that exist in many workplaces. In doing the "look-back" exercise described in the previous column, an organization might find that they have a negative or limiting value of low trust. This limiting value of low trust has a negative impact on the level of job fulfillment experienced by many employees in our organization. The converse of this is a high-trust organization, or an organization that values trust. For those who have experienced a low-trust environment, envisioning an environment of high trust allows them to see a workplace they can enjoy. In many ways, it's as simple as that. Others who perhaps don't have an issue with a specific limiting value may see the purpose of this initiative as enabling the organization to get more work done or to be more effective. To these people, culture leverages the work they already perform and makes their job more satisfying.

To another group within our organization, defining and designing a culture provides clarity. This is a form of cultural communication. Working in an organization where staff members have a clear vision of what they are trying to achieve and what is expected of them is a form of clarity that many employees greatly desire and do not currently have. This obvious growth value provides a reason for some to undertake the hard work of cultural change.

The discussion of how culture benefits the individual leads to the next step—the discussion of what it does for the organization as a whole. It is important not only to continue to identify the benefits of cultural change but to better understand the connectivity that must be achieved for the change to be successful. In other words, the individual must understand that the benefits of a value-based culture directly impact our leaders, our peers and coworkers, those whom we lead, our customers, and even our vendors.

A careful examination of the wide reach of culture provides further evidence of the reasons for undertaking this sometimes uncomfortable transformation. The organization should spend as much time as required on this step, not only for the reasons described above, but because many individuals have become discouraged by the limiting values of their previous culture and may need extra time to see that this approach is proactive, inclusive, and mutually beneficial to all.

THE MEASUREMENT OF CHANGE

The next step of our strategy is to design a form of measurement. Many feel that culture cannot be measured—I disagree. In fact, when done properly, almost all the elements of an organization can be measured; the creation of an empirical scale for culture is both straightforward and meaningful. There are two types of information that will come from this empirical scale. The first is the baseline measurement or the starting point for our cultural change initiative; we need to know where we're starting from so that we can later measure our progress and make adjustments as necessary. The same scale is used with subsequent updates and alterations that measure the continuous improvement of our adoption of a values-based culture.

After selecting the values that we choose for our future culture, we need to give these values descriptors. These descriptors are carefully selected to represent basic first impressions or feelings that those in our organization may identify with when presented with each value. Each value could have six descriptors, with

Please provide specific examples that currently illustrate our values.

Value	Respect	Safety	Responsiveness	Collaboration	Accountability	Quality
Descriptor	• Consideration • Appreciation • Regard	• Security • Assurance • Safeness	• Answer • Actionable • React	• Teamwork • Partnership • Alliance	• Reliable • Responsible • Trustworthy	• Exceptional • Preeminence • Caliber
	• Criticism • Dishonor • Neglect	• Danger • Exposure • Vulnerability	• Disregard • Ignore • Overlook	• Division • Separation • Noncooperation	• Irresponsible • Reckless • Careless	• Poor • Inferior • Substandard

Value	Respect	Safety	Responsiveness	Collaboration	Accountability	Quality
Examples						

three being of increasingly positive value and three of increasingly negative value. These descriptors are presented in random order as choices for each value. This is done to prevent the survey participant from picking values based on a perceived score versus their intrinsic first impression or reaction to the value.

The interpretation of these scores provides our baseline or initial score but also the identification of potential limiting values or the converse of our growth values. For example, if trust were one of our values, and a survey respondent selected a descriptor of "I am not trusted at all," the score might be a –3. It could also be interpreted as a limiting value or evidence of a low-trust environment. The goals for improvement could take the form of eliminating such limiting values from our culture, while nurturing and improving the growth values of our culture.

The mathematical or empirical portion of the scale is the second type of information that will result from this survey, and comes later, when the administrator evaluates the data and conducts follow-up surveys.

Above is an example of what the initial survey might look like. Notice that there is room for the respondents to include free-form comments to help further clarify their opinions; the scoring is applied later (ranging from +1 to +3 on the positive side, and –1 to –3 on the negative side). This is the empirical element of the scale.

Please select three descriptors that currently define facilities services values in our organization.

THE LANGUAGE OF CHANGE

In addition to the creation of the empirical scale, the basic strategy for cultural change requires a definition of shared language and basic ground rules. It is sometimes pointed out in APPA's leadership classes that just selecting a value is not enough; a more expansive definition of how that value is to be interpreted by the participants is needed. This explanation should be compiled by a representative working team that includes all levels of the organization, including those in non-leadership positions. The final result might be as simple as a one-page explanation of what trust means for your facility department. This would not replace the individual employee's view of trust, but provides a general guideline of the basic interpretation of that value for everyone.

