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NUMBER 6

Facilities Manager

The official publication of APPA: The Association of Higher Education Facilities Officers

Planning, Design, & Construction

Lab Space Use

Commissioning

Roof Protection From Snow

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Volume 19 Number 6 November/December 2003

THIS ISSUE'S TOPIC:

PLANNING, DESIGN, & CONSTRUCTION

FEATURE ARTICLES:

Facilities Manager
The official publication of APPA: The Association of Higher Education Facilities Officers

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Columns

Facilities Manager

PRESIDENT: Brooks H. Baker III, University of Alabama-Birmingham
EXECUTIVE VICE PRESIDENT: E. Lander Medlin, Alexandria, Virginia

EDITOR: Steve Glazner
ASSISTANT EDITOR: Betsy Colgan
SUBSCRIPTIONS: Cotrenia Aytch
CREATIVE DIRECTION: Creative Media Group
PRINTING: Corporate Press, Inc.
EDITORIAL OFFICE: 703-684-1446 ext. 236
FAX: 703-549-2772
E-MAIL: steve@appa.org
betsy@appa.org
cotrenia@appa.org
WEB: www.appa.org
ADVERTISING:
Gerry Van Treeck
Achieve Communications
3221 Prestwick Lane
Northbrook, Illinois 60062
Phone: 847-562-8633
Fax: 847-562-8634
E-mail: gvtgvt@earthlink.net

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Global Partner in Learning

From the Editor

by Steve Glazner

APPA and NACUBO, the National Association of College and University Business Officers, are teaming up to provide facilities and business officers with current and relevant information on certain "core" data related to our educational facilities. We will collect this information on an annual basis for the purpose of assisting our members to make informed and sound business decisions related to the capital asset of the institution.

This ongoing longitudinal study will provide us with more and better data on the current replacement value (CRV) of all buildings in the campus inventory, as well as on the CRV of the campus utility infrastructure. CRV—how to define it and how to display or present it—continues to be a contentious issue. However, until we find a better definition, we define CRV as the total expenditure in current dollars required to replace any facility at the institution to its current program use. This includes the full replacement cost for all buildings, grounds, technology, utility systems, and generating plants. We do not recognize insurance replacement values, book values, or original construction costs as legitimate ways to define current replacement value.

The core data survey will also collect the current replacement value within each type of allocated space on campus, using the National Center for Education Statistics' *Postsecondary Education Facilities Inventory and Classification Manual*. Those space allocations include the following:

- Classroom
- Laboratory
- Office
- Study
- Special Use
- General Use
- Support
- Healthcare
- Residential
- Unclassified
- Nonassignable Areas
- Structural Areas

In addition to the CRV component and other basic data such as gross square footage, number and age of campus buildings, etc., the APPA/NACUBO core data study will maintain an annual update on capital expenditures for new construction and major renovations, as well as the level of estimated deferred maintenance backlog on campus.

We'll share more information on this study as we develop it further, and we look forward to your participation to make it as complete and valuable as possible.

* * * *

The new year 2004 will bring a variety of topics covered in future issues of *Facilities Manager*. Be watching for theme issues or features on energy and utilities, renewing and modernizing educational facilities, a preview of the July Forum in Washington, D.C., code advocacy, effective and innovative practices, and maintenance and operations basics. Happy New Year!

Nominate a Colleague Today for an APPA Award!

APPA's awards program recognizes excellence among individuals and institutions. A full listing of the awards and the criteria are available on the APPA website at http://www.appa.org/recognition. APPA now makes it even easier to nominate an individual or institution for an award by completing an online application form which can be found at the above website. APPA's Professional Affairs Committee will review all applications in early Spring and all awards are presented at APPA's annual Forum leadership breakfast and banquet in July in Washington, DC. **Submissions are due no later than January 31, 2004, so nominate an individual or institution today!**

Institute Registration

How to spend a week in Florida? Register for APPA's upcoming Institute for Facilities Management, February 1-5, 2004, at the Tampa Marriott Waterside, in Tampa, Florida. Registration is available online at www.appa.org/education or by calling 703-684-1446.

Front-line Supervision

Join your colleagues for another session of *Supervisor's Toolkit: Nuts and Bolts of Facilities Supervision*. The next session will be offered February 1-5, 2004, at the Tampa Marriott Waterside, in Tampa, Florida. Registration is available online at www.appa.org/education or by calling 703-684-1446.

Member-Get-A-Member Campaign

As an APPA member, you are in an ideal position to impact APPA's growth. Surveys confirm that your personal endorsement is the most effective recruitment tool. When you recruit a new member, everyone wins. With a larger membership, APPA becomes a better resource for you and other facilities professionals. Our new members gain access to a network of over 4,500 facilities professionals, premier educational programming and publications at member rates, and credibility derived from being affiliated with an established community of facilities professionals. The new member's insti-

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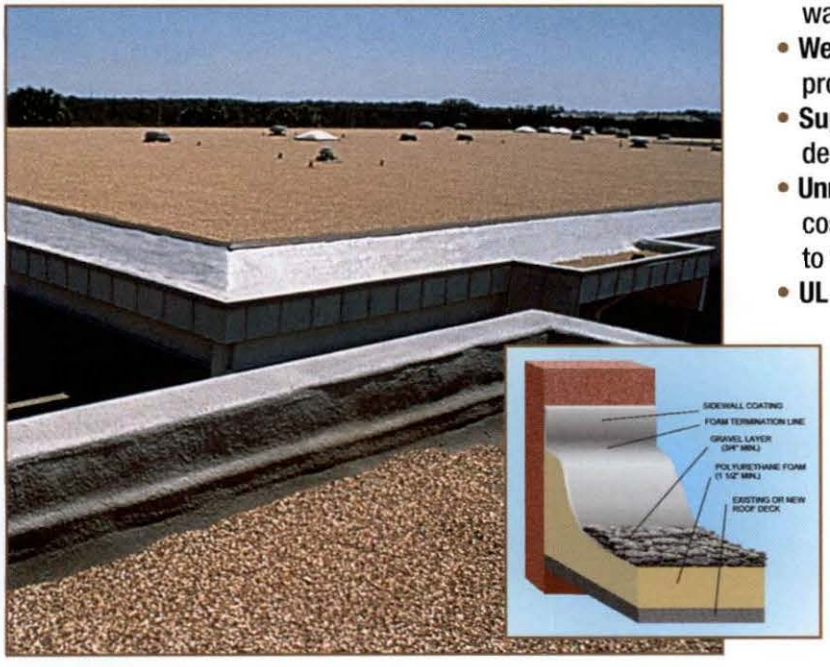

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tution profits from having a more competent and connected employee.

How to Participate?

- Contact a colleague at a nonmember institution. Share your APPA experience and the benefits of APPA membership with them. Send the colleague the new membership DVD.
- Refer them to www.appa.org/membership/membergetamember.cfm where they can download a membership application.
- Or contact APPA Member Services (703-684-1446, randel@appa.org) and send us their contact information (name, mailing address, and e-mail). We will send them an application and prospective membership materials.
- If the nonmember institution joins APPA before mid-June 2004, you are a winner!

Win!

- A copy of *Planning and Managing the Campus Facilities Portfolio*
- Fully-paid registration to the 2004 APPA Educational Facilities Leadership Forum in Washington, D.C., July 25-27, 2004.

ACUHO-I/APPA 2nd Annual Workshop—A Great Success!

ACUHO-I/APPA held their 2003 Housing Facilities Workshop October 12-15 in Phoenix. Over 200 delegates attended this year's event that featured topics that housing facilities professionals continually deal with on campus, such as comprehensive planning, capital renewal, and new construction. In addition, the workshop offered an opportunity for attendees to network with business partners and exhibitors in the exhibit hall. Join us next year in Florida. For more information, visit www.acuho.ohio-state.edu.

Recycle Construction Materials

Do you have concrete, gypsum drywall, asphalt, masonry, wood, cardboard, metal, or appliances you are trying to recycle? If so, visit http://cwn.gsa.gov where you can search for companies (from among 2000) that will haul, collect, and process debris from construction projects.

Mold Is the Winner!

Mold reigns as the indoor air quality (IAQ) issue of most concern to state legislators. Sixty pieces of IAQ-related mold legislation was considered this past year by 27 state legislatures. The bills were broken down into:

- Mold and mold remediation—23 bills; 10 passed and four failed.
- School IAQ—22 bills; two passed and one failed.
- Public building IAQ—15 bills; two passed and two failed.

Action on the remaining bills is pending.

Industry Partnerships Helping Ontario's Universities?

Industry partnerships with Ontario's public universities are hurting these universities. According to an article in *The Chronicle of Higher Education* (September 26, 2003), companies contributing money to Ontario's universities usually expect the funds to support programs relevant to industry-related fields such as computer-sciences, engineering, or business. This information comes from a report by the Canadian Center for Policy Alternatives.

During the 1999-2000 academic year, only 24 percent of Ontario's universities students were enrolled in the computer-science, engineering, or business programs. This current pattern of funding by industry partners has produced "massive inequities," with the humanities, social sciences, and education departments (which enroll half of all Ontario's college students) being the losers. The report also states that larger universities tend to benefit far more from these partnerships than do smaller ones, and that partnership money influences what type of research will be conducted at the university.

"The kind of research that turns into patents is much more interesting to private investors than basic research that turns out fine minds," said

Heather-Jane Robertson, the report's lead author.

A complete text of the report titled "For Cash and Future Considerations: Ontario's Universities and Public-Private Partnerships" is available on the center's website.

Outdated Computers: Recycle or Rescue?

Trying to dispose of normal, aging PCs can be a big problem for colleges and universities. But what if the computer weighs 44,000 pounds. According to *The Chronicle of Higher Education* (September 19, 2003), this was the dilemma faced by J. Ray Scott, assistant director of systems and operations at the Pittsburgh Supercomputing Center. The Center, which is operated by Carnegie Mellon University and the University of Pittsburgh, decided to try to find the computer a good home and listed it for sale on eBay. An unidentified bidder paid $45,000 for the C90, far less than the $10-million price tag when the computer was new.

Since there is very little resale market for most old mainframes and PCs (mainframes are considered old after five to ten years; PCs after three years), many colleges and universities are finding new uses for them or other solutions, such as the following:

- They may end up being rescued and taken home by computer technicians.
- Lucky computers can end up in a computer-history collection.
- Some computers are preserved as artifacts of the information age.
- The majority end their useful life in an electronics-recycling plant.
- Some computers are returned to the manufacturer for credit when new models are bought or leased.

Early in 2001, Pace University in Manhattan packed up its aging IBM mainframe, a nearly five-year-old machine. It was ready to be shipped to anyone who wanted it; no one did. When disaster-recovery planning became a top priority after September 11, 2001, Pace reassembled the old IBM mainframe and put it back into service as a backup for the college's new mainframe.

Another college decided to keep its outmoded mainframe and use it as a reference database. More than 40 years of records, including those of alumni, were now available online.

Most mainframes and PCs wind up at electronics-recycling plants. According to John Pepi, general manager of the Office of Waste Management at the University of Massachusetts at Amherst, until recently the university ran a brisk business in computer "demanufacturing." Now he says, the university has cut back on demanufacturing, preferring to send intact computers off to commercial recycling companies.

Community College Tuition Increases

According to a survey released by the American Association of Community Colleges, tuition for community colleges for the current academic year jumped by 11.5 percent, largely due to state budget cuts. An article in *The Chronicle of Higher Education* (September 26, 2003) states that community-college tuition in more than half the states rose by more than 10 percent, with California and Virginia colleges having the highest increases at 60 and 42 percent, respectively. According to George R. Boggs, AACC president, the association conducted the survey because of concerns that "the tremendous cuts in state revenues were big enough that they are beginning to affect our core values, namely access."

Community colleges tuition remains the lowest in higher education with the average tuition at public two-year colleges $1,560 annually for full-time students. The 11.5 increase in tuition will raise the per semester fee approximately $80.

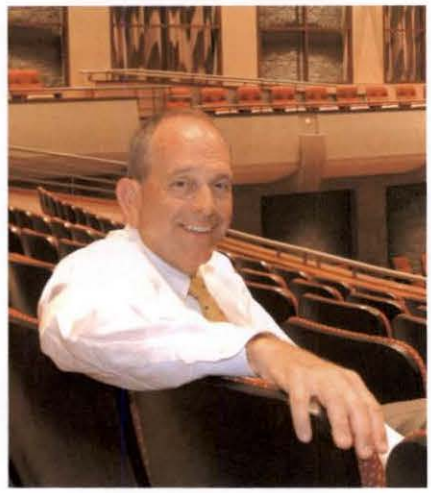
Thoughts on Upcoming APPA Issues

by Brooks H. Baker III

The planning, design & construction issue of *Facilities Manager* is one of my favorites. The articles by the contributing authors are always packed with information that we can use to sharpen our skills in delivering suitable projects for our customers. These articles also add tremendous insight for the facilities manager who is not directly responsible for planning, design, and construction (PDC), but who is part of the PDC team and the key individual for actually making a new project work when it is finished. Convincing our administration that the plant operations and facilities management organizations need significant input on the front-end of all projects is often a challenge.

If the planning and design organization does not have responsibility for building operations, it is quite tempting to value-engineer out the features that enhance life cycle operating costs but have a higher first-cost. Utilizing the tools that APPA provides to show the continuing costs of operations of our buildings as compared to the construction value of these buildings can be of help in getting to the front office with arguments for improving the life cycle of our buildings.

Facilities professionals come up with some interesting ideas periodically in an attempt to save money on construction projects. To reduce the costs of construction at the University of Alabama at Birmingham, we embarked on an adventure a few years



ago called Wrap-Up Insurance. Wrap-Up Insurance does have the potential for significant cost savings, but what an education this country boy has received through the experience of providing insurance for our construction projects on campus.

Our Wrap-Up Insurance program reminds me of my early days growing up on the farm plowing fields in the spring. There was something magical about hearing and feeling the diesel engine roaring along under full power while pulling a bottom plow through the fresh soil. The sounds and smells of springtime on the farm were at their best during spring plowing. Then, just when you thought life couldn't get any better, the point of the plow would hit a submerged rock the size of Mount Rushmore (at least it felt like it) and the tractor would stop so suddenly that you had the imprint of the steering wheel on your chest for days. In the near future we will be doing an article for *Facilities Manager* on Wrap-Up Insurance discussing some of the submerged rocks that left this painful imprint on us as well as some of the good points it provided.

Let's talk for a minute about APPA. With the continuous turnover in our profession and the budget cuts in higher education that we see in virtually every state, we need to redouble our efforts to recruit new members and to encourage our existing members to retain their membership in APPA. It only takes a few minutes to pick up the phone and call a counterpart at another institution who is not a member and discuss with them the benefits of APPA membership.

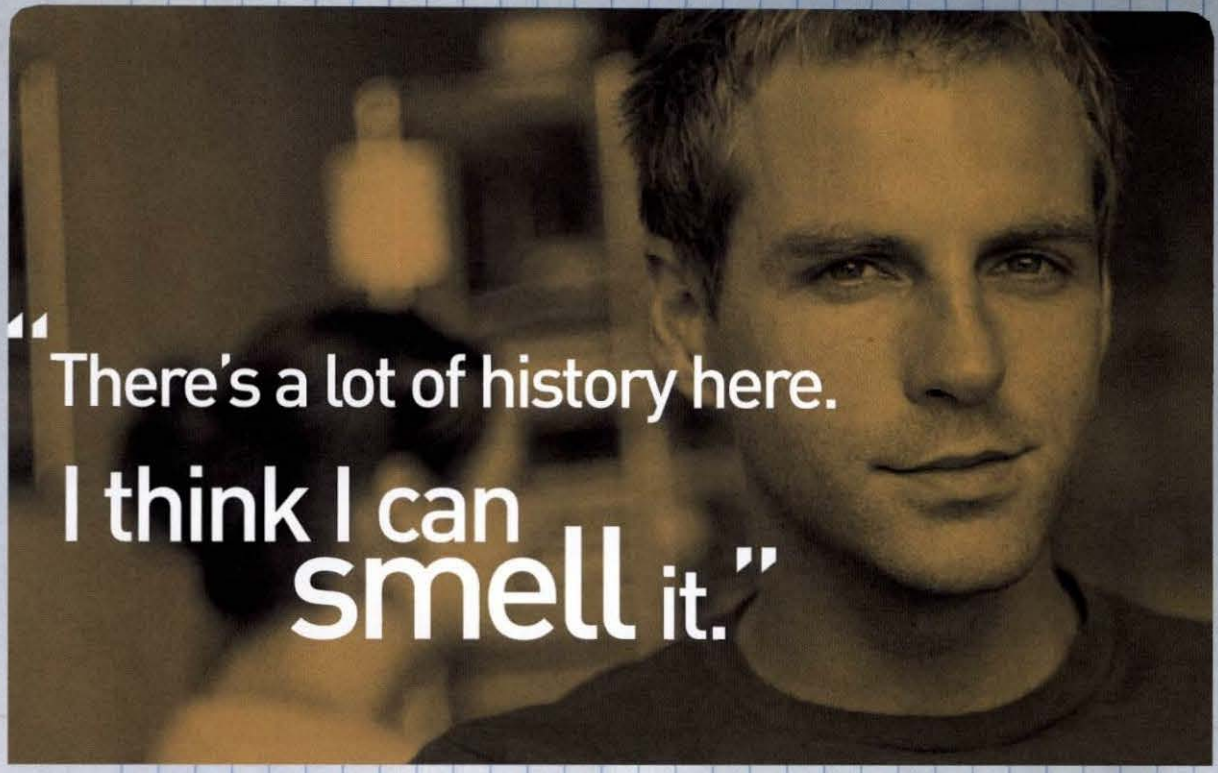
Please take time to do a little bit of recruitment for APPA; our goal is to push our membership past the 5,000 mark during the next two years. This is a small repayment to an organization that spends so much time and energy helping us to become better managers of our facilities.

At the Forum in Nashville last July, code advocacy was introduced as an area of emphasis for the coming year. The Professional Affairs Committee, under the capable leadership of Vice President for Professional Affairs Alan Bigger, is working to develop a way for APPA members to have a role in the creation, modification, and interpretation of the Model Building Codes, NFPA Codes, and others.

We are pondering the advantages of starting a chapter for higher education in the National Fire Protection Association (NFPA). This would enable APPA to have a voice within that code-setting body as well as placing association members on critical committees within the NFPA. We are talking with the American Society for Healthcare Engineering (ASHE) about cooperative efforts in the realm of code advocacy as well as other arenas where our two associations can complement each other.

Stay tuned—you will hear more about these issues during the upcoming year. Now, who can you call to recruit as a member of APPA?

Brooks H. Baker is the associate vice president for facilities at the University of Alabama at Birmingham and the 2003-04 APPA President. He can be reached at bbaker@fab.uab.edu.



The look of a historic campus can be a real draw for a college student. The smell is another story. Yes, students today expect a lot from a school. They love your ivy covered walls, but the technology inside those walls factors into their decision, too. Technology that creates environments that are comfortable, well-ventilated and safe. Thing is, more and more administrators face a serious backlog of deferred maintenance that hinders efforts to attract the best and brightest. Johnson Controls can help. We have the experience and know-how to create the finest, most advanced environments for learning and living. And we have innovative financial solutions that make improvements and new facilities possible. Best of all, you end up with the kind of campus today's students have a real nose for. For details, call us at 1-888-214-0916.

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JOHNSON CONTROLS

Facilities Professionals and the Greater Good

by E. Lander Medlin

In my last column, I explored the question "Will a college degree become an individual benefit or remain a public good"? In other words, will access to a higher education degree be assured for all who want to seek it? Current data shows that this implied social contract is in dire threat of being broken. As the states' and federal government's appropriations diminish and private giving decreases, both public and private institutions have responded with deeper budget cuts and unprecedented tuition increases, all while student enrollments are burgeoning.

We surely sit in the "eye of the perfect storm." With the current economic situation and the looming question of whether a college degree will become an individual benefit or remain a public good, what are college and university facilities professionals doing to aid in their institution's response to this gloomy situation.

1. *They know their service responsibilities and corresponding priorities.* Facilities professionals educate both their staff and the broader community about their responsibilities and priorities and how funding levels align with the institution's core mission and strategy. Many have published a service matrix or applied APPA's trilogy of staffing guidelines (maintenance, custodial, and grounds) as a benchmark in order to manage expectations by all stakeholders. The following priority list is an example of how one institution has assessed their service responsibilities.
   - Maintain security and safety systems.
   - Assure reliability of utility systems
   - Satisfy all codes, laws, and regulations
   - Maintain roofs, exterior walls, windows, and doors to protect buildings against weather.
   - Avoid reduction of services which would cause property loss; maintain exterior paint, floor finishes, water treatment chemicals, fire sprinklers, etc.
   - Maintain building appurtenances (chalkboards, fixed seating, lighting, etc.)
   - Maintain energy consuming systems to avoid waste.
   - Maintain minimum occupant comfort and convenience (elevators, air conditioning, etc.).
   - Keep up the appearance of the "campus front door;" entrance lobbies and first floor corridors have priority.