Besides the explanation of our selected values, the publication and teaching of a new vocabulary is also important. This vocabulary is to include the basic terms, phrases, best practices, and other forms of new content that everyone should become familiar with to benefit from a shared language used to achieve cultural change. To some this may seem redundant or unnecessary—but it never is. Senior leaders often think that a value or concept stands on its own and is easily interpreted by the staff of your organization, but this is rarely the case. The creation of this shared language requires the humble and intentional participation of all those involved.

In our next column, we'll explore how cultural change can be implemented.

Matt Adams is president of Adams FM², Atlanta, GA, and a faculty member for APPA's Leadership Academy. He can be reached at *matt@adamsfm2.com.*

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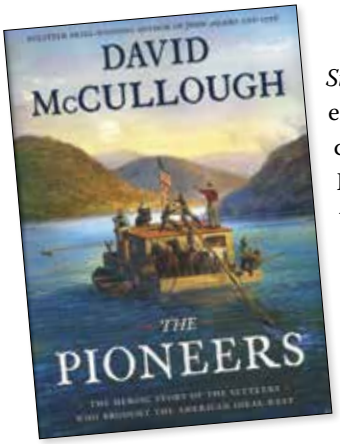
Book Review Editor: Theodore J. Weidner, Ph.D., P.E., AIA, CEFP, DBIA

This column is a departure from the majority of topics I've typically covered, but it still has some relevance to facilities management (FM). I've read two histories lately, one from a favorite author. If you enjoy history as much as I do, primarily for a diversion from the pressures of FM, you should enjoy both of these books.

THE PIONEERS: THE HEROIC STORY OF THE SETTLERS WHO BROUGHT THE AMERICAN IDEAL WEST

David McCullough, Simon & Schuster, New York, 2019, 352 pp., hardcover ($30.00), ebook ($14.99), audiobook ($14.95).



Ever since reading *The Great Bridge: The Epic Story of the Building of the Brooklyn Bridge*, I have enjoyed David McCullough's writing and his coverage of history. *The Pioneers* is no different. In the first chapter, McCullough explains why the Northwest Territories, which eventually became Ohio, Indiana, Illinois, Michigan, and Wisconsin, were so important to education. The Ohio Company bought the land, which had been ceded to the newly formed United States from Great Britain in the Treaty of Paris (to end the Revolutionary War), resulting in a major reduction of U.S. war debt. The original charter required land set aside in perpetuity for primary education and a university. This clearly explains, from one perspective, why there are so many colleges in the MAPPA (Midwestern APPA) region.

Based on several diaries found in the Marietta College archives, *The Pioneers* weaves together an engaging and detailed history of how the nation expanded following its creation. Because the history is based on the writings of the settlers and colonial journalists, some historians will say it presents a Eurocentric perspective with little input from the indigenous people of the area. That could be true; however, this reader found that the gruesome atrocities committed on both sides were understandable, given the situation that both sides faced.

The Pioneers tells several stories of settlers moving from New England and other parts of the original colonies as they searched for more fertile ground for crops, and for access to natural resources in the form of dense forests of massive hardwood trees and abundant fauna of all kinds, including buffaloes, beaver, bears, turkeys, wolves, and many other animals that provided food while settlers awaited the harvest.

The Ohio River was the superhighway of the time. It provided easy access to the continent's interior once the mountains of Pennsylvania had been crossed. Other rivers provided access to the north: The Muskingum, Scioto (sigh-oh-ta), Miami, and Wabash rivers provided access to good farmland. These were the lands of the Cherokee, Chippewa, Delaware, Miami, Mohawk, Ottawa, Seneca, Shawnee, Wabash, and Wyandot tribes, who responded to the settlers in varying ways—sometimes peacefully and sometimes not.

The Pioneers shows us how the states of the Northwest Territories came into being, by focusing on Ohio and examining a relatively narrow time frame from 1788 to 1848. As usual, McCullough brings what many might consider "dry" history to life. The personal accounts he includes, revealing the struggles and sufferings of the intrepid men and women who settled the American West, are worthwhile reading that helps us understand where we came from—and in the case of some Ohio colleges, why they exist. Reading this history gives the reader a better understanding of what made the country strong.

GRANT

Ron Chernow, Penguin Press, New York, 2017, 1,104 pp., hardcover ($40.00), ebook ($16.99), audiobook ($14.95).