2. *They focus on process efficiencies.* The following is but a short list of the various approaches that have been successfully implemented.
   - Redirect staff costs to auxiliary enterprises and/or capital projects. Create special teams to reduce overtime and focus efforts on these projects.
   - Reduce overtime through controlled or planned overtime.
   - Issue chargebacks or develop a menu for auxiliary services and facility usage rental fees.
   - Adjust work schedules
   - Create procurement strategies through purchasing leverage, product testing and competitive performance-based bidding, online purchases, drop shipments, just-in-time deliveries, and use of chemical dispensing and proportioning systems.
   - Utilize outsourcing services in all its forms after cost/benefit analyses have been performed.
   - Modify service frequencies by reestablishing PM set points and reconfiguring custodial task schedules.
   - Engage in proactive planning, long-range strategic planning, and performance tracking.
   - Reexamine space utilization policies and practices with a focus on private versus public spaces.
   - Explore lease versus own options.
   - Engage in "privatization" of discrete functions through public-private partnerships where appropriate.
   - Expand "community collaboration" and outreach to streamline service delivery and reduce duplication.

3. *They focus on improving and increasing channels of communication both internally and externally.* They recognize that we cannot will the good over the bad, but we can choose the attitudes we adopt as we go about our activities. Frankly, the greatest impact on good communication is attitude! George B. Wright aptly put it in his power-packed phrase "You must multiply yourself through others." Without the proper attitude toward and with others we can become paralyzed, quit thinking strategically, stop performing predictably, and avoid decisive actions. A good solid communication plan and effort within the department and across the community improves understanding, reduces many negative judgments, breeds respect and appreciation, fosters continued dialogue, and creates alliances and long-term relationships that can only help when resources flow again.

4. *Finally, the best of the best continue to train and develop their staff.* It's painful for everyone when layoffs occur, but even worse for those individuals who remain with the organization only to receive little or

Lander Medlin is APPA's executive vice president. She can be reached at lander@appa.org.

no training or professional development. In the technological world in which we live and work today, training and development is a must if our staff are to remain effective, productive, and relevant in the jobs they perform. One of the newest tools available from APPA for the front-line supervisor is the "Supervisor's Toolkit: The Nuts and Bolts of Facility Supervision." The program's content extends across eight modules and consists of 36 hours of instruction. Best of all, it can be economically delivered to you at your institution or within your region. Don't hesitate to contact Betsy Colgan of the APPA staff for more information and details.

These are just a few examples of the approaches being utilized by the educational facilities community to streamline operations and communicate with institutional stakeholders. However, if we collectively want to further our efforts to increase the awareness of the facilities profession with senior institutional officers, we must be able to communicate effectively and ultimately speak the language of our business and development officers, presidents, trustees, and regents. This will require a clearer understanding of the issues they face and deem important for the good of the institution and the entire enterprise. What can you do to help?

- Learn more about higher education and other campus departments.
- Always be collaborative and engage the community at all levels.
- Communicate regularly and clearly.
- Develop an understanding of the organization's portfolio of capital assets.
- Deal with the resource issues as long term and leverage some to meet the highest priority needs.
- Focus on your institution's vision, mission, and strategy.
- Strive to deliver the best environment for the students in both a cost efficient and operationally effective manner, thereby ensuring a reliable learning environment.

There is an old story that serves to illustrate the importance of our attitude and the benefits of the effort we put toward our work day in and day out.

"In the days of yore, roads barely existed yet it was the king's responsibility to keep these roads in good order and free of debris. The king sent his aides out to one of the roadways with a purse of gold coins and instructed them to move a large boulder in the middle of the road and place the golden purse underneath the boulder. The purse would serve as a handsome reward for the one(s) who removed the boulder from the path. They were to watch and wait.

Many wealthy and harried individuals came upon the boulder only to walk around it wearily or voice loud complaints and discontent with the king and his inability to keep the roads clear. However, a peasant with a large load on his back happened upon the boulder, proceeded to drop his load to the ground, and pushed laboriously in order to move the boulder single handedly. He almost failed but dutifully kept to the task until he was indeed successful. To his surprise he found the purse filled with gold coins in the place where the boulder had previously sat. He was most pleased, pocketed the money, lifted up his load to his back, and proceeded on his way."

Therefore, always remember, "every obstacle presents an opportunity to improve one's condition!" Although the obstacles in our path are many at the present time, do what you can today to improve your condition tomorrow. If we will focus our attitude and thinking in this way today, maybe just maybe, we can also collectively preserve the concept of "the people's university" for tomorrow.

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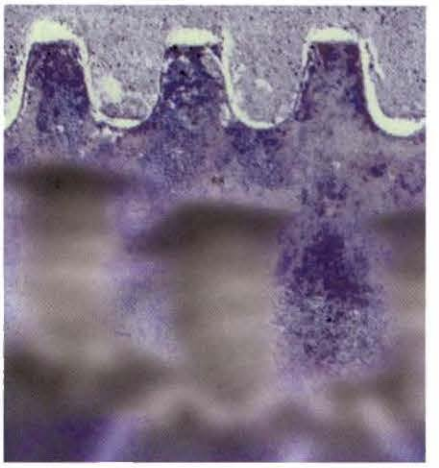
Establishing a Student Chapter of APPA

by Cameron Christensen

Along with two other officers of our student chapter at Brigham Young University (BYU), I had the opportunity of attending the Educational Facilities Leadership Forum in Nashville, Tennessee this past July. We could not have asked for a better welcome. Everyone we met was excited to have us at the conference, and, as a result, it was a great experience and one that I will remember for a lifetime.

At the Forum we had the opportunity to talk with many facility professionals. We talked about the organization of our student chapter of APPA and the quality of the facility management program at BYU. Almost everyone who heard about the BYU program brought up the concern that there is no emerging generation in the field of higher education facility management to whom managers can leave their knowledge and experience. One professional commented that 25 to 30 percent of the facility professionals in the field of higher education would retire within the next ten years.

Students are being trained in facility management; that is not the problem. There are approximately a dozen schools that offer facility management degrees or certificates. One problem may be that students are not receiving enough information about the higher education facility management field and therefore are not drawn to it.



When I began my pursuit of a degree in facility management I decided I wanted to enter the field of higher education. I was familiar with the pros and cons of the field because the BYU program works very closely with the physical facilities departments on campus. However, I didn't feel that I was getting the information that was necessary to help make a proper decision. For that reason I proposed to start a student chapter of APPA at BYU.

This article outlines the basic steps used in establishing the student chapter at BYU and gives the basic steps any institution can take to establish their own APPA student chapter.

How We Began

The facility management program has been in place at BYU since the mid-1950s. Over the past 50 years the program has grown to almost 100 students. The curriculum in facilities management, construction management, and business management, along with its reputation, place BYU graduates among the most recruited in the nation. For years, each facility management student was strongly encouraged to join the International Facility Management Association (IFMA). This association exposed students to the field of facility management and provided networking opportunities that hopefully would last the duration of their careers.

In 2001, I entered the facility management program at BYU. One of the requirements for graduation is completion of an internship with the physical plant on campus. As I finished up my internship, I realized that higher education was where I wanted to spend my career. While IFMA provided many opportunities in facilities management, it did not include much information in the field of higher education facility management. Where could this information be obtained? Since I knew many people associated with APPA and knew of its reputation as an association of and for higher education facility managers, it seemed like a good idea to establish a student chapter of APPA.

We started by selecting a faculty advisor. On campus we have access to a past president of APPA and a tireless volunteer. We invited him to be our faculty advisor and he accepted. Together we formed a presidency, authored Bylaws, and recruited members. At the 2003 Forum in Nashville, my two fellow officers of BYU's student chapter and I had the opportunity to meet with the president, president-elect, executive vice president of APPA, and the RMA regional president to discuss the final details of the organization and to launch the chapter.

How to Establish a Student Chapter

The first step in establishing a student chapter of APPA on your campus is to determine if it is feasible. Are there enough students in facility or construction management who would

Cameron Christensen is president of the Brigham Young University Student Chapter of APPA. This is his first article for* Facilities Manager. *He can be reached at cc335@email.byu.edu.

The first step in establishing a student chapter of APPA on your campus is to determine if it is feasible. Are there enough students in facility or construction management who would join the chapter? Is there a possible faculty advisor?

join the chapter? Is there a possible faculty advisor? These issues and others must be discussed with either a member of the APPA staff or Board of Directors before the organization of a chapter continues. If it is feasible to continue, APPA will send a packet of detailed information outlining the steps for establishment of the chapter.

After this packet is received, the college or department representative for the facility or construction management program will select a faculty advisor. This advisor should be familiar with the program, the facility management field, and with APPA. The faculty advisor should then select a student to serve as the first president-elect of the chapter. It is worthy to note that the president-elect must be able to serve for two years (i.e., have two years left in school). The faculty advisor and president-elect next select a vice president for educational programs, a vice president for information and research, and a secretary-treasurer. These officers shall review the Bylaws and make any necessary changes to adapt to their situations. Finally, after the organization and functionality is established, a formal proposal must be submitted to APPA for ratification of the chapter. Then, if all is well, the new student chapter can register as an entity in APPA and individual members will be allowed to register under their respective chapter.

Benefits of Student Chapters

There are many positive benefits for creating a student chapter. Two of those benefits are:

- a better understanding of the field of higher education facility management, and
- the establishment of valuable networking ties with other facilities professionals that will last throughout a career.

As you work to establish your own student chapter and hopefully realize some of these same benefits, you may experience a few benefits unique to your situation. For students interested in higher education facility management as a career, establishing and/or joining a student chapter of APPA is an excellent way to become educated and integrated into the field.

CLASS LABORATORIES:

SPACE USE AND UTILIZATION

by Ira Fink, Ph.D, FAIA

As campuses work to increase their efficiency, improving space utilization has gained importance as a key facility planning activity. Increasing classroom use and utilization has long been under the microscope as a target for improving the use of campus space. Improving class laboratory use is another matter altogether. These important instructional spaces remain under the radar, because they are not well understood and because they are so varied.

Are Class Laboratories Being Well Used?

Class laboratories are an important and often underutilized component of campus instructional facilities. For many colleges and universities, the amount of space dedicated to class laboratories exceeds the amount of space used for classrooms.

Class laboratories are essential to the teaching mission, allowing hands-on instruction to be carried out in rooms tailored to a specific academic program need. Class laboratories are, or should be, a significant source of departmental pride. At the same time, on some campuses, underused or unused class laboratory space can provide an opportunity to reclaim and reuse excess space for other high priority needs, such as research.

Ira Fink is president of Ira Fink and Associates, Inc., University Planning Consultants, Berkeley, California. He can be reached at ira@irafink.com.

Despite the need for and importance of class laboratories to campus instructional programs, there is no published information about their use and utilization. The bibliography, *Campus Planning and Facility Design* (fourth edition)[1], does not list a single specific book or article on class laboratories. This article seeks to fill this gap in the literature of higher education facility planning and to serve as a companion to my earlier article, "Classroom Space Use and Utilization," which appeared in the May/June 2002 issue of *Facilities Manager*.

Class laboratories have unique characteristics that make them difficult to manage. While they are discipline specific, they are also broadly defined within the facility planner's lexicon, and cover a range of spaces from chemistry class laboratories to band rooms. A better understanding of class laboratories as a space use can help facility planners in their efforts to improve the use of space on their campuses.

This article sharpens the definition of class laboratories, identifies the characteristics that differentiate these types of spaces—including the challenges associated with managing these spaces—and offers a couple of solutions that may help facility planners improve campus space efficiency. The discussion concludes by suggesting an approach to improving class laboratory use and utilization.

Defining Class Laboratories

Types of Class Labs

Class laboratories, also known as teaching laboratories, can generally be divided between science and non-science laboratories, each with identified spatial needs to meet the teaching patterns of the sponsoring discipline and to optimize the station count for span of control and safety. Science class laboratories require unique furniture and specialized equipment, both fixed and movable, while non-science class laboratories have less or no equipment generated needs.

With few exceptions, class laboratories are used only for undergraduate instruction. Graduate students generally conduct their experimental work in their own laboratory stations, usually in research laboratories, which have separate room use classification, use, and utilization patterns.

What is a Class Laboratory?

A "class laboratory" is broadly defined by the U.S. Department of Education's National Center for Education Statistics (NCES) as *"a room used primarily for formally or regularly scheduled classes that require special purpose equipment or a specific room configuration for student participation, experimentation, observation, or practice in an academic discipline."*[2] On most campuses that broad definition covers all class laboratory spaces, regardless of discipline or use. Class laboratories that have "special purpose equipment" also require special furniture or furnishings to use or store the analytical equipment, such as laboratory benches, study carrels, flat tables, or other space consuming items.

To understand class laboratories better, we employ two classifications: class laboratories and special classrooms. The differentiation between these is based upon whether or not the laboratory requires special purpose analytical equipment, and whether the laboratory can also be used for free-time, drop-in, or open use.

Included in the class laboratory category are rooms such as science and engineering laboratories, instructional shops, drafting rooms, group studios, specialized health profession laboratories, language laboratories, and similarly designed or equipped rooms. These rooms are designed for or furnished with specialized equipment to serve the needs of a particular discipline for group instruction. The design of the space or the use of equipment in the class laboratory room normally limits its use to a specific academic discipline; precludes its use by other disciplines; and forecloses its open use. Moreover, these rooms are generally not interchangeable between disciplines. This, in turn, is reflected in their lower use and utilization.

Definition of a Special Classroom

To distinguish between uses, we have added a second room use we call a "special classroom." We define a "special

classroom" as a room or studio used for regularly or formally scheduled classes that requires a unique or distinct space, *but does not require special purpose equipment*, and can have open use. Included in our special classroom definition are rooms such as band rooms, choral studios, dance studios, rehearsal rooms, and similarly designed spaces. In this way, we can hone in on room use and utilization by separating these distinct types of rooms. Rooms used for music practice are yet a separate room use category.

Class Laboratory Service Room

It is important in reviewing class laboratories to recognize one more room type: "class laboratory service." This is a room defined as directly serving one or more class laboratories or special classrooms as an extension of the activities of those rooms to provide supplies, services, preparation, or storage. Included in this room use are balance rooms, cold rooms, preparation rooms, specimen rooms, stock rooms, equipment issue rooms, and similar uses associated with the class laboratory. Class laboratory service rooms do not include rooms serving research laboratories.

Characteristics of Class Laboratories that Affect Space Management

Four characteristics of class laboratories are central to understanding their use and utilization and their space management. These factors are: departmental or decentralized control of class laboratories; distributed use of laboratories; specialized laboratory equipment; and required laboratory support facilities. Each of these class laboratory characteristics is in direct contrast to the elements useful for understanding and improving campus classroom use and utilization.

Departmental or Decentralized Control

The first characteristic, that class laboratories are usually under departmental and/or faculty control, rather than central classroom schedule control, means the laboratories are usually departmental "turf." They are an important component of institutional excellence and a student recruitment tool. A recent Internet search of "teaching laboratories" found 15,500 entries, many touting the importance of one or more class laboratories specific to a departmental purpose.

Class laboratories are also part of the rachet effect of space on campuses. Once assigned, they are held on to, "just in case," regardless of how well they are being used or utilized. In other words, departments or units are loathe to give up the space, even if the class laboratories are unused or not well used.

The amount of class laboratory space kept "just in case" it may be needed for a yet to be identified use, can be reduced by either central scheduling of class laboratories and/or by keeping better track and accountability of class laboratory use on an annual basis. To regain excess class laboratory space, the campus must have an up-to-date space inventory or facilities room database. This database must classify rooms by their use and assignment, including class laboratories, special classrooms, and class laboratory service rooms, along with identifying other features of the rooms, including square footage, station count, room number, specific use, and departmental assignment. An annual record from the registrar of whether the room is being used for regular or formally scheduled classes is also needed. Matching the facilities database to the registrar's record will identify rooms that are not being used.

For example, one campus had 124 rooms classified as class laboratories in the facilities room database. Yet, the registrar's record of scheduled courses showed only 89 class laboratories in use. In other words, 35 rooms or 30 percent of this inventory was not being used as designated. At another campus, the registrar's record of scheduled use accounted for only 62 out of 192 class laboratories and special class laboratories shown on the facilities room database. Upon further review, some rooms had been converted to other uses, such as research, and some had simply become costly storage areas for old and unused equipment and furniture.

Distributed Space

The second characteristic, distributed space, means class laboratory space occurs across the campus, rather than centralized in a "class laboratory building" or buildings. Because many disciplines and departments have class laboratories, this decentralized "ownership" allows for space to be sprinkled across the campus when excess or unused class laboratory space is identified. This fragmented ownership also can permit the excess space to be hidden from view, especially in those buildings designed for or occupied by a single department or discipline. However, once identified and reclaimed, the space can be better used, which is a considerable aid when small amounts of space are needed to accommodate incremental program growth or other newly identified needs. Excess, unused, or underused class laboratories are reservoirs of potentially available space about the campus, waiting to be reclaimed.

Almost every academic department has some space assigned to it that is identified as class laboratories. While the majority of class laboratories are in the sciences and engineering, most departments in schools of business, education, fine arts, medicine, music, and nursing have class laboratories. The only departments that consistently do not have class laboratories are economics, history, philosophy, and religion.

On average, class laboratories, special classrooms, class laboratory service, computer laboratories, and open laboratories represent about 7 percent of the assignable space on campus, excluding housing. This means the amount of campus space devoted to class laboratories is an even larger amount than space used for classrooms and classroom service, which averages about 5 percent of assignable space, as shown in Table 1.

Class laboratory space (which for space planning purposes are all spaces with NCES Room Use Codes from 200 to 249) ranges from a low of 4 percent to a high of 20 percent of academic, administrative, and support space on campus. This

Table 1. DISTRIBUTION OF ACADEMIC, ADMINISTRATIVE, AND SUPPORT SPACE AT 27 COLLEGES AND UNIVERSITIES, EXCLUDING HOUSING

NCES Room Use Codes and Room Type	25 Public Universities		2 Private Universities Average	27 Colleges and Universities Average
	Average	*Range*		
100 Classrooms	5.2%	3.3 to 12.4%	15.7%	5.3%
200 Class Laboratories	7.0	4.3 to 19.5%	18.3	7.1
250 Research	15.3	8.3 to 24.1%	3.6	15.2
300 Office	22.5	11.0 to 33.1%	23.0	22.5
400 Library/Study	6.6	4.9 to 12.8%	17.7	6.6
500 Special Use	14.1	1.2 to 25.8%	13.3	14.1
600 General Use	11.2	4.7 to 19.0%	4.6	11.2
700 Support	14.4	5.4 to 26.7%	0.5	14.3
800-900 Health Care	3.7	0.9 to 5.5%	3.3	3.7
TOTAL	**100.0%**		**100.0%**	**100.0%**

Source: *Ira Fink and Associates, Inc., based upon data from 25 public universities and two private universities*

finding is based on data from 25 public universities, mainly large research campuses, as shown in Table 1. Class laboratory space can be compared to classroom space on these same campuses, which ranges from 3 to 12 percent of total campus space.

The percentage of class laboratory space may be highest among community colleges. For example, among the community colleges in the University and Community College System of Nevada, 25 percent of all assignable square footage is in classrooms, while 27 percent is in class laboratories.

Specialized Equipment

The third characteristic, that class laboratories contain specialized equipment, has two important subcategories: the age and usefulness of the equipment and the amount of floor space required for its use. Class laboratories that house aged equipment are generally less used than laboratories with up-to-date instructional equipment. This results in a need for the campus to plan for and fund equipment (and furniture) renewal to improve class laboratory space use and utilization. When renovation or equipment funds are not available, the little used class laboratory becomes even less used, and often defaults to becoming a storage room.

Class Laboratory Station Size

All class laboratories with furniture for specialized equipment, whether new or old, require more space per student station than other rooms used for instruction, such as classroom or lecture space. On average, class laboratories, when measured in square feet per student station, are two to three times larger than classrooms station size. At the same time, class laboratories have fewer stations per room. The number and capacity of class laboratories at a variety of campuses are shown in Table 2.

Another important measure is the space per station or square footage per station. This calculation is made by dividing the number of stations contained in the class laboratories into the square footage of the room to determine average area (square footage) per station.

In the Table 2 examples, the assignable square footage (asf) per class laboratory station varied from 39 asf to 63 asf, with an average of 51 asf per station across all campuses. Among the six campuses reported in Table 2, class laboratories had an average of 17.7 stations per room and a range of 16.1 to 19.0 stations per room. This high square footage per station and low station count is typical of class laboratories.

By comparison, classrooms at these same campuses had an average of 44.7 stations per room and an average area of 17 square feet per station.

Also, as shown in Table 2, class laboratories as a room type have considerably fewer stations than classrooms, with one-quarter having nine or fewer stations and none reported having 75 or more. The economies of scale that occurs in large-station count classrooms does not equally apply to class laboratories.

As Table 2 illustrates, class laboratories, due to their fixed furniture or furnishings, require considerably more square footage per station than classrooms with movable table and chair rooms. Fixed table rooms that are Americans with Disabilities Act (ADA) compliant require 35 to 40 asf or more per station since fixed tables and an instructor's podium take up considerably more space per station than moveable furniture.

Class Laboratory Stations and Headcount

One way to grasp the amount of class laboratory space on a campus is to compare headcount enrollment to the number of class laboratory stations. On the large public campuses shown in Table 2, there are approximately ten headcount students per class laboratory station. On the small private university campuses, there are approximately six headcount students per class laboratory station. In other words, small private universities have more class laboratory stations per student than do large public universities.

Continued on page 22

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Table 2. DISTRIBUTION OF CLASS LABORATORIES BY NUMBER OF STATIONS AND ASF AMONG FOUR PUBLIC UNIVERSITIES AND TWO PRIVATE UNIVERSITIES

Class Laboratory (Stations)	Large Public University		Large Public University		Large Public University		Large Public University		Small Private University		Small Private University		TOTAL	
0 to 9	24	20%	26	37%	12	26%	20	36%	--	0%	5	23%	87	26%
10 to 19	34	28%	14	20%	16	35%	12	22%	5	31%	8	36%	89	27%
20 to 29	46	38%	19	27%	12	26%	12	22%	11	69%	5	23%	105	32%
30 to 39	13	11%	9	12%	1	2%	6	11%	--	0%	4	18%	33	10%
40 to 49	3	2%	1	1%	5	11%	4	7%	--	0%	--	0%	13	4%
50 to 74	1	1%	2	3%	--	0%	1	2%	--	0%	--	0%	4	1%
75 & above	--	0%	--	0%	--	0%	--	0%	--	0%	--	0%	--	0%
TOTAL	121	100%	71	100%	46	100%	55	100%	16	100%	22	100%	331	100%
Class Laboratory ASF	124,041		44,036		42,188		50,043		19,154		19,775		299,237	
Total Class Lab Stations	2,256		1,140		785		971		304		407		5,863	
Stations/ Room	18.6		16.1		17.1		17.7		19.0		18.5		17.7	
ASF per Room	1,025		620		917		910		1,197		899		904	
ASF per Station	55		39		54		52		63		49		51	
Headcount	23,600		11,500		13,000		9,600		2,200		2,100		62,000	
ASf per Headcount	5.3		3.8		3.2		5.2		8.7		9.4		4.8	
Headcount per Class Lab Station	10.4		10.1		16.6		9.9		7.2		5.2		10.6	

Source: *Ira Fink and Associates, Inc.*

Continued from page 20

Enrollment Headcount and Number of Instructional Spaces

As illustrated in Table 3, there is variation in the number of headcount students per class laboratory room measured as a campus-wide average. The range in headcount enrollment to the number of class laboratories varied from a low of 95 students per class laboratory at a small, private university to 293 students per class laboratory at a large public university. By comparison, for classrooms, the data show considerably fewer students per room, with the range of headcount students per classroom ranging from a low of 27 students per room at a small private university to a high of 126 students per room at a large public university.

A rule of thumb is that in research universities there should be about 1.3 times as much total class laboratory square footage as classroom; for comprehensive universities and for small private colleges and universities, there should be an equal amount of total class laboratory and classroom space.

Class Laboratory Support Facilities

The fourth characteristic of class laboratories that affects space management, support facilities for class laboratories, reflects the fact that many other types of rooms are needed to supply and prepare for class laboratory use. For example, prep rooms and equipment rooms are needed to support biology, chemistry, and physics class laboratories. If the class labs are underused, it is likely their supporting facilities are unused or underused as well.

Based on data from the six campuses shown in Table 3, class laboratory service space as a percentage of class laboratory space ranged from a low of 14 percent to a high of 52 percent, with an average of 28 percent. In other words, for every 1,000 square feet of class laboratory space, an average of 280 square feet of support space was needed. This results in an increase in the reservoir of available space when class laboratories are unused or underused. At the same time, it is important to plan for and include necessary service and support space when programming or considering new or renovated class laboratories.

Unique Patterns of Class Laboratory Use by Days of the Week

A common misnomer in higher education planning is that most classroom instruction occurs on a Monday-Wednesday-Friday schedule, to allow class laboratories to take place on a Tuesday-Thursday sequence. Like many other icons of space use, this too needs to be revisited. For example, on two campuses where we have recently conducted class laboratory use and utilization studies, we found the Tuesday-Thursday laboratory schedule to be very limited.

The pattern of laboratories occurring on the sequence of Tuesday-Thursday applied to slightly less than one-quarter of class laboratory courses at one example campus and 7 percent at another. What is most surprising, and as shown in Table 4, is that more than one-half of the laboratory courses, 51 percent, met only one day per week on one campus, and 91 percent met only one day a week at a second campus.

Tuesday Is the Busiest Day

While Tuesday and Thursday are peak class laboratory instructional days, the busiest of the two days for class laboratory enrollment is Tuesday, as shown in Table 5. It is

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Table 3. CLASS LABORATORY AND CLASSROOM STATIONS PER HEADCOUNT

Institution	Head Count Enrollment	Class Laboratories		Classrooms		Enroll per CLab	Enroll per CRm
		No. of Class Labs	No. of Stations	No. of Classrooms	No. of Stations		
A Large Public	23,600	121	2,256	187	9,456	195	126
B Large Public	11,500	71	1,140	218	7,457	162	53
C Large Public	13,000	46	785	150	9,141	293	87
D Large Public	9,600	55	971	203	8,939	175	47
E Small Private	2,200	16	304	53	1,591	138	42
F Small Private	2,100	22	407	79	2,571	95	27

Source: *Ira Fink and Associates, Inc.*

Table 4. CLASS LABORATORY MEETING TIMES

Class Laboratory Meeting Days	Campus A		Campus B	
	Total Courses	Percent	Total Courses	Percent
Monday Only	41	7.2%	29	14.4%
Monday-Tuesday-Wednesday-Thursday-Friday	7	1.2	--	--
Monday-Wednesday	57	10.0	2	1.0
Monday-Wednesday-Friday	66	11.6	1	0.5
Monday-Friday	6	1.0	--	--
Tuesday Only	82	14.4	52	25.8
Tuesday-Wednesday-Thursday	2	0.4	--	--
Tuesday-Thursday	136	23.7	14	7.0
Wednesday Only	72	12.6	49	24.4
Wednesday-Friday	2	0.4	--	--
Thursday Only	81	14.2	47	23.4
Friday Only	19	3.3	7	3.5
TOTAL	**571**	**100.0%**	**201**	**100.0%**

Source: *Ira Fink and Associates, Inc.*

Table 5. AVERAGE ENROLLMENT BY DAY OF THE WEEK

Day	Class Laboratories		Classrooms	
	Courses	Enrollments	Courses	Enrollments
Monday	177	3,094	903	26,458
Tuesday	**227**	**3,807**	**948**	**29,032**
Wednesday	206	3,654	941	27,318
Thursday	226	3,759	926	28,060
Friday	100	1,682	603	20,015

Source: *Ira Fink and Associates, Inc.*

important to note that not only is Tuesday the busiest class laboratory day at this campus, but it is also the busiest classroom instruction day as well.

While classroom enrollment on Friday was about 70 percent of the peak Tuesday enrollment, class laboratory enrollment on Friday was less than 45 percent of Tuesday. One reason is that for some class laboratories, instruction is not offered on Fridays, as the day is set aside to take down and set up experiments.

Class Laboratory Use and Utilization

Utilization Analysis for Class Laboratories

One of the more contentious issues in higher education facility planning is the concept of measuring class laboratory utilization. An excellent discussion of the development and evaluation of institutional utilization criteria for classrooms and class laboratories, including critical comments on utilization guidelines, is in Manual Two of the WICHE *Higher Education Facilities Planning and Management Manuals*.[3] The authors note that utilization studies suffer from serious deficiencies in research design, including, for example, issues of one size fits all, too narrow of a focus, the use of overall averages, oversimplification of summary data, and lack of insight into total institutional resources. What has occurred in utilization guidelines is that a method for forecasting the needed amount of class laboratory or classroom space has been inverted to become a utilization guideline.

To emphasize the point of the deficiencies of these analyses, and for purposes for this article, daytime class laboratory utilization is presented for two campuses where we have recently conducted use and utilization studies. These studies were based on a 45-hour class week (8 a.m. to 5 p.m.), with 50 percent room use rate, which is an indication of the percent of time a room is used each week. The station occupancy rate—the percent of stations or seats in use—is pegged at 80 percent for class laboratories. These are guidelines that are generally used for estimating the amount of space needed in biological science, business, education, languages, law, mathematics, physical science, psychology, and social science class laborato-

Table 6. CLASSROOM AND CLASS LABORATORY UTILIZATION FACTORS, USED FOR FORECASTING SPACE NEEDS

Room Type	Hours Available	Hours Utilized	% Hours Utilized	% Stations Occupied
Classrooms	45 hours/week	30 hours/week	66.7 percent	60.0 percent
Class Labs[a]	45 hours/week	22.5 hours/week	50.0 percent	80.0 percent
Class Labs[b]	45 hours/week	11.25 hrs/week	25 percent	80.0 percent

a: Biological Science, Business, Education, Language, Law, Mathematics, Physical Science, Psychology and Social Science Class Laboratories
b: Engineering, Health Professions, Agriculture Class Laboratories

Source: Space Planning Guidelines. *Columbus, Ohio: Council of Educational Facility Planners, Int'l, 1985, pp. 5–12.*

ries. In the two example campuses, the calculated use of reported class laboratories was 58.3 percent at one campus and 52.8 percent at the second. Class laboratory utilization was 54.5 percent and 51.7 percent respectively.

The Council of Educational Facility Planners in its *Space Planning Guidelines* (1985),[4] suggests an alternative guideline of a 25 percent class laboratory use factor (11.25 hours per week) for forecasting class laboratory space needs in engineering, the health professions, and agriculture, because these disciplines are likely to require a wider variety of laboratory types. Table 6 summarizes typical classroom and class laboratory guideline factors used in higher education.

Class Laboratory Utilization

To determine the degree to which class laboratory use and utilization is actually measured on campuses, we recently polled 30 universities as part of a classroom use and utilization study. We obtained data from 11 campuses, with nine campuses reporting in a comparable method. We assumed the 19 campuses that did not respond did not have data on their class laboratory use and utilization.

The information obtained from the nine campuses is reported in Table 7. The data show a pattern of low use and utilization of class laboratory space. Among the institutions where information was available, five reported class laboratory use in the range of 20 to 35 percent, three in the range of 60 percent. Class laboratory utilization at the five institutions where data was available ranged from 32 percent to 84 percent. As Table 7 illustrates, one campus based their class laboratory utilization on a 30-hour week, five did so on a 45-hour week, one on a class week of 50 hours, and at two of these institutions the data was based on a 70-hour week.

It is difficult to gauge the significance of information on class laboratory utilization, because the data is usually an average taken across all class laboratories on a campus and because the requirements concerning the class week vary so widely. For campuses that conduct such studies, the utilization results should not be an end in themselves. Rather, the data can be used as part of an analysis to help identify the circumstances that control the amount and level of class laboratory use. If it is possible to consolidate or better schedule the class laboratories, a campus may gain better efficiencies or reclaim unused class laboratories for other uses.

It is important to use the utilization analysis process to identify class laboratories that are little used. They may be consolidated for use with another similar laboratory. It is also important to identify class laboratories that have no regular or formal scheduled use and can be reclaimed into the space inventory for reassignment and reuse.

Approaches To Improving Class Laboratory Use and Utilization

New Approaches

This article has concentrated on the importance of class laboratories, their spatial characteristics, and their reported low use and utilization. Problems in this area are being

Table 7. SUMMARY OF COMPARATIVE CAMPUS BENCHMARK DATA

University	Classroom		Class Lab		Class Week Time Period	Year/Term
	Use %	Util %	Use %	Util %		
A	63% - 71%		30% - 42%		50-hour week	2001–02
B	32.5%		21.1%		45-hour week	Fall 2001
C	34.6%	59.6%		71.5%	30-hour week	2001–02
D	86.0%	60.0%	57.0%	31.8%	45-hour week	Fall 2001
E	60.7%		61.6%		45-hour week	2001–02
F	57.1%	65.0%	34.3%	67.0%	70-hour week	Fall 2002
G	58.6%	72.0%	34.3%	84.0%	70-hour week	Fall 2002
H	83.6%		29% - 51%		45-hour week	Fall 2002
I	74.2%	85.4%	58.3%	54.5%	45-hour week	Fall 2001

Source: *Ira Fink and Associates, Inc.*

addressed by many campuses. Some, with aging facilities, build new replacement class laboratories or install new casework and equipment; others incorporate new instructional approaches or look for alternative solutions; some do nothing.

One change that is occurring is the use of computer simulation for hands-on experimentation. An example is the Studio Physics program at Rensselaer Polytechnic Institute (RPI). The traditional experimental "wet" physics class laboratory at RPI has given way to physics instruction in which students are paired at a computer workstation and experiments performed through course designed computer software. At the University of Iowa, undergraduate chemistry class laboratories are taught in a laboratory-studio system: during one week, one-half of the students conduct experiments in chemistry class wet laboratories; in the alternate week they are in a computer classroom working on case studies. With the two groups of students trading places each week, the campus has been able to match its class laboratory resources to its instructional demand.

Other changes in the methods of instructional delivery are occurring. Some of these changes have resulted in the repackaging of course sequences among lecture, demonstration, experiment, and recitation. These changes are being reflected in laboratory courses which occur only one day per week rather than two or three. These changes may eventually result in reductions in station sizes and in the number of rooms by discipline.

Specialized Class Lab Furniture and Equipment

One concern in developing or redeveloping class laboratories, particularly in the sciences, is the cost. In addition to the investment in movable analytical equipment used in laboratories, there is the cost for casework (benches, counters, cabinets) and fixed equipment such as fume hoods.

Finding data to estimate the cost of laboratory furniture and equipment is difficult. To provide an understanding of what campuses can face in renovation or new construction, listed in Table 8 are current costs for fixed casework and installed fixed equipment for various science teaching and research laboratories being constructed in California.

At the top of the cost scale are organic chemistry class laboratories. The estimated cost for fixed casework and installed fixed equipment alone, including hoods, could average about $120 per square foot of laboratory area. The cost for installation of fixed casework and installed fixed equipment for other teaching and research laboratories shown in the table are less costly, and vary by, and within, a discipline. In biology, for example, there is less spread between the cost of biology class laboratories and research laboratories. Other science class laboratories, as well as all non-science class laboratories, would

Table 8. COST OF FIXED CASEWORK AND FIXED EQUIPMENT, PER SQUARE FOOT OF LABORATORY AREA, CALIFORNIA COLLEGES AND UNIVERSITIES

Type of Laboratory Space	Average Cost per Square Foot of Laboratory Area for Fixed Casework and Installed Fixed Equipment
Organic Chemistry Teaching Laboratories	$120
Organic Chemistry Research Laboratories	$110
Inorganic Chemistry Teaching Laboratories	$110
Inorganic Chemistry Research Laboratories	$100
Molecular Biology Research Laboratories	$75 to $100
Physics Research Laboratories	$60 to $90

Source: *Davis Langdon Adamson, Cost Consultants, Santa Monica, California, 2003*

fall below these ranges. For example, autoclaves can have a large impact on cost—since it is easy in biology laboratories to spend $100,000 on an autoclave, with some costing well over $250,000. This alone could add $5 per square foot of laboratory area for each autoclave.

The Future Challenge

To review the use and utilization of class laboratories on a campuses, three steps are needed:

First, match the facilities room inventory database of class laboratories with the registrar's record of regularly and formally scheduled class labs and identify any rooms that have not been scheduled for use.

Second, analyze class laboratory use and utilization to identify any sparsely used laboratories, and single these out for additional analysis.

Third, from these steps identify and document the class laboratories that have little or no use—too little demand, too much capacity, outdated equipment or obsolete space that no one wants to use.

Based on this information, decide how to proceed: revise or consolidate the laboratory portion of the course to better manage the space; provide physical improvements to the space to encourage and promote better use of the room; or, remove the space from departmental use and reassign it for another higher priority need.

Since the management of class laboratories is an area that doesn't receive much attention, the action of conducting a space use analysis may result in developing an inventory of class laboratories that are better used. Generally, low room use or utilization does not result in a change in assigned room use until there is a competing demand for the space. Follow-

ing the above process will make the campus proactive, and can save the institution considerable capital funds.

If the result of the study and analysis is a need to reconfigure or renovate the class laboratories, be deliberate. Carefully program and size the number of stations in all class laboratories. Match the room capacity to the section size used in the academic instruction program and the span of control for purposes of instruction and of safety. If the typical section size for hands-on laboratory work is 16 to 20 students, there is likely no need to build 28-station class laboratories, with the expectation that enrollments may change dramatically.

If the class laboratory is for advanced, rather than entry-level course work, remain cautious about building and outfitting rooms that have station capacity above the level of demand as measured by majors, course offerings, and degree requirements. Analyze carefully the instructional demand for all laboratories—new, renovated, and remaining—and simulate the instructional pattern both before and after improvements to be assured the need for even one more class laboratory is justified.

Recognize the total project cost of adding class laboratory space. These costs could be $150 to $200 dollars per gross square foot for construction, plus laboratory casework and equipment, plus soft costs (fees, contingency, inspection, movable equipment) all added together to account for total project costs.

If the need to construct new space or renovate existing space is confirmed, then build the class laboratory or laboratories, so they too will be touted by the departments and become a calling cards for th0e campus. They may have to serve the campus and its students for a generation or more.

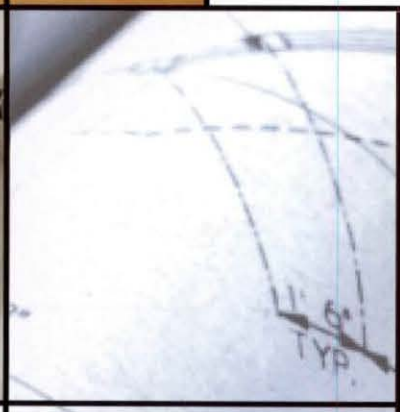
Endnotes

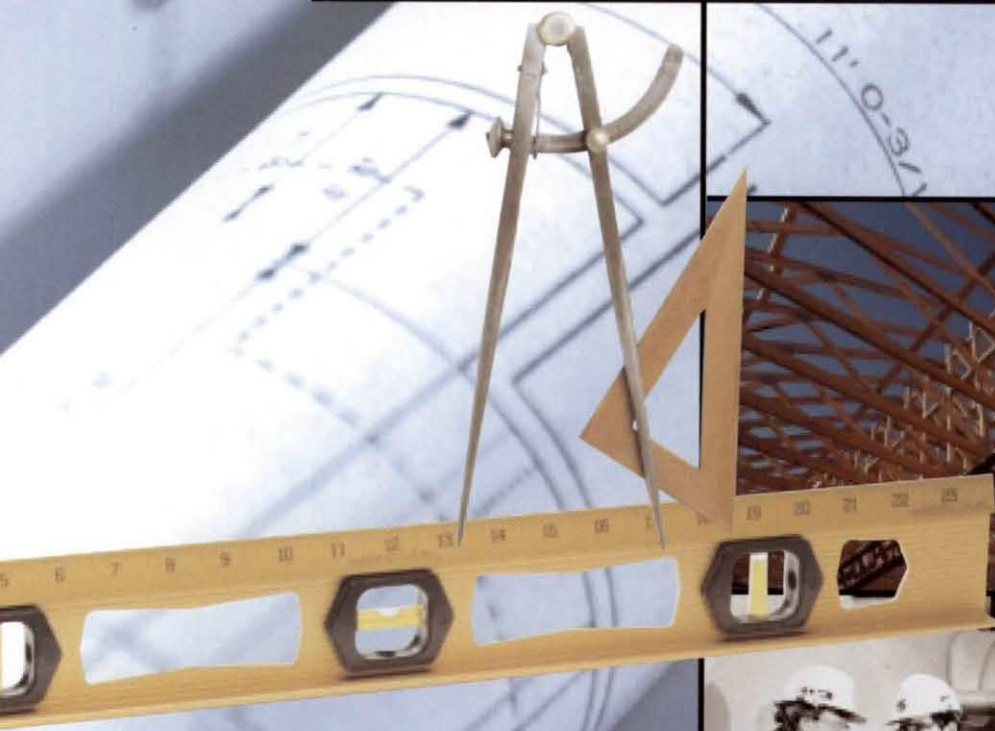
1. Ira Fink. *Campus Planning and Facility Development: An Annotated Bibliography, Fourth Edition.* Berkeley, California: Ira Fink and Associates, Inc., 2002, 197 pp. Available from APPA at www.appa.org.
2. National Center for Education Statistics. *Postsecondary Education Facilities Inventory and Classification Manual.* Washington, D.C.: U.S. Department of Education, Office of Educational Research and Improvement, National Center for Education Statistics, 1992, p.45.
3. WICHE. *Higher Education Facilities Planning and Management Manuals. Manual Two: Classroom and Class Laboratory Facilities.* Boulder, Colorado: Planning and Management Systems Division, Western Interstate Commission on Higher Education, May 1971. For a thorough discussion read pages 139 through 154 on "The Development and Evaluation of Institutional Utilization Criteria for Classrooms and Class Laboratories."
4. *Space Planning Guidelines.* Columbus, Ohio: Council of Educational Facility Planners, International, 1985, 37 pp.