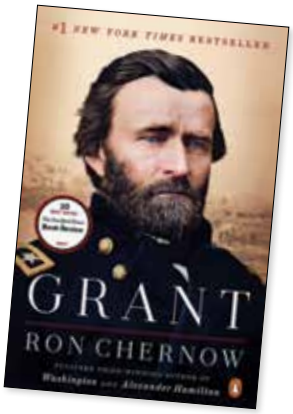
The myths that have often been taught in schools about Ulysses S. Grant are gradually dispelled and corrected in Ron Chernow's biography. This lengthy volume covers Grant's life in great detail—some parts of which were indeed heroic, but some much less so.

Most school children know that Grant was the

Union Army general who brought a conclusion to the Civil War at Appomattox Courthouse in 1865. But where he came from, what he did before and after the war, and what he struggled through during his two presidential terms and post-presidency are not as well known.

Grant had a powerful intellect. He might not have been as smart as other presidents, but he had a good understanding of right and wrong. He gave a great deal of authority to those who reported to him—sometimes too much. He trusted people and assumed they all had the same morals he did. Too many did not, and he was often unable to perceive their weaknesses—a serious deficit in an otherwise highly upstanding character.

Born into a humble, industrious family, Grant studied hard and entered West Point with some help from parental connections. His moral character (he was born in Ohio where slavery was prohibited) resulted in the implementation of the strongest protections for former slaves for a century after the Civil War. However, he utilized federal forces in a way that some would claim was an inappropriate intrusion on state's rights. And his fear of dying in penury drove him to several unfortunate alliances during and after his presidency.



The political machinations of the post-Civil War era are somewhat reminiscent of our current political turmoil; Grant did a commendable job of getting opposing sides to work together through compromise. Chernow provides a compelling and complete picture of *Grant* as both a man and a President, chronicling his struggles against numerous challenges. Facility managers may find some valuable leadership lessons in this excellent biography.

Ted Weidner is an associate professor at Purdue University and consults on facilities management issues primarily for educational organizations. He can be reached at *tjweidne@purdue.edu.* If you would like to write a book review, please contact Ted directly.

new products

Compiled by Gerry Van Treeck

EXTECH INSTRUMENTS announced the launch of the MA44x series of 400A clamp meters. The three meters offer comprehensive multimeter functions and a built-in non-contact AC voltage (NCV) detector to meet the exacting needs of electrical contractors and HVAC/R technicians. Complementing the existing clamp meter lineup, the meters in the new series are all equipped with the fundamentals. The MA440 measures AC current up to 400A, DC and AC voltage up to 600 volts, resistance, capacitance and frequency. The MA443 adds True RMS measurement, for the accurate reading of non-sinusoidal waveforms, and thermocouple temperature measurement. In addition to these, the MA445 measures DC current up to 400A, which makes it the ideal clamp meter for professional residential and commercial applications such as automotive, heavy equipment and marine DC current measurements. All three models are rated CAT III - 600V. For additional information on Extech Instruments go to *www.extech.com*

RUSSELECTRIC a manufacturer of automatic transfer switches and power control systems, manufactures UL-listed cogeneration systems for combined heat and power (CHP) applications in which the generator sets are run to serve the connected load and heat is also recovered for other uses. All Russelectric cogeneration systems are UL listed, offer programmable logic controller (PLC) system controls, and are supervisory control and data acquisition (SCADA)-capable. They feature utility/generator paralleling control, and provide active synchronization and soft loading. Systems use a utility-approved interconnecting protective relay system. Russelectric cogeneration power control switchgear may have additional controls and monitoring to optimize heat recovery. The systems can be designed to operate in parallel with the utility to optimize power and heat balance. For additional detailed information on Russelectric visit *www.russelectric.com*.

CENTERLINE by Hobart introduces a new line of kitchen equipment, debuting with the introduction of the Centerline HMM20 Standard Heavy-Duty 20-Quart Mixer in May 2019 and Centerline CUH undercounter dishwasher, to be released later this year. The Centerline HMM20 mixer is designed to be ideal for kitchens that depend on a mixer for shorter periods of time and multiple applications. It features a ½-hp motor, three mixing speeds, and an all-gear transmission for superior reliability and performance. The HMM20 also includes features like the GearSafeSystem, which protects the mixer from damage if speeds are changed while it's running, and Last Time Remind, which automatically recalls the last mixing time used, making it simpler to mix multiple batches of the same item. For detailed information on Centerline visit *www.centerlinefoodequipment.com*.

MASTER LOCK is introducing a new generation of its legacy family of Laminated Padlocks with notable security upgrades. Key enhancements include the following: Enhanced Internal Locking Components provide improved protection against rapping, prying, and shocking attacks. Durable Shackle Materials offer increased levels of cut resistance against bolt-cutter attacks. 4-Pin and 5-Pin Cylinder Options offer superior protection against picking attacks. The Hourglass-Shaped Keyhole protects against drilling. Product samples are also available upon request. For more information on Master Lock visit *www.masterlock.com*.