The Building Commissioning Handbook

Second Edition

John A. Heinz, P.E.
Richard B. Casault, P.E.





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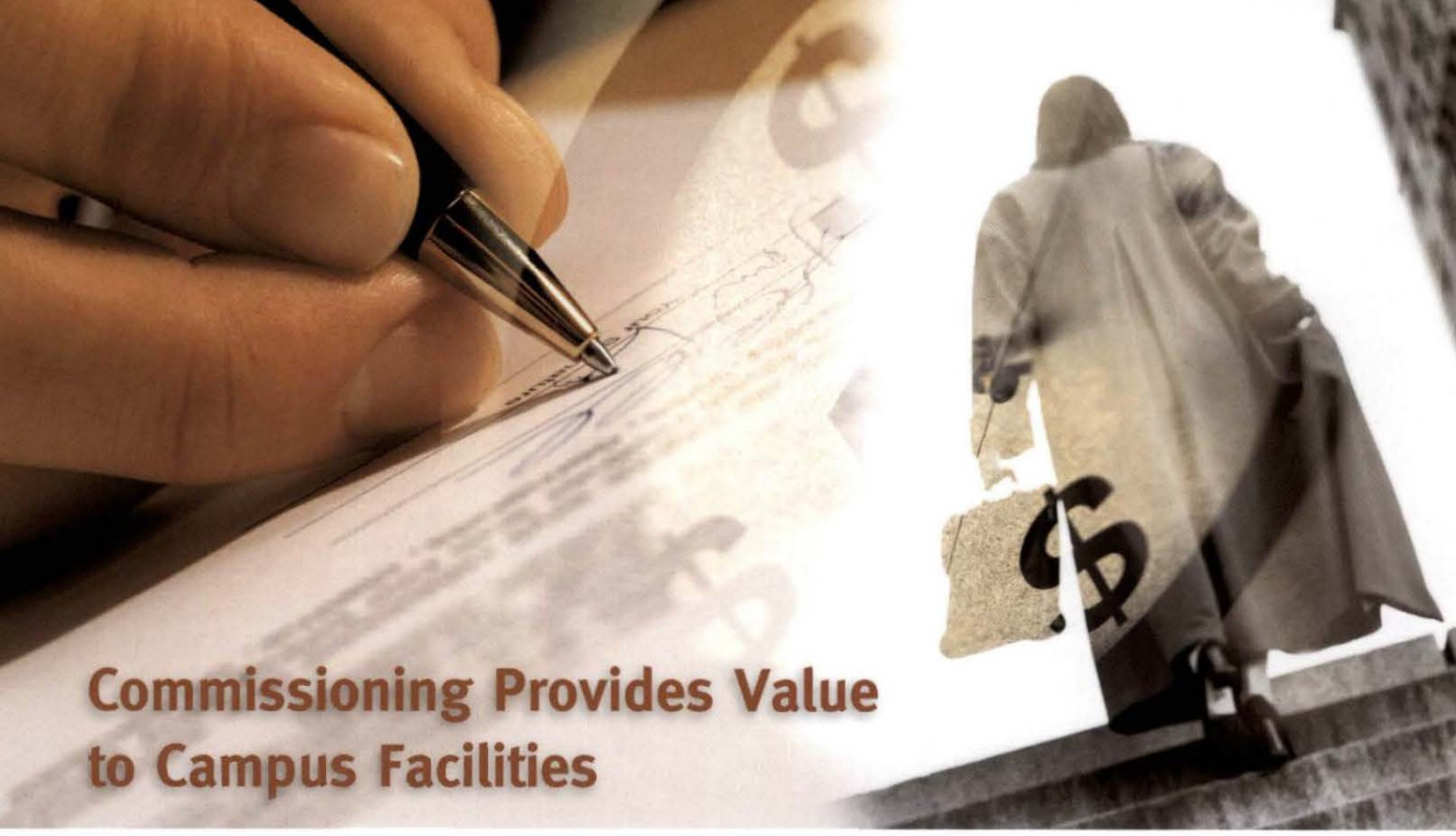


Commissioning Provides Value to Campus Facilities

by John A. Heinz, P.E. and Richard B. Casault, P.E.

During the latter half of the 20th century a great deal of refinement has taken place in the building design and construction industry. Somewhat common throughout that period have been the several stages of project development—predesign, schematic design, design development, construction documents, bidding, construction, and warranty—followed by many years of operation and maintenance. Each of these phases has experienced significant process refinements, all intended to improve the efficiency and effectiveness of the process and the quality of the final product for the building owner.

One of the more recent refinements has been the introduction of building commissioning. Even though the process of building commissioning has been developing during the past 30 years, it is still in its early stages of acceptance throughout the industry. In fact, as the subject of commissioning the building is brought into the early planning or design stages for a new facility, often some of the first questions to arise are:

- Why do we have to have a special program for commissioning the building?
- With a good design professional and construction contractor shouldn't the building work like it is supposed to?

Ideally, one would like to respond to the second question in the affirmative: "Yes, it should." But the reality is—it just doesn't work that way any more.

Back in the 1950s commissioning a new facility was not a concern. In fact, the word "commissioning" was not a commonly used term in the commercial and educational building design and construction industry. For the most part, new buildings operated the way they were supposed to. During the 1950s a great evolution in facilities design and construction technology was just beginning, was well underway during the 1960s, and continued through the end of the 20th century. In the 1970s there was increasing difficulty in getting buildings to work as they were supposed to. In the 1980s it was not uncommon for complex science and research buildings to take as long as three years to be fully debugged to the point that they worked as they were supposed to. This change is primarily attributable to the increased complexity of building systems and the ongoing rapid changes in technology.

The increased complexity of building systems results from several developments:

- more stringent energy conservation requirements,
- the need for safer work environments,

John Heinz is a professional engineer in Seattle, Washington, and can be reached at jheinz@bcxa.org. Rick Casault is president of Casault Engineering, Seattle, Washington, and can be reached at rickc@casault.com. They are coauthors of APPA's new book,* The Building Commissioning Handbook, second edition, *from which this article is excerpted. This publication was developed jointly by APPA and the Building Commissioning Association.

- demands for improved indoor air quality and comfort control,
- technological advancements in office equipment,
- advanced phonic, image, video, and data communications technologies, and
- rapidly changing research and teaching methodologies.

Distributed digital control systems help meet some of these needs, but they also add sophistication and complexity.

The traditional methods for building start-up and final acceptance proved inadequate in the 1980s and 1990s. The negative impact on the occupants and operating staff during the initial post construction years became intolerable and something had to be done to shorten (preferably, to eliminate) this stressful break-in period for the people involved. The entire process of acquiring new facilities had to become more sophisticated in order to keep pace with the complexity of new technologies and to get the required performance from them. Thus, contemporary building commissioning was born.

Commissioning isn't a new concept, but what *is* new is its increasing application in the building design and construction industry. The failure of traditional building start-up methods—combined with the health, safety, and energy consequences of failure—is the impetus driving adaptation of the commissioning philosophy to commercial and educational facilities.

The Optimum Quality Assurance Program

Commissioning is not an event. Commissioning is a process. When properly executed the process will ensure the highest quality and operational reliability of the completed facility within the funds available. Ideally, the process begins during the facility's initial programming phase (the predesign phase); continues with increasing intensity through the design phases; reaches its peak activity throughout the construction phase; becomes the key to final acceptance; and culminates with operational sustainability, an ongoing monitoring and trend-logging program, and the tools for recommissioning systems when needed. To be sure, the process is intended to ensure that all systems operate as intended. However, it is much more than just that. It is a process that will ensure optimum quality for everything that is designed, acquired, and constructed—resulting in a facility that is ideally suited for the owner's operations, with sustainable operability.

If the commissioning process is properly developed and applied it is the optimum quality assurance program for all phases of the project.

- It helps the owner develop and document the owner's project requirements for the facility.
- It helps the design professional determine and document the important parameters of the basis of design, select optimum system design solutions, ensure their commissionability, and prepare construction documents leading to construction of a commissionable building.
- It helps the prime contractor, subcontractors, and vendors select and properly install components and systems in accordance with the commissionability requirements for the project, and then to perform all commissioning tests necessary to validate performance of the facility as required by the owner's project requirements.
- It helps the owner make sure operating staff is properly trained and provided with the necessary documentation to be able to ensure optimum operational sustainability of all systems.

Each step is intended to assure the quality of the effort at hand, which is critical to the next sequential step of the program. A lapse in quality during any step can contribute to lack of proper understanding of requirements in subsequent steps, which can become cumulative and ultimately result in degradation of the final outcome, thus increasing the likelihood that the project will fall short of meeting the owner's project requirements.

For a variety of reasons commissioning is often not initiated until late in some projects, perhaps during the construction documents design phase or the construction phase. Even though this late application of the process has significant disadvantages in achieving the preferred optimum results of the commissioning process, there are still benefits to be gained. However, the potential optimum benefit will most likely have been lost.

A skilled commissioning authority can document the potential savings and economies that commissioning can bring about during each step of the process. It is a rare case when such documentation does not demonstrate that the savings achieved exceed the otherwise additional costs for corrections during or after construction and the ongoing increased energy costs that result from the loss of optimum efficiency performance of the systems.

Definition

An all-inclusive definition of "commissioning" has not been universally adopted. As one listens to early commissioning advocates it becomes apparent that definitions often reflect the specialty within a facility that is being commissioned. Electrical utilities concentrate on commissioning energy conservation measures for which they have contributed funding in order to optimize energy consumption profiles. Local fire departments concentrate on commissioning fire and life safety provisions required by related codes. Other regulatory agencies insist that provisions within their purview be proven fully operational in accordance with their specific requirements.

As these narrow definitions persist, they have had a negative effect on the proper understanding of the comprehensive requirements for commissioning an entire facility. Whereas utilities and regulatory agencies focus on commissioning certain systems the owner must be assured that all systems within the facility have been commissioned. Commissioning is imperative for hospitals and other healthcare facilities, and is becoming a critical requirement for high-technology labora-

tories and research facilities. It is also becoming an important way for classroom and office buildings to meet the specific and diverse needs of the occupants. Hence, it is essential to come up with a broad definition of total building commissioning.

The owner views the entire building as a system, one that must meet a wide range of occupancies and functional needs. Perhaps the definition from the summary report from the 1993 National Conference on Building Commissioning is appropriate: **"Commissioning is a systematic process of assuring that a building performs in accordance with the design intent and the owner's operational needs."**

Another valuable characteristic of commissioning is discovery. Although no quality assurance process, including commissioning, should be expected to achieve zero defects, commissioning is a process that ensures discovery of flaws in the design or construction that will preclude facility operation in accordance with parameters set forth by the owner. Of course, discovery will inevitably occur, but it usually occurs under the most unfavorable circumstances, resulting in operating difficulties that could be critical or, in the extreme, even fatal. The least that will result from untimely discovery is inconvenience for building occupants and operations and maintenance staff. Commissioning forces discovery to take place under controlled conditions and at a time when dire consequences are least likely to result.

Further, if discovery occurs before the construction contract is accepted as complete, the consultants and contractors will bear the burden of taking corrective action and, generally, paying all related costs. When discovery occurs later the owner inherits these responsibilities and costs with little or no recourse to those responsible for the failure.

Goals

The overall goal of building commissioning is to construct a facility that operates as intended. However, it is important to recognize several specific subgoals that will be achieved as a direct result of the commissioning process.

- The primary goal is to *provide a safe and healthy facility* for employees and the public in a commercial facility, or for students, faculty, staff, and the public in an educational facility. Commissioning minimizes functional and operational deficiencies that have been shown to be responsible for the majority of indoor air quality problems and complaints about comfort. Commissioning minimizes liabilities inherent in laboratory building operations.
- The second goal is to *improve energy performance.* Commissioning is the tune-up that brings about the most efficient performance by the installed equipment. Commissioning tailors the system's operating parameters to the conditions of actual usage. Commissioning optimizes system performance to meet the requirements of the conditions rather than simply operating at the capacity of the equipment.
- The third goal is to *reduce operating costs.* Equipment operating improperly is operating inefficiently. Improper operation usually induces more frequent maintenance and results in shorter life expectancy for the equipment, thus increasing annual operating costs and the frequency of capital replacement costs.
- The fourth goal is to *improve the orientation and training of the staff* who will operate and maintain the systems and equipment. The sophisticated systems being installed will be disabled or compromised if operations and maintenance staff do not understand operation and maintenance requirements. No matter how well the equipment and systems operate at the outset, systems will degenerate without proper care. Designers and contractors can barely keep up with the proliferation of high-tech system configurations and associated equipment and controls. Without design documentation, explicit diagrams and

operating procedures, and opportunities for effective training, operations and maintenance staff will soon flounder as a result of the information overload and their lack of adequate training.

- The fifth goal is to *provide improved documentation*. Traditionally, specifications and drawings do not include all information needed for operation, troubleshooting, and renovation of the facility. The owner's project requirements, the basis of design documentation, control logic diagrams, one-line diagrams, and operating descriptions help to communicate the designer's intentions to current and future operators and designers. Fully documented testing procedures and results verify the capacity and operating parameters of the facility and the systems, and they facilitate recommissioning that will be needed in the future.
- The final and most important goal is to *meet the owner's needs*. Systematic scrutiny, verification, and functional performance testing of the design and construction will achieve the overall goal of providing a facility that operates as intended and thereby result in a satisfied owner.

Benefits of Commissioning

The benefits of a well-developed and well-executed building commissioning program are extensive and accrue nearly equally to all three principal participants: the owner, the design professional, and the contractor. Therefore, it is difficult to suggest which benefits may be considered the most important.

Perhaps the primary benefit is simply that the commissioning process serves as the overall quality assurance program for the functional success of the project. That is because the disciplines inherent in the commissioning process sequentially assure optimum overview and review of programming, design, construction, start-up, functional performance verification, training, and establishment of the completed facility's sustainable operation. The commissioning process leads to a higher probability that construction will be completed on schedule and within budget. There are numerous specific benefits for the participants.

Benefits for the Owner

- All building systems will function as intended. This includes one of the traditional gray areas that heretofore has been inadequately addressed, and that is the complex interaction between systems. For example, commissioning verifies the interaction of heating, ventilation, and air conditioning systems with fire protection systems and emergency power systems during emergency operating conditions, including restoration of normal operating conditions following an emergent condition.
- A safe, healthy, comfortable environment will be assured upon occupancy, resulting in higher levels of productivity because of occupants' satisfaction with their working environment. The flaws that heretofore often have been discovered long after initial occupancy will be discovered and corrected during the design and construction phases.
- The intended operating efficiency of the systems will be established before the project is accepted as complete and therefore result in optimized consumption of resources, hence, minimum annual utility costs.
- Efficiently operating systems indirectly result in less wear and tear on systems apparatus and less frequent need for replacement.
- Operations staff will be better trained and will receive extensive system operations documentation that has not existed heretofore. The newly available documentation will significantly enhance maintenance of the intended sustainable operation of the facility.
- Better documentation throughout the project will pay dividends in future years as alterations are needed

The benefits of a well-developed and well-executed building commissioning program are extensive and accrue nearly equally to all three principal participants: the owner, the design professional, and the contractor.

because of changes in occupancy. Design consultants will not need to make assumptions about the original basis of design because it will all be documented.

All of the benefits that accrue to the owner lead to a higher probability that the project will be completed on schedule and within budget.

Benefits for the Design Professional

- The commissioning process refines design philosophies and concepts. The commissioning authority brings operating engineer experience directly into the design process, which more often than not influences many of the design details. Construction specifications become more highly refined via the commissioning authority's review, helping to ensure selection of the proper equipment and components that are critical to the intended and reliable operation of the systems.
- Commissioning-oriented review leads to a reduction in design errors. That, coupled with the rigorous functional performance testing of components and systems during the construction phase, virtually eliminates post-construction callbacks for the design professional.
- Profits for the design professional will not be eroded due to spending time resolving design or construction issues that did not have to occur.
- The qualifications and reputation of the design professional will be enhanced over time as they expand their expertise because of participation in commissioning activities.

Benefits for the Contractor

- The commissioning process increases attention to scheduling and coordination, primarily because commissioning testing begins about one-third of the way through construction and continues on a regular basis thereafter. Better scheduling and coordination lead to smoother installation and fewer conflicts between trades vying for installation positions.
- There is greater contractor emphasis on quality control. The disciplines of the commissioning process result in easier, faster resolution of problems discovered during construction. As a result, there is increased likelihood that the project will be completed on schedule and within budget
- Commissioning nearly eliminates post-construction callbacks for the contractors.
- Contractors' profits will not be eroded because of the need to spend time resolving design or construction problems that did not have to occur.
- The qualifications and reputation of the contractors will be enhanced over time as they expand their expertise because of their participation in commissioning activities.

As evidenced by the increasing number of successful commissioning programs, when all parties enthusiastically accept and integrate a well-developed commissioning process into the project the process becomes a win-win situation for all involved.

When Does Commissioning Start?

There is a tendency to assume that commissioning is an activity that occurs only during or at the end of the construction period. In many cases it may happen that way, particularly in situations where commissioning had not been considered until the owner became concerned that the new facility likely would not, or will not, operate as intended. One might say, "Then it is too late." However, it is never *too* late. Nevertheless, there is a great deal to be gained by starting the commissioning effort much earlier in the design/construction process.

Ideally, commissioning should start during the predesign (programming) phase for the facility. A variety of factors often result in postponing hiring the commissioning authority until later, but the project team should at least agree during the predesign phase that the facility will be commissioned. If functional issues are not addressed and documented during this phase, and during the early design phases, it is very difficult to achieve the key goals of commissioning and meet the needs of the owner.

However, that is not to say that projects that have progressed past the predesign phase cannot be successfully commissioned. When commissioning is introduced during the design or construction phases, the process will not be as smooth but commissioning can still be initiated and still benefit the project. Revisions to design and construction contracts already in force will need to be negotiated in order to incorporate commissioning at these later stages.

We recommend that the services of a qualified commissioning authority be secured as early in the project as possible to help guide the process. To a great extent, the traditional members of the design and construction teams are not yet skilled in the commissioning requirements and processes.

Which Projects Should Be Commissioned?

Should every new facility be commissioned? In an ideal world the answer would be "Yes." However, the decision really becomes a consideration of what is critical to the owner in terms of health, safety, and liability risk as it relates to the pri-

mary use of the facility, and the comfort and productivity of the facility's occupants. Certainly, facilities that, by definition, provide critical services to the owner, institution, or community should be fully commissioned, including hospitals and other health care facilities, research and teaching laboratories, and any facility that handles hazardous materials or is involved with what might be considered potentially hazardous activities. The prudent owner will apply resources where they will do the most good and minimize risk for the community and the investment.

The variable involved in making decisions about which projects should be commissioned is not so much which facility should be commissioned but, rather, how much of the facility—that is, which systems should be commissioned. That becomes a process of identifying the best commissioning scope for each particular case. Should one apply total building commissioning or should it be reduced? The key to whether to pursue a reduced scope of commissioning is the assessment of the risks involved. A reduced or modified commissioning scope should be employed only where the perceived risk is low.

Which risks should be evaluated? Clearly, risks to occupants' health and safety are primary. Energy consumption efficiency should be considered for most projects. Political sensitivity, such as space being prepared for a high-profile faculty member, a project championed by the administration, or a project funded by a generous donor should receive careful consideration for commissioning. Generous donors become less generous when projects don't live up to their expectations.

Which Systems Should Be Commissioned?

Ideally, all building systems—both static and dynamic—should be commissioned. Dynamic systems are more readily recognized because they are the ones that maintain the environment, provide utility services, convey people, materials, and communications, and respond to emergent conditions. Static systems are not recognized as readily because they include the building envelope, contribute to the desired acoustic environment, minimize vibration, mitigate seismic impacts, and so forth.

Without question, all health and life safety systems should be commissioned. Building codes generally require functional performance testing of such systems to validate performance in accordance with code requirements. Municipal fire departments were probably the first to require confidence testing of life safety systems before initial occupancy; followed by annual retesting of these systems. Environmental health and safety agencies require performance testing and certification of a range of equipment and systems in high-tech research laboratories. None of this testing is optional.

Beyond the health and life safety systems, the owner should focus on those systems in previous projects whose unsatisfactory performance has plagued occupants and the operations staff. If the owner's biggest facilities operations headaches are traditionally leaking roofs and fenestration, then one emphasis of commissioning should be those systems. Roofs and window systems can be performance-tested for waterproof integrity. During the initial construction period, mockups of these construction features can be erected and tested, and accepted. The proven construction methods can then be applied to the entire facility, virtually ensuring a successful outcome.

Similarly, if indoor air quality has been a plaguing problem, applying the commissioning process to the HVAC and envelope systems will virtually ensure that the design solution, construction documents, and construction process will result in a trouble-free heating, cooling, and ventilation system. Experience indicates that, in general, seventy-five percent of the commissioning work and ninety percent of the problems discovered are associated with the HVAC systems.

During predesign is when all of the scope-of-commissioning issues should be discussed and philosophical agreement reached amongst the owner, commissioning authority, and the design professional, if available.

Can We Afford It?

The obvious concern is: How much is all of this additional effort and detail during design and construction going to cost? It is easy to jump to the conclusion that the process will inevitably increase the cost of projects. It is fair to say that at the outset there will be some net increase in the overall cost of design and construction. However, experience will prove that, when all costs of commissioning are compared with ***all*** costs of ***not*** commissioning, commissioning will not increase the owner's overall costs. Moreover, as the commissioning industry matures and design professionals and contractors become more accustomed to the building commissioning process and its benefits, it is reasonable to expect project costs to decrease, although that may be difficult to prove.

Whereas a decrease in costs may seem unrealistic, experience indicates that project management by the prime contractors is markedly enhanced due to the increased discipline for scheduling and coordinating throughout the entire construction period, with commissioning properly integrated throughout, and the increased level of quality control induced by the realities of commissioning. The net result is tighter schedule control, better consideration of submittal materials, improved installation and workmanship, and so forth, resulting in a reduction in construction deficiencies and associated delays in completing construction.

Regardless of the specific circumstances at your institution, most owners will agree that they cannot afford to not commission their new facilities.

Ed. Note: *The Building Commissioning Handbook, second edition* is available for $65 for APPA member institutions, $95 all others. Order at www.appa.org/applications/publications/index.cfm.

A GUIDE TO Protecting Your Roof FROM A SNOW-RELATED FAILURE

by Gary W. Brown, P.E.

LANHAM, Maryland (CNN) – Search-and-rescue crews were sorting through the unstable wreckage of a Toys "R" Us store Saturday, looking for customers who might have been inside when the store's roof collapsed under the weight of rain and melting snow. Authorities are "cautiously optimistic" that no one is trapped inside.

The preceding news story is not what you want to see in the newspaper or on television concerning your institution's facilities. Snow-related roof failures of buildings that vary from hen houses to classroom buildings to shopping centers have cost hundreds of millions of dollars in damage in the last few years. These catastrophic events can cause serious damage to property, and more importantly to occupants, resulting in a debilitating effect on your operations.

Code and Theoretical Implications

The causes of snow load collapses are typically understood by structural engineers and roofing professionals because model building codes contain specific reference to snow load design. The more recently adopted codes are significantly more stringent than previous codes in the requirement for snow load analysis. Prior to 1968-1970, almost no U.S. building codes required structural engineers to consider the increased loads from snow drifting that can occur on roofs as a result of their geometry and proximity to other structures. Depending on the time when the specific codes were adopted, a building that was properly designed prior to 1975 was not likely designed to safely withstand the type of snowdrifts that can accumulate on its roof, according to current codes.

The 2000 International Building Code (IBC), which is in effect throughout much of the United States, requires that design snow loads be determined in accordance with *Section 7 of the American Society of Civil Engineers (ASCE) 7 Minimum Design Loads for Buildings and Other Structures.* Therefore, to bring your building up to current code requirements, you must perform a separate analysis to check the structure and possibly design reinforcements to the structure.

The IBC and the ASCE-7 standard base their requirements on a "50-year" storm. The East Coast of the United States had a storm over President's Day weekend in 2003 that resembled this severity. There were more than half a dozen buildings in the region that sustained newsworthy damage, including at least one fatality. A portion of the B&O Railroad Museum, constructed in 1884 and housing the oldest and most comprehensive railroad artifacts in the country, collapsed under

***Gary Brown is a writer and engineer for Gale Associates, Inc., Herndon, Virginia. He can be reached at gwb@gainc.com. This is his first article for* Facilities Manager.**

Catastrophic deck failure due to snow and heavy rains at a school in Maryland; note that the collapse occurred well away from potential (and actual) drift locations.

the weight of the snow and the heavy winds. Is this to say that there will not be another storm of this magnitude until 2053? Nobody really knows for sure. Furthermore, the failures of the roofs in the region are currently under forensic investigation as to what mechanisms caused the catastrophic collapses. The issues may be related more to the heavy rain on top of the snow than the high drifts.

The flat roof snow load is calculated to yield the likely conditions for the life of the structure. The engineering judgment of the design professional is critical in deciding how conservative this load is based on adjustment factors. The current roof snow load determination factors described by ASCE include the following:

- **Ground snow load** is depicted on a map of the United States based on a statistical 50-year storm. This is a storm that has a 2 percent probability of occurring. The value varies from 0 pounds per square foot (psf) in Florida, southern Louisiana and Texas, and parts of the southwestern states to 100 psf in the Upper Peninsula of Michigan and northernmost Maine. The ground snow loads in Alaska can reach 300 psf in Whittier, Alaska, or be as low as 25 psf in Cold Bay, Alaska. A significant portion of the United States has a value between 10 to 30 psf.
- **Snow exposure factor** is dependent on the terrain category and the effects of wind shelter provided by adjacent structures, etc. Buildings in city centers are afforded more wind protection than isolated buildings. Isolated "wind swept" buildings actually have a reduction in snow load since the snow will blow off the building. This can add load to lower buildings and will be accounted for in the drifting calculations.
- **Thermal factor** is dependent on the interior thermal conditions of the facility. A continuously heated greenhouse with low R-values, which is the measure of thermal resistance to heat flow, will get a reduction in load as the snow is allowed to melt while an unheated structure or one that is intentionally kept below freezing will need to have an increase in loading. Most buildings will simply have the thermal value at 1.0.
- **Importance factor** is the magnification of the snow loads (or the decrease) based upon the use of the building. The importance factor is assigned based on the nature of the occupancy and the hazard to humans. For example, a structure in a college or university with a capacity of 500 or greater is given a Category III exposure that requires a 10-percent increase in calculated snow load over a standard Category II building. If the building is a hospital, a 20-percent load increase is required.

Based on the ground snow load and certain geometric characteristics of the building, the minimum flat roof snow load may be increased beyond the calculated ground snow load. Additionally, roofs with slopes greater than five degrees are adjusted with a slope factor that is primarily due to wind action. The roof pitch, the type of roof covering, and the thermal conditions of the roof all affect the roof slope factor. After

Likely origin of collapse where drain and duct penetrations were in close proximity and deck was not properly reinforced.

all is said and done, the calculated flat roof snow load is checked against a minimum value depending on whether the ground snow load is above or below 20 psf.

After the roof snow load is determined, calculations for unbalanced loading (due to partial removal or melting) and drifting (due to roof projections or adjacent buildings) must be performed.

Steep roofs that shed their snow onto lower roofs do so at a rate of 40 percent of their total surface area load. The snow is expected to extend out from the end of the eaves to a distance of 15 feet; therefore, a sloped roof that is only 40 feet from eave to ridge can be expected to discard at least 320 pounds of snow per foot of edge. This will add over 21 psf of snow to the structure below. You can see how significant this is considering that the flat snow load was previously calculated to be about 20 psf. In addition to this extra load for sloped roofs shedding their snow load, you then need to add in the snow drifting conditions.

Windward and leeward drift each need to be considered. The drift height can be determined by a graph or an equation stipulated by ASCE-7. The variables that must be considered for the determinations are the ground snow load in the region and the lengths of the roof area that are causing the drift. The length of the upper roof governs the leeward drift. The length of the lower roof governs the windward drift. Roof projections that form inside corners may even have drifts in more than one direction.

After the heights of the drift(s) are determined, the weight of the snow is calculated by multiplying the height by the density of the snow. This will ultimately be the information that is needed to analyze the capacity of the existing structural supports to withstand the snow load.

Lastly, a surcharge from rain-on-snow should be considered on roofs with relatively low ground snow load values. A 5-psf load must be added in certain circumstances where there is a possibility of rain over the snow or snowmelt is expected, especially in very low-slope configurations.

Protecting Your Building From Harmful Snow Loads

To prevent the sudden collapse of roof structures, building owners and managers need to perform the following steps to prepare for future weather events.

- **Check the original design documents to ensure that the roof was properly designed.** The General Notes of many structural drawings state the design roof live load, the design snow load, and a statement about "drifting conditions." Contact the original architect or structural engineer to inquire about modifications made during the design that resulted in roof projections or the drifting effects of adjacent buildings.
- **Review subsequent renovation/modification drawings for conditions that could result in ponding or drifting situations.** Ponding conditions due to renovations or additions are typically the result of impeding the originally designed drainage patterns (i.e., a structure or a roof-

Progressive collapse led to failure of shear attachment at wall parallel to deck planks; collateral damage to wall occurred.

Devastating effect on school facility and operations due to localized collapse. Fortunately, the building was closed at the time and no injuries occurred.

mounted unit is placed in an area that blocks the existing drains). Drifting conditions can result from new screen walls, new structures, or superimposed sloped roofing panels.

- **Ensure that the drainage components are not undersized, blocked, or easily frozen, allowing them to hold excessive quantities of water.** If necessary, snake out the drains. If frozen pipes will impede the flow or burst the pipes, consider heat-tracing systems to warm the drainage component. Consult a roofing professional if the drains appear to be undersized or incorrectly located to remove most of the water. Small ponded areas can have a detrimental effect on the roofing membrane while large or deep ponded areas may have serious structural implications known as ponding instability.
- **Inspect the roof periodically to ensure that prior events did not weaken or over-stress the components.** Incessant roof leaks over the life of the structure may have caused deterioration and decreased capacity to the structural elements. A structural engineer should analyze cracked beams, deflected joists, and the like immediately.
- **Determine a safe depth of snow for the roof in general and some specific drifting areas.** Monitor the roof during heavy snowstorms to check that these depths are not exceeded.
- **Develop a snow removal plan.** If it is structurally safe to do so, consider shoveling snow off the roof onto the ground or onto areas of less accumulation. Remember that the roof is going to be slippery and the heavy snow may collapse the structure. Therefore, consider the safety of the workers when deciding if you should remove the snow. Take care not to damage the roof membrane during removal operations.
- **Canopies and overhangs are especially susceptible to excessive loading of snow.** Keep the areas beneath the canopy clear of stored goods and traffic. If it can be performed safely, shore up areas that are in danger of imminent collapse.
- **Inspect the structure after the storm to ensure that the elements are able to perform adequately in the future.**

A Facility Manager's Checklist

To prevent a future roof collapse due to snow or ice accumulations, you should commence preparations and precautions as soon as possible. The actions may be as simple as good housekeeping or as complex as structural analysis and augmentation. Even if your structure has already withstood the onslaught of blizzards, there are warning signs to be aware of for the future.

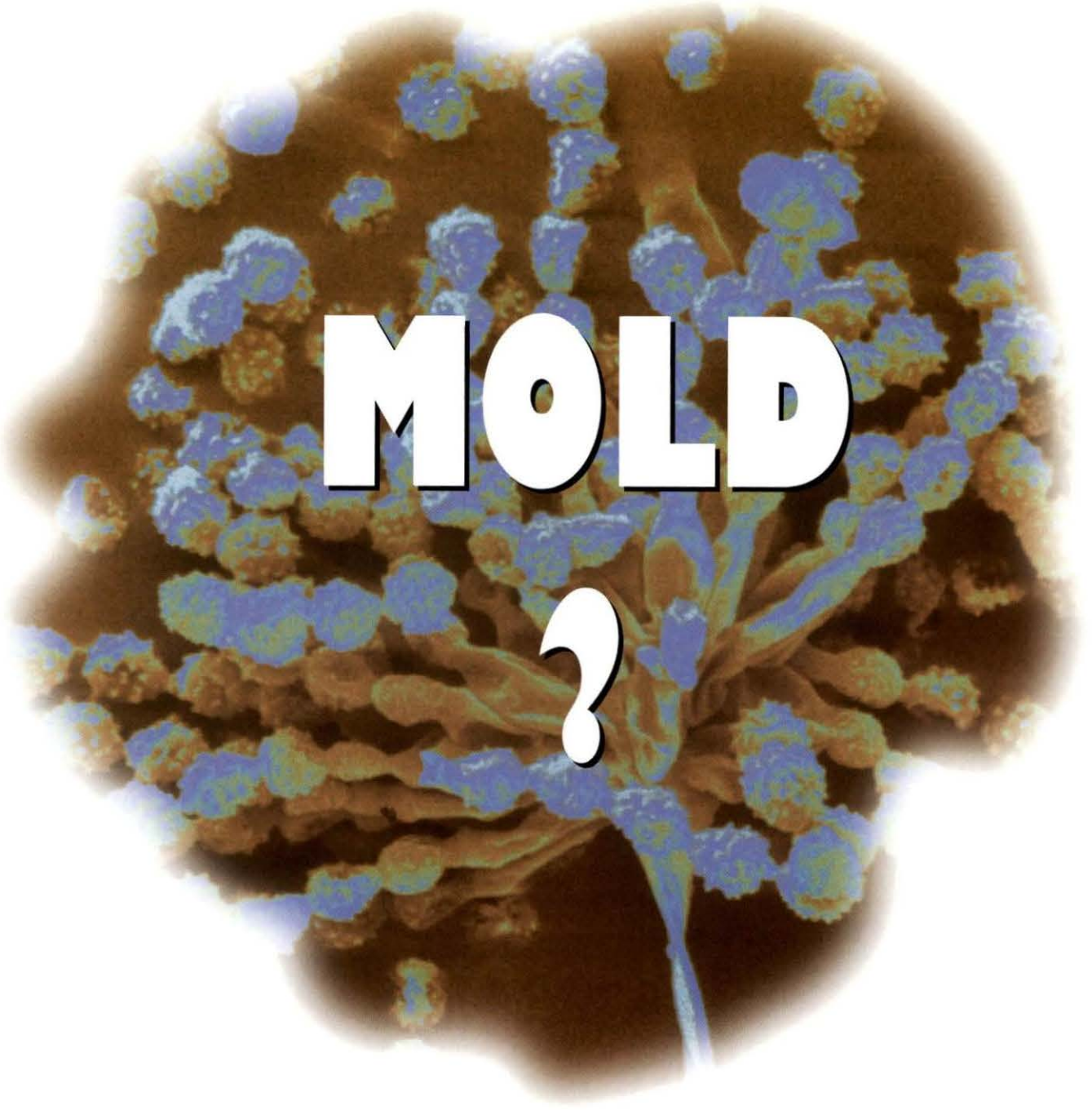
- If the building was constructed prior to 1975, it was most likely not designed to withstand the code-prescribed snow loads.
- If there have been renovations to the building, including the installation of retrofit roof membranes without regard to the considerations of the existing structure, there may be far-reaching ramifications. Ensure existing roof drains were not covered over with subsequent roof systems. Also make certain that the new structures do not form barriers for drifting unless the supports beneath the drift areas are thoroughly checked.
- If the waterproofing elements have been compromised to the point that the structure is deteriorating, there may be diminished capacity. Typically, this is evidenced by oxidized (rusted) metal decking or joists; sagging wood decks or saturated wood framing; or concrete supports that are spalled or delaminated.
- If there is no provision for overflow, or if drain leaders have experienced blockage, the likelihood for ponding instability is increased.
- If snow or live loading in the past have caused excessive deflection or creep in the structure, additional ponding may result, exceeding the capacity of the structure.
- It may be advisable to consult with a structural engineer and/or a roof consultant with expertise in these areas should these warning signs be present.

Conclusion

The model building codes prescribe the performance of a building under extreme conditions that are only expected to occur at infrequent intervals. Typically, the loads due to snow, rain, and wind work in combination of varying degrees with each other and result in circumstances that may even be counterintuitive to ordinary observations. Even though the circumstances for failure are rare, they do happen.

A building owner or facility manager can mitigate the effects of these rare occurrences by taking proper precautions. At a minimum, the building should be designed, constructed, and maintained to meet the code requirements. The maintenance of structures includes careful inspection of structural members to ensure that the strengths of the materials anticipated during the original design and construction activities are still being achieved.

Additional preparations can be made when a significant snow event is forecasted in the same manner that building owners protect against forecasted hurricanes or other predicted events. The best time to prevent building failures due to snow is during the spring, summer, and fall seasons.



Mold Control

Why has there been a sudden upsurge during the last few years in reports about buildings contaminated with mold and research linking negative health effects of people in these buildings to mold contamination?

The cause of the microbiological problems from mold today can be blamed on economics. The increased amount of insulation used in homes and various other buildings save money on heating and cooling of a facility or home. But the environment that is created by eliminating the flow of fresh air promotes the growth of bacteria and fungi. Most of our dwellings today are built with paper products, which hold moisture and grow mold.

Mold is a term used to describe a category of fungi, which is a large group of unique living organisms, that is neither plant nor animal, but rather a kingdom unto itself. Although all molds are fungi, all fungi are not molds. Mold is a type of fungi, found both indoors and outdoors, that produces spores that migrate through the air. These spores are smaller than the width of a human hair. When spores land in the right environment they grow rapidly. Moldy smells from damp materials indicate fungi are present. As the spores grow they actually fight their competition for space and survival.

Health effects and symptoms vary from mild to severe depending on the individual and the exposure levels. Many fungi such as stachybotrus chartarum, aspergillus, penicillium, fusarium, memnoniella and trichoderma can produce harmful potent mycotoxins. There are thousands of possible mold allergens that can trigger allergic reactions, asthma and other respiratory complaints, irritation to the eyes, throat and skin infections, fatigue, cough and flu-like symptoms. Individuals who suspect their persistent health problems are related to mold exposure should have their physician refer them to a practitioner who is trained in occupational and/or environmental medicine and who is knowledgeable about these types of exposures. However, mold spores do not negatively affect everyone, and typically a person's health improves after the exposure to mold is eliminated.

Costly building damage will occur if mold is not removed with speed and expertise. Porous materials such as ceiling tiles, carpeting, upholstered furniture and wallboard that have sustained extensive microbial growth usually have to be removed. Mold growth is abated from non-porous surfaces by vacuuming with a high efficiency particulate air filter vacuum and washing with a solution of biocide and detergent. Other, often unnoticed, reservoirs become breeding grounds for mold and must be addressed. It is important that humidity levels be controlled in workplaces and residences to help avoid mold growth.

Potential liability from workers compensation claims and other lawsuits has increased against landlords, municipalities and employers. Claims similar to those arising from the asbestos and lead paint health hazards are surfacing and some insurance companies have excluded mold damage from their general liability insurance policies. This exclusion leaves builders, contractors and building owners without coverage.

A certified industrial hygiene firm that has certified trained hygienists in mold remediation should be consulted when looking for a solution to mold related problems. Air sampling for fungi should not be part of a routine assessment, because air tests are prone to produce false negative results. Bulk or surface samples may be collected to identify specific fungal contaminants. A laboratory specializing in mycology should be consulted for specific sampling. Decisions about the appropriate remediation strategies will usually be made on the basis of a visual inspection.

A professional environmental contractor should be chosen to do mold remediation. The contractor should have the following qualifications, and resources:

- Experience with similar projects that involve containment and demolition.
- Licensed as an environmental contractor.
- Environmental general liability insurance and bonding.
- On-staff certified safety professional and/or certified industrial hygienist.
- Employees trained in respiratory and personal protection.
- Provision of a customized plan of action.

SETTING THE PASE FOR MEETING FACILITY NEEDS

by George A. Hess

School systems, colleges, universities, and governmental agencies all have complex facility needs. Meeting those needs is difficult for several reasons, not the least of which is trying to plan and select the best projects with uncertain and inconsistent funding streams. This article discusses a *flexible* approach used at the University of Illinois at Urbana-Champaign for managing those facility needs.

This approach is based on a four-step process referred to as PASE.

- **P**lanning
- **A**ssessing
- **S**electing
- **E**valuating

Planning

In the planning phase we focus on determining the facility needs through a strategic assessment of how the facility will be utilized. Emphasis is placed on the modification required to provide functional space for the facility's intended use. We do not focus on the relative strategic importance of that space or program to the institution.