AIRCUITY announced several new products and additional features for its analytics platform. Based on two years of experience with a new cloud-based platform, these innovations are specifi-

cally targeted to the fast-growing commercial building health and wellness market. Aircuity recently completed delivery of its solution to two of the most iconic U.S. commercial office projects and is active internationally in the same space, thanks to its best-in-class life-cycle cost and its extremely accurate indoor environmental quality (IEQ) sensing approach. These new products and features address the fast-growing building wellness movement (and corresponding standards like WELL and Fitwel), which is based on recent academic results linking environmental quality to improved cognitive function. For additional information on Aircuity visit *www.aircuity.com*.

A.O. SMITH has announced the launch of its Commercial Heat Pump Water Heater (CHP-120) for light commercial applications, suitable for any facility that would traditionally use a standard commercial electric water heater. The CHP-120 has 50 percent more storage capacity and greater efficiency than any commercial integrated heat pump water heater on the market. Built with facility managers in mind, its integrated design and front-mounted components allow for easy install and maintenance. Thanks to an industry-leading 4.2 coefficient of performance (COP), this high-efficiency heat pump can save up to $3,500 in annual energy costs as compared to a standard electric commercial water heater. This results in an average payback on investment in two years or less. The CHP-120 is ENERGY STAR qualified, making it eligible for many local utility rebates. For more information go to A.O. Smith online at *http://www.hotwater.com.*

MILLS PRIVACY PARTITIONS by Bradley Corporation welcomes restroom users with privacy, comfort, and style, enhancing the user environment and experience. With privacy emerging as a key user preference in commercial restrooms, the new partitions add extra height, width, and No-Site options to create the feeling of a private individual room. Mills Privacy Partitions feature 72-in. tall doors and panels mounted 6 in. above the finished floor for standard stalls, and 69-in. tall doors and panels mounted 9 in. above the finished floor for ADA stalls. To provide additional space, panels are available up to 84 in. deep, and feature a new aluminum H bracket that provides a cleaner design aesthetic and faster installation. For more information about Mills Privacy Partitions visit *https://www.bradleycorp.com.*

The **DANFOSS TURBOCOR** Oil-Free Compressor has received the endorsement of the Solar Impulse Foundation as one of the top 1,000 solutions for protecting the environment. Danfoss is already recognized as the world leader in oil-free, magnetic-bearing compressor technology for the HVAC industry, and this prestigious award further validates the Danfoss Turbocor Oil-Free Compressor as a viable solution for reducing harmful greenhouse gas emissions while also providing economic benefits to end users through an ROI in less than three years and reduced energy consumption. For more information about Danfoss Turbocor visit *www.danfoss.com.*

BOSCH offers the GSB18V-535C 18V EC Brushless Compact Tough 1/2-In. Hammer Drill/Driver and Bosch GSR18V-535C 18V EC Brushless Compact Tough 1/2-In. Drill/Driver, proving that a small package can not only pack a serious punch, but deliver next-generation jobsite technology. From Bluetooth connectivity to KickBack Control, these lightweight, compact tools promise to be go-to options in your tool bag. The Bosch GSB18V-535C Hammer Drill/Driver and Bosch GSR18V-535C Drill/Driver combine advanced user control with a compact, powerful cordless tool. The tools feature Bluetooth connectivity (which connects to an optional Connectivity Tool Module) that links the tool to the free Bosch Toolbox App, which is

available at the Apple App Store or the Google Play Store. The app works with a mobile device to provide enhanced tool control and detailed tool-usage feedback, including battery-charge status. For additional detailed information on Bosch visit *www.boschtools.com.*

ECORE, a manufacturer of safe, ergonomic, and acoustic performance surfaces for commercial and athletic markets, has streamlined its ECOsurfaces product offering to include 32 colors. Available in rolls and tiles, this high-performance, durable, vulcanized composition rubber flooring offers an ergonomic solution with superior slip resistance and enhanced acoustic properties. ECOsurfaces features an array of metal- and wood-like neutrals accented by splashes of complementary colors. ECOsurfaces' ergonomic and acoustic properties make it an excellent alternative to concrete and carpet, while adding warmth and comfort to the interior landscape. ECOsurfaces offers sophisticated, welcoming design options for a wide range of applications, including corporate interiors, educational institutions, public spaces, and hospitality and retail environments. To learn more about ECOsurfaces visit *http://www.ecorecommercial.com/Products/Composed/ECOsurfaces.*

New Products listings are provided by the manufacturers and suppliers and selected by the editors for variety and innovation. For more information or to submit a New Products listing, contact Gerry Van Treeck at *gvtgvt@earthlink.net.*

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