Assessing

In the assessment phase we look at the current condition of the space. We determine what it will cost to modify the space. We create a list of deficiencies and then select the appropriate deficiencies to group together, to build projects that will provide the type of space required for the intended use.

We also link these deficiencies so that deficiencies common to more than one project can be identified.

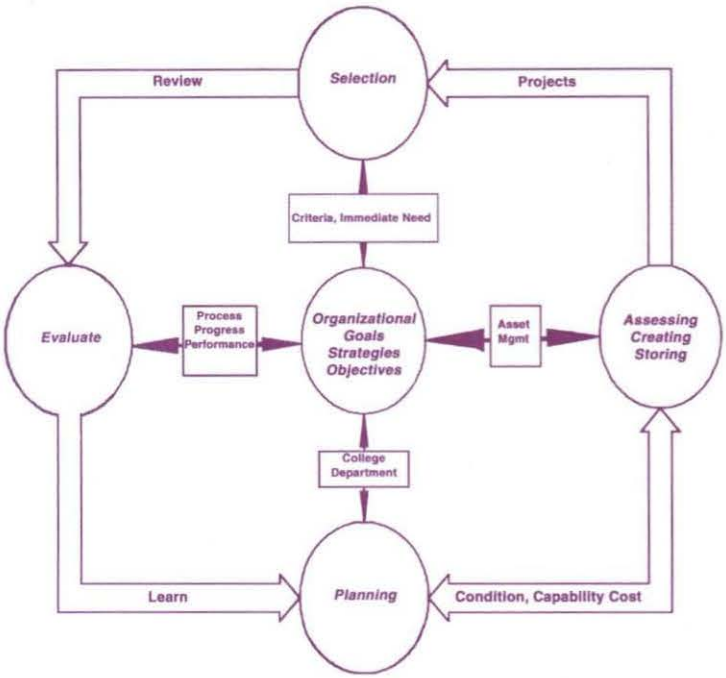
Select

In this phase projects are selected using a set of criteria selected and weighted by the institution. Appropriately selected and applied criteria will identify the projects with the highest "cost-to-benefit" ratio. This criteria can also be used to maximize the number of projects possible within a given funding constraint, if the right tools are chosen for the selection process.

Evaluate

In the evaluation phase we measure the effectiveness of the planning, assessing, and selecting phases. We utilize key performance indicators (KPIs) that incorporate occupant satisfaction, operational cost, maintenance cost, utility cost, and other costs that facilitate the management and improvement of the process.

***George Hess is the director of customer relations and communications at the University of Illinois at Urbana-Champaign, where he has worked in facilities for more than 19 years. He can be reached at gahess@uiuc.edu. This is his first article for* Facilities Manager.**



Cost

The cost in both time and money associated with the PASE approach depends on the degree of sophistication and integration desired.

We believe the cost of not utilizing this approach will manifest itself in higher construction cost, longer remodeling time frames, underperforming facilities, and missed economic benefits.

This approach is not revolutionary in its design. We believe all managers understand what needs to be done, but don't have the tools to effect change. Jeffery Pfeffer and Robert Sutton's book *The Knowing-Doing Gap* discusses the difficulty managers face in implementing processes they know should be implemented. The PASE process is designed to establish four steps, all centered on our strategic goals and objectives. It is designed to meet the specific needs of an institution, allow us to focus on those steps, and also recommend some tools that help accomplish those steps

Quality

The quality of the results is determined by:

- The commitment of the organization to implement the process.
- The value of the planning process.
- The selection of the appropriate tools for the assessment, project selection, and measuring phases.
- The ability of the organization to stay strategically focused.

The Planning Phase

The planning phase is not necessarily difficult, but does require the institution to decide how a building or space will be utilized. It is possible that programmatic or capital upgrades are planned even though the use of the space will not change. It is important at this stage of the process not to worry about the overall importance of the space or building to the institutional goals and strategies. The selection process will address those issues. Planning will often be done with college and departmental administrators and faculty that need to know what it will cost, in resources and time, to create space for them that will meet their objectives.

The most important part of the planning process is to *clearly identify and communicate the intended use of the space.*

The Assessment Phase

After plans are complete we need to create and store projects. To create projects we need to know what the current condition of the space is and what it will take to modify the space to meet the expected needs of the occupant.

There are many ways to approach the assessment of the existing facilities. When making a decision about how to approach the facility assessment we should consider:

- What data already exists?
- What is the most cost-effective method to provide the level of assessment required?
- Does the institution, or other governing body, impose any mandatory expectations (code compliance, facilities standards, etc.) when remodeling is undertaken?

All of these questions affect the level of detail required when assessing a facility.

Many institutions have already performed complete facility condition assessments (FCA) of their facilities. If this is the case, much of the work associated with the assessment phase will already be complete. Most facility condition assessments will have at least three areas they address:

- Determining the current replacement value (CRV) of each facility.
- The identification of deficiencies associated with each facility.
- The price of correcting identified deficiencies.

The PASE program does not require an organization to secure a facility condition assessment of all of their facilities. The FCA only need be accomplished for the facilities identified during the planning phase. PASE is designed with the idea that projects will be developed in the assessment phase and stored in a database of all possible projects. It is our intent that projects be created by selecting from a list of deficiencies in the database. This provides several important benefits:

- It allows for reporting on deficiencies common to more than one project.
- It can report by building on all programmatic renewal, deferred maintenance, and capital renewal.
- It allows for reporting on organizational goals, such as deferred maintenance corrections, code compliance, etc.

During the assessment of each facility the following points should be considered:

- The current condition of the facility?
- How well does this facility meet the current needs of the program(s) housed in the facility?

- What is the value of the facility as it pertains to institutional tradition and image?
- Can the facility be maintained well enough to meet current serviceability requirements?
- What is the cost of ownership? Include all tangible costs such as utilities, maintenance, and operational costs.

In those cases where buildings are part of the organization's tradition and image, the replacement cost may not be an issue; however, if it is considered irreplaceable that should also be noted.

The assessment phase in PASE is not intended to provide a global assessment of the facilities and it will not give you an FCI, or facility condition index. It provides the cost for remodeling and construction to meet identified space needs.

The Selection Phase

In the selection phase we use a set of criteria to select projects. The criteria is determined and defined by what is important to the institution. Once the criteria has been established, each prospective project is graded on a score of 1 to 100 for each criterion. The projects with the greatest benefit and lowest cost will surface as the best projects.

The software we use demonstrates "before and after" impact scenarios as changes are made. The ability to see in "real-time" how project selection is impacted by changes in funding constraints, the cost of the project, or designation as "non-discretionary," provides a valuable management tool. Criteria should be limited to three to six items for the best results. The weighting of the criteria can be equal or it can be proportioned. Projects can be selected as non-discretionary so management control is unchanged; however, the impact on other projects is also immediately seen in the before and after scenarios provided by the decision making software. Projects that are not selected can be exported back to the assessment database. The selection process also allows "project champions" to support projects and indicate to the scorers why a particular project should be scored high in one or more of the criteria.

The Evaluating Phase

To have a complete, effective, and "living" program it is essential to measure the results of the planning, assessment, and selection phases. To do this we must develop key performance indicators (KPIs), which measure various aspects of the program. The maintainability and the functionality are measured to help evaluate the planning and assessing phases. The cost of remodeling and the construction schedule and completion dates may also be measures of the planning and assessing phases.

Reports on any institutional constraints such as the dollar amounts spent on code compliance, ADA compliance, or building envelope repairs are created. Utility cost and operation and maintenance cost are collected to compute cost of ownership.

Conclusion

We wanted to develop a program that approached our facility needs in a systematic way, yet provided the flexibility we needed to manage the changes that occur. We wanted to focus our resources in ways that gave the greatest maximum current benefit. We needed a way to demonstrate the effects of changing decisions about which projects would be done and which ones would not.

This process called **PASE** is the result of input from a lot of people who have spent a great deal of time in the field of facility management. We are convinced that if we **Plan, Assess, Select,** and **Evaluate,** if we learn from our past efforts, if we use the right tools, we can maximize the benefits available from the resources we have.

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Heat You Can Bank On

Physical Fitness for Facilities Folks

by Frederic J. Gratto

I met my wife in college and my first job after graduation was in her hometown. As a result, I met several of her high school buddies and many of them became my friends as well. When we moved to Florida, I wanted to stay in touch with them and she wanted to attend her high school reunions, so we have been to all of them since 1976. Every five years, we've gotten together with them to reminisce about the old days, brag about our kids, and just have fun.

Before each gathering, one of the things we probably all thought about was our own appearance. In fact, at the big 30-year reunion, one of my friends confessed that he hired a personal trainer for six months to get in good physical shape so that his ego wouldn't get bruised. He looked great and as I glanced around the golf course clubhouse, I was reminded of a guitar-laced ballad by Joe Walsh in which he says that life has been pretty good to him so far. I recalled his words: "Everybody's so different but I haven't changed."

Unlike Joe, I have changed but I still weigh the same as I did in college. Many people at the class reunion had changed too, and it looked like some of them had put on more than a pound a year. Likewise, while at our recent APPA and regional conferences, it occurred to me that those of us who take care of college campuses might benefit from a few words about getting in better shape and having better health.

Society bombards us with pleas and goads us with guilt to get in shape. From every angle, magazines in grocery stores, roadside billboards, and fitness clubs, advertisements grab our attention. They point out fat thighs and drooping bellies, trying to get us to eat right and move more. Nearly every month, for example, *Reader's Digest* has a story about diets, exercising, losing weight, or staying healthy. From this source and countless others, everyone probably knows that to be healthy we need to eat right and get plenty of exercise. Though we all know the way to physical fitness, not everybody takes it. Some people don't need or want to change their level of physical fitness. But, for those who do want to lose a few pounds, perhaps a yarn from Abraham will make a point.

Four score and fifty-eight years ago, he liked to tell a story about a frog that fell into a deep, muddy wagon rut. A couple days later he was still in it when his frog friends happened to come by. They urged him to get out and he made a few feeble attempts with no success. The same thing happened the next day and for several more. Finally, the frog friends gave up and went back to their pond. The next morning, much to their surprise, they saw the frog sunning himself on a lily pad and they asked how he got out of the rut. He responded that while he tried pretty hard earlier and couldn't get out, a wagon came along and he *had* to.

Fred Gratto is assistant director of physical plant at the University of Florida, Gainesville, Florida. He can be reached at fgratto@ufl.edu.

Likewise, when it comes to being physically fit and healthy, we are better off taking action because we want to rather than waiting until something happens and we have to. Just as the frog was successful when he decided to get out of the rut, we can shed pounds if we choose to lose. A friend of mine did. We used to go hiking together and I would remind him how good it felt to take off a 30-pound backpack. Finally, he said he was sick and tired of being thick and tired so he decided to do something about it. Now he can look down and see his feet.

Losing weight is like any task on campus. There is little hope of success for those who do not have a central purpose or definite goal at which to aim. Stated another way, the first step toward accomplishing anything is deciding that you really want to do it.

I am not an expert but I do know that before anyone begins a fitness program, they should get a physical exam and a green light before starting something that will be a real jolt to the body. A doctor can provide an assessment about current physical condition and advice about fitness goals. With this information, you can determine how to lose weight, reduce cholesterol, lower blood pressure, and address other health concerns. This is critical because just like any project or program on campus, you will need a plan. Follow the plan. Stick to it just as you do with any other path to success in your life. If you decide to start exercising, help yourself by finding a convenient time and handy location or you might not stay with it for long.

Another thing that might help is a consistent routine. Make a commitment to dedicate a chunk of time to exercise regularly. For example, I prefer to run before work because my days are so full. Besides, getting up early allows me to enjoy the sunrise and really earn my shower. Exercise is the fountain of youth, so finding a convenient time to do it is worthwhile. If exercise isn't convenient and fun, it will be hard to find the time or willpower to get moving.

As we drove north to the class reunion last summer, we took a detour to Gettysburg, Pennsylvania, because I love American history and because I was driving. One of the gift shops at the national park displayed several books about the great Civil War battle that took place nearby. Thumbing through one of them I saw a picture of an emaciated Union soldier who had been imprisoned at Andersonville prison in Georgia. Because he didn't have enough to eat, he lost weight. While no one would recommend starvation as a way to shed pounds, most people would probably agree that being significantly overweight is not healthy. In fact, Benjamin Franklin in his *Poor Richard's Almanac* said: "A full belly is the root of all evil." That assertion is debatable, but it is a fact that eating less usually helps people lose weight.

Less food means fewer calories consumed and this can result in weight loss, in spite of one's metabolism or heredity. By fine-tuning eating habits, eating less, and using common sense food substitution such as water instead of carbonated beverages, pounds can go away. For instance, replace the cream in your coffee with skim milk and you could probably peel off a few pounds over the course of a year. Switching from a morning croissant to a bran muffin would also help reduce calories. Top off a morning muffin with a tablespoon of cream cheese instead of butter and you would probably see another few pounds go away.

Whatever you do, though, do not skip breakfast. Some studies have found that people who do not eat breakfast are more likely to snack more frequently throughout the day or overeat later when the opportunity comes along. Besides, going without breakfast causes the body to go into a starvation mode which means that it burns calories more slowly than normal. This is counterproductive to the goal of losing weight. A more reasonable alternative to food deprivation is to eat food with few calories such as

Losing weight is like any task on campus. There is little hope of success for those who do not have a central purpose or definite goal at which to aim. Stated another way, the first step toward accomplishing anything is deciding that you really want to do it.

fruits and vegetables. All of us can lose some weight by simply reducing intake of calories. But the real key to losing weight and keeping it off is improved eating habits combined with regular exercise.

Since I work in Physical Plant, I spend a lot of time walking around campus to see what's going on. I seldom take time to sit down and eat. As a result I used to visit the vending machines a few times a day or keep candy bars in my desk drawer. One morning it occurred to me that my time exercising was wasted if I ate two pounds of junk food before lunch. Now, instead of reaching for something chocolate, I eat the apples or bananas that I keep in my office. I have learned that eating smart is an easy and painless way to stop weight gain.

Drinking plenty of water helps avoid hunger pangs since it partially fills the stomach. This is good to do whether on a diet or not. In fact, water might be the most important ingredient for good health. It cushions joints, helps regulate blood pressure and body temperature, and removes waste from our bodies. Water is good stuff and we ought to drink plenty of it. I have often read that eight to ten glasses of water per day is best for overall good health. Most of us could go several days without eating if we really, really had to but only two or three days without water, at best.

Several years ago Dan Rather wrote a book called *The Camera Never Blinks*. One point he made is that the camera never misses anything so he always has to be at his best when doing the evening news. He can never let down his guard. Likewise, our stomachs never miss anything so we can't let down our guard. Whatever food we swallow adds up. Every calorie counts. Therefore, whenever we can cut a corner and not eat something such as cheese, mayonnaise, or ketchup on a hamburger, we have avoided a few calories and the effort needed to burn them off.

Just as recycling waste material rather than hauling it to the landfill is a measure of cost avoidance on college campuses, eating smart is an easy way to avoid unnecessary calories. This is good to remember so that we are not too casual about what we eat. Besides, no diet lasts forever. At some point, weight loss occurs and an acceptable level of physical fitness is accomplished by learning how to eat better while enjoying yourself. Obtaining a good level of physical fitness is not a job or an obligation. It is just the natural process of making wise lifestyle choices day after day. It's that simple. The secret is that there is no secret.

While trying to lose a few pounds it's a good idea to monitor progress. This is no different than checking performance on the job. At the University of Florida Physical Plant we measure and monitor our customer service by quantifying it. We use MOE, Measures of Effectiveness, to help track the time required to complete work orders, how many we have completed, our backlog of work orders, how many we have generated in a month, and upward or downward trends in performance of service. Graphs and other statistical data tell a pretty clear story and show whether or not goals are being met. Some of our measures, such as the time required to complete a work order, have upper and lower control limits.

For example, if work orders are getting closed out too quickly, we might wonder if a particular crew has enough work to do or if they are not being sufficiently thorough. On the other hand, if it consistently takes a team too long to complete work orders, we are interested in finding out what is causing the delays. From our perspective and certainly from the customer viewpoint, taking too long to complete a request is not a good situation. While it might be alright to not hit our goal every time, it is not alright to exceed it by very much. That's why we have control limits and measure often.

We check monthly to see how we are doing. We don't wait six months or a year because things might be way out of hand by then. Besides, if measuring shows that our customer service is at an acceptable level, we are encouraged and inspired to do even better. This same reasoning works when trying to lose weight. Celebrate little victories. Don't wait to reward yourself until after you've lost 25 pounds. Pat yourself on the back every time you turn down a second helping of dessert, go by a candy machine without stopping, or walk on campus instead of driving. I feel pretty good about myself when I ride my bike to work rather than driving my gas guzzling truck.

Another helpful point to keep in mind is that nobody gets significantly overweight in just a few days. Being out of shape is a consequence of actions and decisions over a period of time. Conversely, smart choices about food and exercise can help create a healthy lifestyle that over time will lead to physical fitness. This means more endurance, an improved appearance, and better health. Who wouldn't want these?

Just as customer service is a journey without an end, so is the business of staying in shape once you get there. To do this a messenger is needed. A bathroom scale is your friend, not your enemy, because it provides feedback just as customer surveys help campus organizations stay on course toward goals. I need plenty of input to make sure my pants aren't too tight so I get on the scale every morning. If my weight is not within an acceptable range, I do something about it that day

Just as recycling waste material rather than hauling it to the landfill is a measure of cost avoidance on college campuses, eating smart is an easy way to avoid unnecessary calories.

such as eating less or exercising more. To keep moving in the right direction I need to react, just as those of us who manage facilities need to react by monitoring work habits because of their impact on performance.

My hometown is so small that according to the atlas behind the seat of my pickup truck, only 809 people live there. Forty years ago when I lived there, everybody knew everyone and we were all among friends. Mable Baker didn't check identification at her country store so I could run errands for my father. Even when I was only seven or eight years old, he used to give me a quarter and send me there to get him a pack of cigarettes. Fortunately, smoking never occurred to me so I just brought them home like a good little boy. Like my dad, lots of people smoked in those days, even Andy Griffith in Mayberry. Nobody knew the harm they were causing to themselves. However, lots of people still smoke today, even though the health risks of doing so are well known. It seems like one way to better health, though not simple or easy, is to stop smoking. Since I have never smoked, I don't understand the addiction and how difficult it must be to quit. Nonetheless, since bad things sometimes happen to good people, it occurs to me that one of the bad things that could be avoided is bad health due to smoking. Taken as directed, cigarettes can cause lung cancer and emphysema. Reading the warning label on a pack of cigarettes would be enough to scare me.

Getting up early to exercise before work can be hard to do. Trying to find time after work can be just as difficult because of family matters, meetings, or other obligations. Rather than letting fitness be the last or most neglected priority, you might try incorporating it into your time on campus. I have found that fitness can thrive from eight to five. Walking, lots of it, is easy to include in a typical day. Start by parking further away from your office in the morning than you need to. This will burn a few extra calories. Rather than drive across campus, walk to meetings or to inspect projects. This is an easy way to get exercise. So is using stairs rather than elevators. I try to avoid elevators, not to get more exercise, but to avoid getting a headache at the end of the ride.

Another way to exercise during the workday is by jogging or walking at lunchtime. Walking is fine way to stay physical-

ly fit and it's easy on knees but I prefer jogging because it gets my heart pumping harder faster. Besides, unlike tennis or golf that require a fair amount of skill to be successful, running is something most people can do well if they want to. I learned this many years ago when I was a pudgy little teenager. Since I didn't have a bike and couldn't drive a car, I stayed home some summers to can vegetables with my mother. While I was breaking both ends off green beans, most of my buddies were at the local swimming hole learning how to kiss girls with their eyes closed. To get out of the house and find something to do, one day I decided to run along the dirt road into town. It was easier than I thought it would be so I tried it again the next day and it was no problem either. Before long I began to enjoy running because even I could do it. Within a few weeks, I started to love running because it got me where I wanted to go and helped me lose weight without even trying, or so it seemed. Today I still look forward to my daily runs; the University of Florida campus has many quiet streets, plenty of nice trails, and a fitness center for those who have the opportunity to be away from the office for about an hour.

Working out at lunchtime, whether jogging or lifting weights, provides benefits that far transcend the mere maintenance of physical health. Talking to people in the gym or along the jogging trail every day helps build relationships. I have met lots of people by exercising daily. While sitting on a bench in the locker room or while running along Lake Alice, deans, engineers, lawyers, directors, librarians, physicians, chemists, counselors, and faculty from all over campus have become my friends.

During our daily runs we discuss sports, the cost of a parking space, religion, preferences in music, the impact of political correctness in academe, the great climate in Gainesville, our kids, and a hundred other topics. Almost always our discussions are friendly but sometimes they become small arguments that tend to make us run faster and further. But, by the next day we are no longer miffed at each other and we're well rested so around the lake we go again. After years of doing this we really know each other well and these relationships are a big asset to all of us. People on campus now know whom to call to get something fixed and I know who to call about a problem or project or when I need input about our customer service.

On most college campuses there seems to be a correlation between big bottoms and big chairs. But this doesn't have to be the way it is. Being physically fit is a choice and it is one of the best things anybody can do in the short term and for the long haul. Being healthy is a great way to live and there simply is no substitute to looking good and feeling good.

APPA WELCOMES 109 NEW ATTENDEES

SUPERVISOR'S TOOLKIT TRAINING INTRODUCED

APPA concluded the Institute for Facilities Management September 18 in Indian Wells, California. The popularity and strength of the Institute program continues to grow; the program welcomed the largest group of new attendees—109. During the week of classes in Indian Wells, Institute attendees learned about the newest critical issues in the facilities management field and were provided the tools to overcome daily challenges.

A new supervisory program was introduced at the Institute—*Supervisor's Toolkit: Nuts and Bolts of Facilities Supervision.* This program was designed by professionals in the facilities and training fields and was created to increase productivity and morale in front-line supervisors while decreasing poor performance. Facilitators Michelle Estep, American University, Carol Trexler, Rutgers University, and Wally Glasscock, Glasscock Development & Training, delivered the full week of training to 27 attendees, who not only received excellent supervisory training but also had the advantage of networking with the Institute attendees.

Lawrence Abeln	*Covenant Theological Seminary*
Appi Alla	*Edinboro University of Pennsylvania*
John Bailey	*Eastern Illinois University*
William Barr	*Dartmouth College*
Michael Bergeron	*Wentworth Institute of Technology*
Rebecca Bizzell	*East Carolina University*
David Boekweg	*Brigham Young University*
Terry Booth	*Central Carolina Technical College*
Darrell Boutilier	*Dalhousie University*
Thomas Buffington	*University of California/San Diego*
Kelvin Bush	*University of California/Davis*
Shawn Casey	*University of Rochester*
Victor Cornejo	*Universidad de Monterrey-Mexico*
Thomas Cunningham	*Rutgers University*
Alberto Delgado	*Florida International University*
Vernon Detert	*University of Saskatchewan*
Robert Dougherty	*Middlesex County College*
Mike Drennon	*Evergreen State College*
Bill Duncan	*University of Cincinnati*
L. Denise Forrest	*Joliet Junior College*
Brian Foshee	*Rhodes College*
Daniel Franke	*California State University/Hayward*
Lowell Hanson	*University of Michigan/Ann Arbor*
Michael Hanson	*University of California/Santa Cruz*
Lonnie Harder	*University of Saskatchewan*
Susan Hartman	*Cornell University*
David Hoyler	*Texas Christian University*
Ernest Hunter Sr.	*University of Texas-Austin*
Charles Jackson	*University of North Texas*
Randy Kiah	*Norfolk State University*
Cecil King	*Emory University*
Wayne Lamoureux	*Bentley College*
Elaine Lee-Price	*Rose-Hulman Institute of Technology*
Michael Loftus	*University of Delaware*
Michael Marshall	*University of North Carolina/Greensboro*
Ernest McVay	*Ohio State University*
Gwendolyn Morrison	*Argonne National Laboratory*
Charles Norris	*Emory University*
Luis Ortega	*Universidad de Monterrey-Mexico*
Harold Ostler	*Brigham Young University*
Janette Pekar	*Point Park College*
Raymond Popp	*he Principia*
Jonathan Ray	*Indiana University-Purdue University at Indianapolis*
Minerva Rivera	*New Mexico State University*
Juan Rocha	*New Mexico State University*
Deb Routhier	*University of Vermont*
John Sacre	*University of British Columbia*
Richardo Sanchez	*California State University/Hayward*
Martin Schmitt	*St. Paul's School*
Carol Schmitz	*Rochester Institute of Technology*
Connie Simmons	*Phillips Exeter Academy*
Robert Snip	*Indiana University Southeast*
Richard Stearman	*Rice University*
Robert Still	*East Carolina University*
Timothy Thoroughman	*Wright State University*
Carl Weaver	*Brown University*
Dave Willis	*University of Iowa*
H. Wilson	*Anne Arundel Community College*
Vincent Zapata	*Alamo Community College*

SPECIAL THANKS TO THE FACULTY OF SEPTEMBER 2003

Ralph O. Allen, *University of Virginia*
Lucinda Andreani, *Energy Strategies*
Jay Becker, *University of Idaho*
Ron Bernstein, *Echelon*
Joe Bilotta, *JBA Incorporated*
Kirk Campbell, *Carleton College*
Douglas Christensen, *Brigham Young University*
Terry Conry, *Ohio University*
Lynne Finn, *South Dakota State University*
Jeff Gee, *Swinerton Management & Consulting*
James Gentry, *Cutler-Hammer*
Wallace E. Glasscock, *Glasscock Development & Training*
Cheryl Gomez, *University of Virginia*
Don Guckert, *University of Iowa*
Clinton Hewitt, *University of Minnesota*
Charles Jenkins, *Jenkins & Associates*
Harvey H. Kaiser, *Harvey H. Kaiser Associates, Incorporated*
Maggie Kinnaman, *University of Maryland/Baltimore*
J. Craig Klimczak, D.V.M., M.S.
Jay Klingel, *University of Virginia*
Santalynda Marrero, Ed. D., *SM Consulting*
E. Lander Medlin, *APPA*
Ted Michelsen, *Michelsen Technologies, LLC*
Warren Moulaison, *Saint Mary's University*
Bill Nelson, *GLHN Architects & Engineers*
Mo Qayoumi, *California State University/Northridge*
Gary Reynolds, *Colorado College*
Edwin Robinson, *Arizona State University*
Mac Shipley, *Lerch, Bates & Associates, Incorporated*
William Stauff, *University of Georgia*
Steven Thweatt, *University of Colorado*
Mark Valenti, *The Sextant Group, Incorporated*
Mike Van Yahres, *Van Yahres Associates*
Mary Vosevich, *University of New Mexico*
Emily Wren, *Indiana University-Purdue University at Indianapolis*
A.L. Zimmerman, Ph.D., *Interax Corporation*

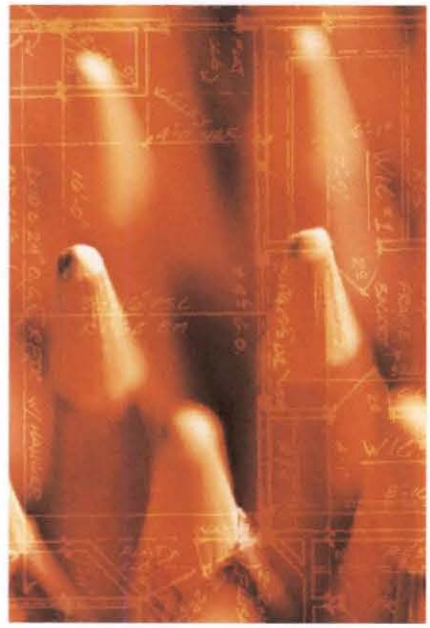
Finding the Right Architect or Engineer

by James E. Christenson

The theme of this issue of *Facilities Manager* is planning, design, and construction. In these functional areas, more than any others, the leader of the facilities management organization must depend on business partners. The process of selecting business partners for design services, especially, varies as widely as the names of the institutions retaining outside architects and engineers (A/E). And the success of the processes varies accordingly. Here are some thoughts on what works and what doesn't work.

As a rule of thumb with a few exceptions, it seems that the more prestigious the institution, the more likely the process of selection will be flawed. Often the presidents of these institutions believe that it is important that architects with national or international reputations be retained, reasoning that a collection of buildings by these luminaries will bring great honor (plus building donors, other money, and famous researchers) to the institution. Sometimes they are right. More often, this decision is the first of a series of snowballing mistakes.

Nearly 20 years ago, one Midwestern university engaged a world-famous architect to provide the overall design for a very complex building that was to provide laboratory and office space for interdisciplinary work by scientists from four different colleges. With this building, the university intended to attract some of the nation's best scientists in the field. The university went though a perfunctory selection process that actually included brief consideration of a major architect/engineering



firm that had just successfully completed a similar project. But, for the foregoing reasons, the university awarded the design contract to the more famous architect. This architect had never designed a laboratory, much less this type of laboratory, and had not designed facilities of any kind in regions subject to blizzards and ice build-ups. The months that followed were not happy ones for either the architect or the university. With the help of a local architect, the facility was finally designed and built. But, as is too often the case, this incredibly expensive facility failed to attract the target scientists and the building itself, as expected, required excessive maintenance attention because it had not been designed to deal adequately with the wide range of temperatures and with the ice build-up.

An Eastern university employed a different internationally revered architect to design a spectacular student center. In this case, the center adequately performed the intended function. But since most of its exterior is glass, often set an angle, the building consumes immense quantities of energy and requires the employment of a steeplejack to perform the necessarily frequent cleaning of the glass envelope.

Obviously, there is nothing wrong with employing world-famous architects or engineers. They are famous for a reason. But the reason may not always be pertinent to the project being considered. As with any decision, design should start with a clear statement of objectives. Before engaging an outside professional and certainly before determining a range of cost, the leaders of the institution need to answer the journalist's questions: What? Why? How? When? Where? And only later: Who?

For example: Why do we need a new building or central chilling plant? How would we be impacted if it were not built? What functions do we want it to accomplish? How do we want various groups to interact within the facility? When do we need it? Where on campus can the functions be best performed?

When these and other basic questions have been answered to the satisfaction of the administration, it is very useful to commission a "preliminary design report," a conceptual design that details the project scope and converts the users' input into quantified space. Such a report does not attempt to deal with exterior architectural treatment. This work is often done in-house, but could, as an alternative, be the first step in an outside architect's design. If the regents or trustees insist on knowing the final cost up-front—rather than authorizing the first stage of design to form, among other things, the basis for estimating the total project cost—the preliminary design should be done in-house. This speeds up the generation

Jim Christenson is an APPA member emeritus and can be reached at jchriste@jackelec.com.

of necessary information—especially the projected cost—while preventing potential design contract problems. Much too often, a project runs into trouble because the regents/trustees insist on approving a project cost before the project can be adequately defined and then insist that the cost not be changed. This results in either excessive initial estimates to be sure there is no need to return to the governing body (thus also making approval less likely) or, more often, to a stripped-down facility that does not meet functional requirements or is built with low initial cost/high life-cycle cost materials.

Once the detailed scope is established, the A/E selection process begins. This should start with the full realization by everyone involved that design has an enormous leveraging effect on construction cost and quality. Paying an extra 1 to 2 percent of construction cost in design fee to get the best-qualified design professional or to give that professional an adequate fee to test several conceptual alternatives may save 10 percent or more in construction costs and will probably result in better functionality.

Best practice suggests that the institution appoint an A/E selection board that includes some of the institution's licensed architects and engineers and user representatives. This board should be charged with:

1. Thoroughly studying the scope of work.
2. Identifying design firms that have done such work.
3. Reducing the list of firms (through use of criteria such as that below) to a number that can reasonably be interviewed (a slate of prospective firms).
4. Interviewing representatives of each firm on the slate.
5. Tentatively selecting the apparent best qualified.
6. Checking references (owners of projects designed in the recent past).
7. Visiting one or two similar projects designed by the apparent best qualified.

Obviously, there is nothing wrong with employing world-famous architects or engineers. They are famous for a reason. But the reason may not always be pertinent to the project being considered.

8. Recommending selection of the designer determined best qualified.
9. Negotiating the fee with the approved A/E.

In determining the best-qualified designer, the selection board should be guided by criteria such as:

1. How convenient is the geographical location of the firm? (Can we expect them to visit the site often enough to conduct sufficient user interviews and to design the building to really fit the site?)
2. Is the size of firm appropriate for the project?
3. What is the A/E's performance record?
   a. Quality
   b. Timeliness
   c. Design-generated change orders
   d. Cooperation with the owner
4. How appropriate is the A/E's specialty?
5. How extensive is the A/E's experience on similar work?
6. What are the qualifications of the people who would be assigned to the work?(Will the firm provide reasonable assurances that the key people listed will stay with the project?)
7. Is it likely that the A/E can complete the work on schedule?
8. Does the A/E understand and agree to re-design responsibility if bids are not within authorized funds?
9. Is the A/E genuinely interested in this job—not some future, larger one?

Generally these criteria are given numerical weights for relative importance, the highest for numbers 3 and 5, with numbers 7 and 8 sometimes being go/no-go. An additional consideration in selection, especially for public institutions, is to attempt to rotate design work among well-qualified firms.

A final note. I routinely receive a bulletin from the Wisconsin Examining Board of Architects, Landscape Architects, Professional Engineers, Designers, and Land Surveyors. It is dull reading and I usually throw it away unread. But I decided, before throwing away a recent issue, that the section on disciplinary actions may be worth reflecting on in the context of trust in professional relationships. This bulletin named four professionals as receiving disciplinary action. All of them were fined. Most of them had repeated violations in more than one state. In the case of one, whose license had been revoked by the most recent board action, the report was quite specific, "...did not complete work and never communicated with clients... Failed to return advance payments."

In modern society and business, we depend on one another. Facilities officers cannot get the job done without commercial providers/business partners. That dependency is supported by the bridge of trust between the leaders of the two organizations.

When we need to design a research building or a utility system, we typically search primarily for competence, following a procedure such as outlined above. Usually we spend less time verifying the trustworthiness of the designers. In part, this is because they are professionals who promise to work by certain standards of integrity. In part, we are comforted by action such as that by the Wisconsin board against those who fail to live up to their promises. But either way—by self-discipline or by enforcement—we depend on that fragile attribute called trust in professional relationships as much as we do in our internal organization.

APPA'S 2004 *Awards & Recognition* PROGRAM

Each year, APPA recognizes outstanding individuals and institutions for their contributions to the education facilities profession. APPA is pleased to announce it is now accepting awards for 2004.

Award for Excellence

The APPA Award for Excellence is designed to recognize and advance excellence in the field of educational facilities. Originally established in 1988, the Award for Excellence is APPA's highest institutional honor and provides educational institutions the opportunity for national and international recognition for their outstanding achievements in facilities management. The award is designed to encourage a systems perspective of facilities operations as a critical contributor to the overall institutional mission and vision. The Award for Excellence designation is valid for a period of five years. **Award submissions are due no later than January 31, 2004.**

Effective & Innovative Practices Award

Sponsored by Sodexho USA, APPA's Effective & Innovative Practices Award recognizes programs and processes that enhance service delivery, lower costs, increase productivity, improve customer service, generate revenue, or otherwise benefit the educational institution. Entries can describe either a new program or significant restructuring of an existing program or process. Up to five ranked submissions will be eligible for a cash award of $4,000. Winning entries will receive special recognition on both APPA's website and in APPA's ***Facilities Manager.*** **All entries are due no later than January 31, 2004.**

Meritorious Service Award

Each year, APPA members bestow the Meritorious Service Award upon the individual member or members who have made significant, life-long contributions to the profession of higher education facilities management. APPA's highest individual honor, the Meritorious Service Award is given to no more than three individuals a year. Individuals must be an active member of APPA for a minimum of five years; attended and participated in meetings and other functions at the international level, and demonstrated continued and distinguished service to the association. **All entries are due no later than January 31, 2004.**

Pacesetter Award

The Pacesetter Award is designed to encourage further participation in APPA among those who have already made significant contributions at their regions or chapters. Up to seven Pacesettter Awards will be given each year. **All entries are due no later than January 31, 2004.**

APPA encourages you to contact your regional representative to discuss how you can apply for an award. To receive an application and guidelines, visit www.appa.org for additional details. All award submissions are due no later than January 31, 2004.

The Spectrum of Capital Planning

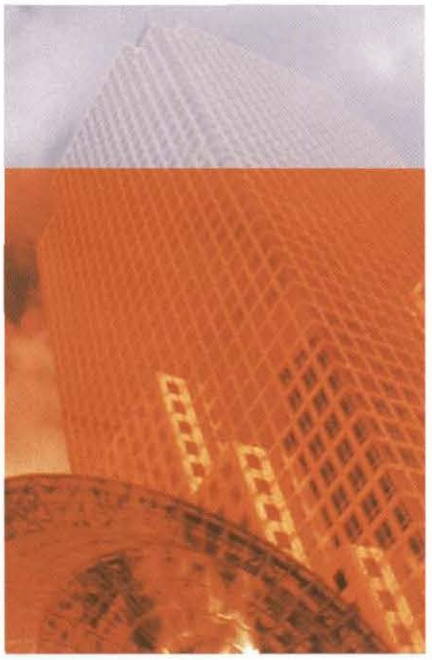
by Matt Adams, P.E.

There is power. There is process. There is information. All three elements come together in the institutional environment to control the expenditures of facility capital. On the surface, this idea seems simple enough. However, the exact recipe for mixing the three is critical. In order to engineer new, re-engineer, or simply navigate the empires of capital, more details are necessary.

During the month of June, Samer Maamari, director of the facility planning and design unit of American University of Beirut (AUB), and I went on a tour of selected U.S. universities. AUS was putting together a new facilities department, and Samer wanted to get ideas from his western counterparts about policies and processes for facility planning departments. By first visiting some well-known universities and then reviewing the plans from our shared past visits, we discovered the variety and power of the recipe mentioned earlier.

In the maintenance departments of these institutions, the policies and processes vary, but generally follow one of a few industry best practices. For capital planning, however, the variety of styles used is quite broad in spectrum. Each style is influenced by campus culture, the incremental change of the past, and personalities. The good news is that there are examples at each end of the spectrum that work very well. On the other hand, there are examples in the spectrum that are very ineffectual.

In the institutional community, recognition, power, and influence are



ubiquitous. We are a community of smokestacks and competing interests that jockey for resources. In capital planning, decision-making authority is closely linked to the pot of gold. That is to say that the owner of the checkbook has the ultimate decision power. In the institutions with totally centralized budgets, the Chancellor, Chief Business Officer, and Board may have the final decision. In other institutions where resource-centered management is used, the dean or department head, having their own individual checkbooks, may have decision-making power. The location of the decision-making authority on a campus is the first step in understanding planning—this is the fixed starting

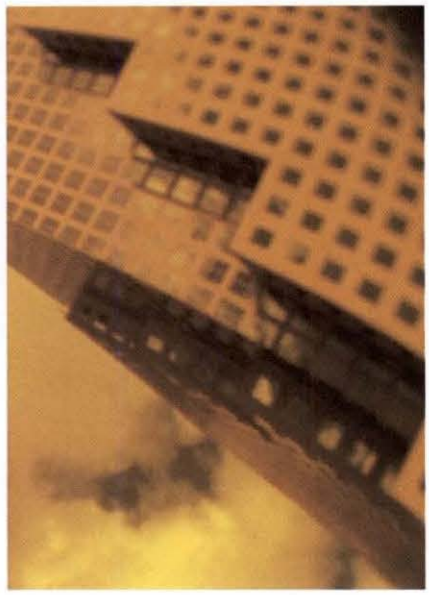
Matt Adams is president of The Adams Consulting Group, Atlanta, Georgia. He can be reached at matt@adams-grp.com.

Trusting that all decision makers ultimately have the best interests of the institution in mind, good information supplied to assist the process mechanism and decision-power authority is beneficial. The key here is "good information."

point. While this authority might be challenged, it is highly unlikely. In one sense we have eliminated a variable since if we know exactly who has the power, then we know where to place the centroid of information flow and process. This is where there is a chance to make a difference!

Perhaps too much has been said about process engineering and re-engineering during the last ten years. Another moniker might be in order because there is still a need for these processes. Industry best practices might work, but they are rarely used. Once again, the spectrum we observed was broad. The most thorough process is one where each level of stakeholder need and administrative authority is respected. In this model, the planning process starts at the faculty and staff level and percolates up through the institution. Any and all requests can enter the process. The process filters, tests, and prioritizes requests. While time consuming, this exhaustive process ensures equal voice to campus stakeholders, which is very important on some campuses. The process feeds "ready-to-make" decisions to the decision authority. For those public institutions that want to embrace fair play, this approach is most popular.

In the middle of the spectrum are those institutions that use an interdepartmental process for planning, followed by an advocacy-style decision process in a high-level committee. This format consists of a high-powered meeting where the athletics vice president competes with the academic provost, and so on. Cases are presented and votes taken. After a process of politics and maneu-



vering, the senior executives validate the final decision.

On the other hand, there are some well-known institutions where the senior administrators themselves collect capital proposals. It is the most informal of processes, where campus leaders, in the form of e-mails, verbal requests, and formal proposals, can make capital requests. In this case, the process is the rationalization of disparate requests by the chief administrator. There is no process, perse, only politics. If there is no process to influence or navigate, the only alternative is the third one—information.

All institutions should maximize information processing in the capital planning process. Currently, this is not the case. Rather than look at this as a failure, it is really an opportunity. Trusting that all decision makers ultimately have the best interests of the institution in mind, good information supplied to assist the process mechanism and decision-power authority is beneficial. The key here is "good information." This is where the planning function within a campus is most critical. Administrators who are planners on campus are really the "brain trust" of facility information. Regardless of the decision-power style or process in place, accurate information is the most simple means to influence or navigate capital planning decisions. A facility planning function on campus occupies a unique position—ensuring that unbiased information is utilized. Can your campus quickly review a capital proposal in the context of the master plan, deferred maintenance, ongoing major capital projects, and departmental initiatives? If you can't score a proposal against all relevant sources of facility information in a clear and meaningful way, you are not there yet.

There are a few campuses that have begun efforts to re-think their capital planning polices. Without a structured approach, this can seem daunting. The experience of seeing the wide spectrum of practices has proven to me that there is a priority to any review process. First of all, acknowledge the location of the decision authority on campus—at the top, shared, or distributed. Next, identify any existing processes used by this authority. A review team has the opportunity to enhance and add to the processes used by the decision authority. Finally, create a function where the entire spectrum of facility-related information is easily and accurately applied to the process at strategic points. In this way a review team can realistically improve capital planning on campus.

Bookshelf

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

I'm happy to have the pleasure of sharing this month's column with my predecessor, the happily retired Dr. John Casey. John provides us with a review of an updated and improved book that can help us address ways of protecting our campuses from the variability of the grid and save money too. I am stepping away from technical books and recommending lighter fare that should help you recharge your batteries. As winter approaches, what could be better than enjoying the longer nights with a good book or two. However, if you are still into technical reading, check out some books that I'll review in the coming months: SCUP's *Transforming e-Knowledge*, by Donald Norris, et al. and *Connecting the Dots ... the Essence of Planning*, edited by Rod Rose.

* * *

Small-Scale Cogeneration Handbook, Second Edition, by Bernard F. Kolanowski, Lilburn, Georgia: Fairmont Press, 2003. 204 pages, hardcover.

Three years ago

I reviewed the first edition of this book, and suggested that, in spite of the inclusion of an unfortunate personal experience by the author, facilities managers should consider purchasing this book. While the second edition still contains an account of this incident, I still feel that the book has potential merit for APPA members.

To review, cogeneration projects involving "package" units, with electrical energy outputs in the 150 kW and smaller range, may have application in many APPA institutions. Indeed, the rising costs of energy and the threat of brownouts should send many facilities professionals scurrying for more information about this type of equipment. Cogeneration can simultaneously produce both electrical energy and heat energy at a cost that is lower than would occur if each were produced independently. As a result, users can save utility costs, have standby electrical capacity, and be "green," all at the same time.

To determine if your facility is a candidate for small-scale package cogeneration systems, I suggest facilities managers read the second edition of Bernard Kolanowski's *Small Scale Cogeneration Handbook*. This is a neat little book with information that will help you and business managers decide whether or not to devote additional time and effort to answer the question, "Should we install a small cogeneration unit?" A history of cogeneration, including significant regulatory actions and an update on the debacle in California, takes the reader through the acronymic thicket of PURPA, FERC, etc. Chapters in the *Handbook* cover both the potential uses and pitfalls of these systems and present a balanced guide to readers in the search for the answer. Important information concerning permit requirements and approvals from the appropriate utility, municipality, FERC, and air quality management district is also included.

This handbook is not a professional design guide, nor will it address specific energy costs in a given area. Institutions of all sizes should at least consider installing these small units and benefit from the potential ability not only to save energy costs, but also to install distributed systems campus wide without the need for a large and expensive central cogeneration system. Facilities managers should consider purchasing *Small-Scale Cogeneration Handbook* if the installation of a small cogeneration unit is being considered for his or her campus.

Reviewed by
Dr. John M. Casey, P.E.
Director, Engineering Department (Retired)
University of Georgia Physical Plant
Athens, Georgia

* * *

The Work of the University, by Richard C. Levin, New Haven, Connecticut: Yale University Press, 2003. 288 pages, hardcover.

We all work for

them but few of us have the opportunity to sit down and listen to what university presidents have to say. We are always busy behind the scenes making the room or event comfortable and attractive, or we are too busy to stop and listen at convocation,

Continued on page 57

Ted Weidner is president of Facility Asset Consulting, Amherst, Massachusetts. He can be reached at tweidner@charter.net.

Supervisor's Toolkit

Nuts and Bolts of Facilities Supervision

February 1-5, 2004
Tampa, Florida

Structure

This exciting new program, developed for front-line supervisors and written by facilities professionals and trainers, will be held in Tampa February 1-5, 2004, alongside the Institute for Facilities Management. The training program consists of the following topics:

Schedule

Sunday, 10:00 am-2:00 pm
Module 1: Supervision, What Is It? Learn to define effective facilities supervision; identify the roles and responsibilities of supervisors; and understand four key functions of supervision.

Monday, 8:00 am-11:50 am
Module 2: It's More Than Administration. Learn to understand the supervisor's role in administering organizational policy and procedures; recognize the legal considerations in the facilities environment; and gain an awareness of resource management.

Monday, 1:00 pm-4:50 pm
Module 3: Communication, Let's Talk! Identify barriers to effective communication; demonstrate communication skills; and understand your role in the communication process.

Tuesday, 8:00 am-11:50 am
Module 3: Communication, Let's Talk!, continued.

Tuesday, 1:00 pm-4:50 pm: Module 4: If It Weren't for the People. Understand the importance of developing and maintaining effective relationships with others in the workplace; examine the different types of relationships that exist in the workplace; and identify strategies and skills for improving relationships with others.

Wednesday, 8:00 am-11:50 am
Module 5: Motivation and Performance. Identify methods of training and developing employees; ascertain methods of positive reinforcement; and understand the importance of performance management and evaluation.

Wednesday, noon
Free afternoon/lunch & dinner on your own.

Thursday, 8:00 am-11:50 am
Module 6: Customer Service Triangle. Learn to create a basic understanding of three major aspects of customer service which include process, experience, and recovery; examine the role of the supervisor in customer service; and help participants identify areas for improvement in service delivery in their organizations.

Thursday, 1:00 pm-4:50 pm
Module 7: Supervisors as Leaders. Master techniques to understand critical elements of leadership; transition from managing to managing and leading; and understand your own preferred leadership style, and **Module 8: Synthesis.** Look at lessons learned, examine your toolkit, and evaluate the program's effectiveness.

Tuition

APPA members: $745
Nonmembers: $945

Meals

Several meals are included in the registration fee: breakfasts from Sunday through Thursday; lunches for Monday, Tuesday, and Thursday; reception and banquet Thursday; and refreshment breaks from Sunday through Thursday. All other meals are at the attendee's expense.

Materials

Materials will be provided to students at registration.

Accommodations

Tampa Marriott Waterside Hotel and Marina
Phone: 888-268-1616
Fax: 813-221-0923
www.marriotthotel.com

Travel

Association Travel Concepts
www.atcmeetings.com
Phone: 1-800-458-9383
Fax: 858-362-3153

Registration fees do not include lodging or travel and room reservations must be made separately.

Trainers

Michelle Estep is the training and development manager for facilities and administrative services at American University, Washington, D.C.

Carol Trexler is coordinator, facilities human resources, facilities business administration department, Rutgers University, New Brunswick, N.J.

For a more complete biography of the trainers for **Supervisor's Toolkit**, visit www.appa.org.

Continued from page 55

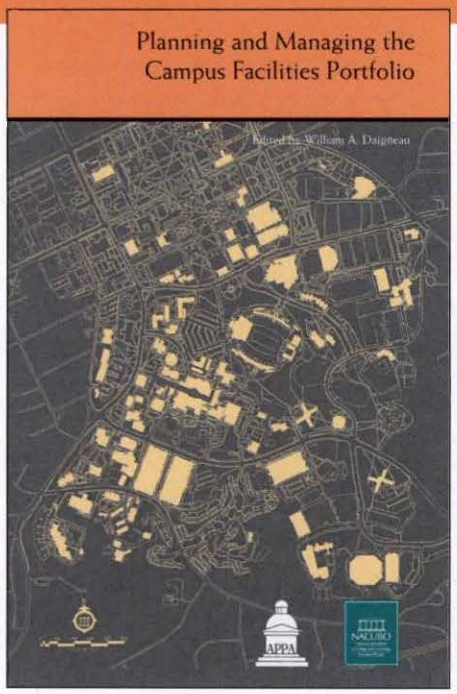
commencement, or an alumni event. Now there is an opportunity to read one current university president's opinions on higher education, the challenges of the future, and the joy of learning.

The Work of the University by Richard Levin, president of Yale University, is a collection of speeches and essays that have been delivered by Levin over the past ten years. While Yale has resources and facilities that more than 99 percent of most facilities managers can only dream about, the overall academic message is still the same. To incoming freshmen, it is an exciting time and opportunity to grow, learn, and discover new and interesting things that will provide future benefits. To the graduating senior, it has been a wonderful experience, the first step of many as one continues his or her education or embarks upon a career. To the alumnus, it is warm remembrances of social and intellectual development and the need to continue those opportunities for future generations. Finally, to the scions of business and industry, it is the economic and financial benefits derived from the excitement of learning and the output of creative endeavors that thrive at institutions of higher learning which must be supported for the future of a great nation.

The book does not address specific topics that APPA members would generally be interested in, such as employee development, technical refinements, or better management techniques. But it can help the busy manager, swamped by numerous daily and long-term problems, to refocus and to be reminded of the importance of the overall institutional mission.

It is almost impossible to criticize the overall message of this book; while it isn't mom and apple pie, it is a message of encouragement, excitement, discovery, and contemplation. The book does not address specific topics that APPA members would generally be interested in, such as employee development, technical refinements, or better management techniques. But it can help the busy manager, swamped by numerous daily and long-term problems, to refocus and to be reminded of the importance of the overall institutional mission. For these reasons I recommend *Work* as a book that is important to help restore the big picture in the minds of those of us who silently and invisibly lead an organization and make a college or university a desirable and valued place to be.

Planning and Managing the Campus Facilities Portfolio



Edited by William A. Daigneau, chief facilities officer at the University of Texas M.D. Anderson Cancer Center, this book is based on one simple premise:

The campus and facilities of a college should be managed using the same principles as any other investment in an institution's financial portfolio!

An outgrowth of APPA and NACUBO's Institute for Facilities Finance program, *Planning and Managing the Campus Facilities Portfolio* addresses the totality of managing the facilities investment — an issue that is even more important today than in the past because:

- Resources are scarce and likely to become more scarce in the future.
- Challenges in technology and environmental issues exist today that never did before.
- Changes in demographics and society are reshaping the availability of resources and how they are deployed.

Written by top facilities and finance professionals in the field, the book is divided into three general sections, which are presented in the order in which critical issues must be addressed.

Part I covers the tools required to answer the question: "Where Do We Want To Go?"

Part II presents the key components used to answer the question: "Where Are We Now?"

Part III completes the trilogy by guiding the reader through the elements needed to answer the question: "How Do We Get There?"

This is a MUST book for college presidents, trustees, business officers, and facilities professionals!

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Ansell's ArmorKnit gloves and sleeves offer comfort and flexibility while supplying resistance and protection against cuts. Made from 100 percent Kevlar Armor and standard Kevlar, these products are ideal for work environments requiring protection from sharp, jagged edges, sparks, and flames. Studies show that ArmorKnit medium-weight gloves provide twice the cut resistance as standard medium-weight or heavy-weight cut resistance gloves without the bulk. For complete details, call Ansell at 800-800-0444.

Mule Lighting, Inc. introduces the KES Series of commercial and/or industrial emergency lighting units. When power is lost, these units offer a minimum of 90 minutes and up to eight hours of operation time. The unit can be adapted with a self-diagnostics system to perform critical tests at regular intervals, with minimum staffing required. For greater detail, call Mule Lighting, Inc. at 800-556-7690.

INDEECO offers a new series of electric Unit Heaters (UHI) for commercial and industrial applications. Ranging in size from 3 kW to 10 kW, UHI Series heaters may be wall or ceiling mounted. Standard voltages include 208, 240, 277, and 480 in single and three phase. Heaters come with built-in controls, eliminating the costs of field installed options. For more information, call INDEECO at 314-644-4300.

Manitowoc Crane Group reintroduces the Manlift T40 telescopic, straight boom, aerial work platform. The Manlift T40 extends to a 40-foot platform height or a 46-foot working height. With standard 4-wheel drive, 60 hp dual-fuel or diesel power, the T40 offers users a long list of other standard features. The T40 is compact and provides excellent onsite mobility and the hydraulic components are consolidated for ease of serviceability. For additional information, call Manitowoc Crane Group at 717-593-5348.

Zurn Industries, Inc. adds to its Temp-Gard product line with the Aqua-Panel prefabricated shower units. The Aqua-Panel units consist of a vandal-proof, prefabricated 18-gauge stainless steel shroud and top cap with #4 brushed finish. Each unit includes a pressure-balanced valve and an institutional ball-joint shower head with lever-operated, adjustable spray, as well as bottom access and integral stops for ease of maintenance. For complete information, call Zurn Industries, Inc. at 814-455-0921.

Wilson Locking Systems distributes the new heavy-duty WheelLock vehicle immobilizer. Weighing only 18 pounds, the WheelLock fits all wheels from 13 to 18 inches and, with its built-in chock, makes a vehicle virtually impossible to move. Constructed of boron-impregnated 1018 steel for added hardness in order to resist cutting, the WheelLock vehicle immobilizer has 76,000 PSI tensile strength. The locking assembly is made of titanium for exceptional strength and durability. For full details, call Wilson Locking Systems at 505-471-1948.

Coming Events

For more information on APPA seminars and programs, visit our website's interactive calendar of events at www.appa.org/education.

Educational Programs - 2004

Feb 1-5—*Institute for Facilities Management.* Tampa, FL.

Jun 20-24—*Leadership Academy.* Fort Lauderdale, FL.

Jul 25-27—*Educational Facilities Leadership Forum.* Washington, D.C.

Sep 12-16—*Institute for Facilities Management.* Montreal, Canada

Regional Meetings - 2004

Sep 18-21—*RMA Regional Meeting.* Jackson Hole, WY. Contact Mark Shively, 307-766-2537 or e-mail mshively@uwyo.edu.

Sep 26-29—*ERAPPA Regional Meeting.* Syracuse, NY. Contact Robert Britton, 315-443-3529 or e-mail rkbritto@syr.edu.

Sep 27-Oct 1—*PCAPPA Regional Meeting.* San Diego, CA. Contact Scott Burns, 619-594-6001 or e-mail sburns@mail.sdsu.edu.

Oct 3-6—*MAPPA Regional Meeting.* Cleveland, OH. Contact James Cesen, 216-368-6537 or e-mail jac5@po.cwru.edu.

Oct 8-13—*CAPPA Regional Meeting.* Kansas City, MO. Contact Darrel Meyer, 816-759-1061 or e-mail meyerda@ac.kcmetro.cc.mo.us.

Oct 30-Nov 3—*SRAPPA Regional Meeting.* New Orleans, LA. Contact Marion Bracy, 504-483-7507 or e-mail mbracy@xula.edu.

Other Events

November 12-14—*Finding Excellence in Tough Times.* Scottsdale, AZ. Contact Construction Owners Association of America, 800-994-2622, coaa@coaa.org; event website: www.coaa.org.

November 16-18—*Performance-Driven Business Models for FM & CRE.* San Diego, CA. Contact Tradeline, Inc., 925-254-1744; registrar@tradelineinc.com; event website: www.tradelineinc.com/models.

November 19-21—*NAESCO's 20th Annual Conference.* New Orleans, LA. Contact National Association of Energy Service Companies, 202-822-0950, tes@dwgp.com; event website: www.naesco.org.

November 19-20—*School Maintenance Conference and Tradeshow.* Tucson, AZ. Contact Joe Bidwell, 520-225-4941, joe.bidwell@tusd.k12.az.us; event website www.adsso.org.

December 9-10—*Turfgrass Institute and Trade Show.* Contact Georgia Turfgrass Association, 800-687-6949, gta@turfgrass.org; event website www.turfgrass.org.

2004 Listings

March 9-11—*National Facilities Management and Technology Conference/Exposition (NFM&T).* Baltimore, MD. Contact Tim Rowe, 414-228-7701, tim.rowe@tradepress.com; event website www.nfmt.com.

May 11-14—*DOE's 2004 National Conference for States & Communities.* Minneapolis, MN. Contact Ron Santoro, 202-586-8296, ronald.santoro@ee.doe.gov; event website www.2004nationalconference.com.

May 12-14—*Challenge and Response.* Orlando, FL. Contact Construction Owners Association of America, 800-994-2622, coaa@coaa.org; event website www.coaa.org.

May 12-14—*COAA Spring Owners Leadership Conference*. Orlando, FL. Contact Construction Owners Association of America, 800-994-2622, coaa@coaa.org; event website www.coaa.org.

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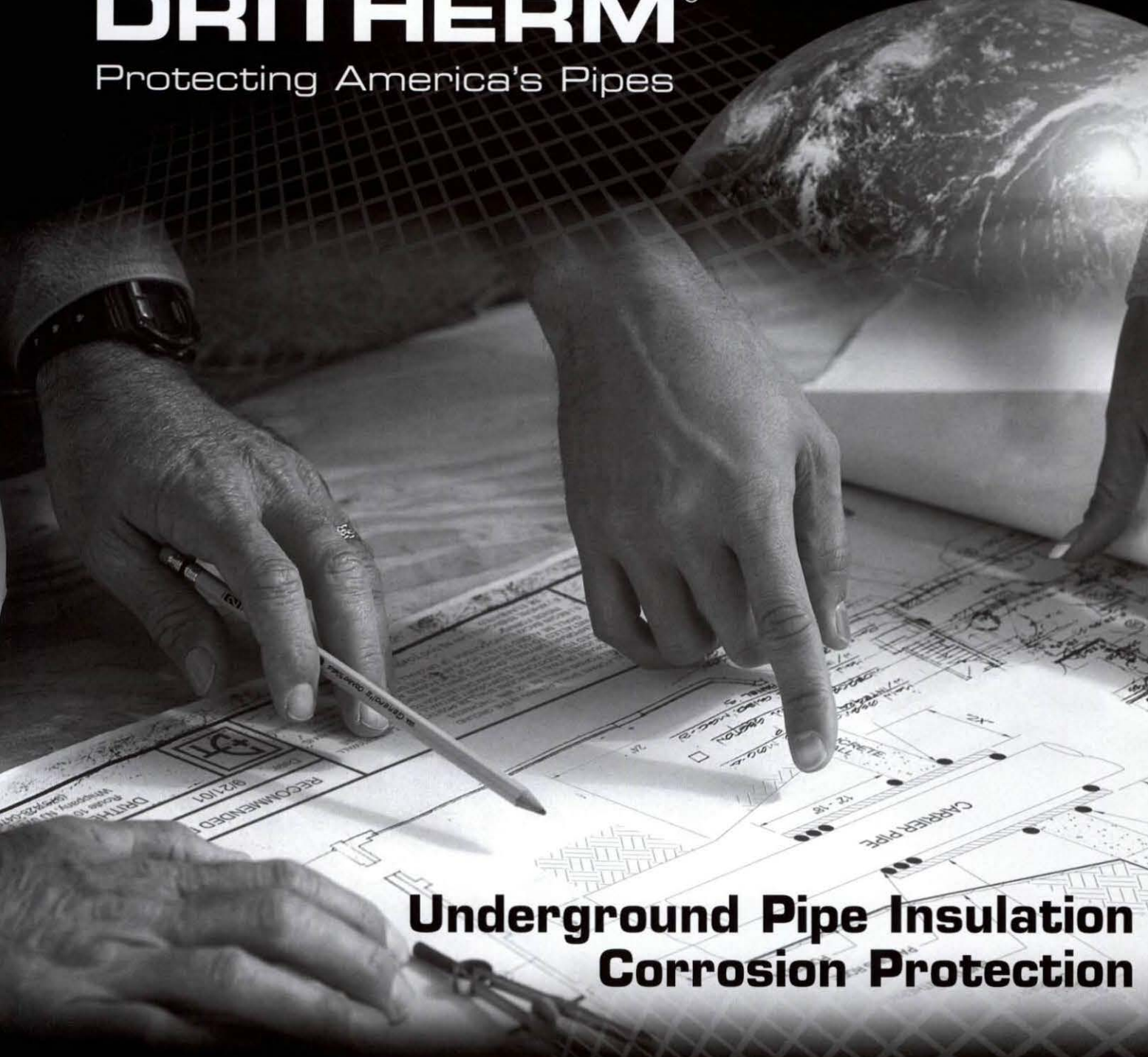

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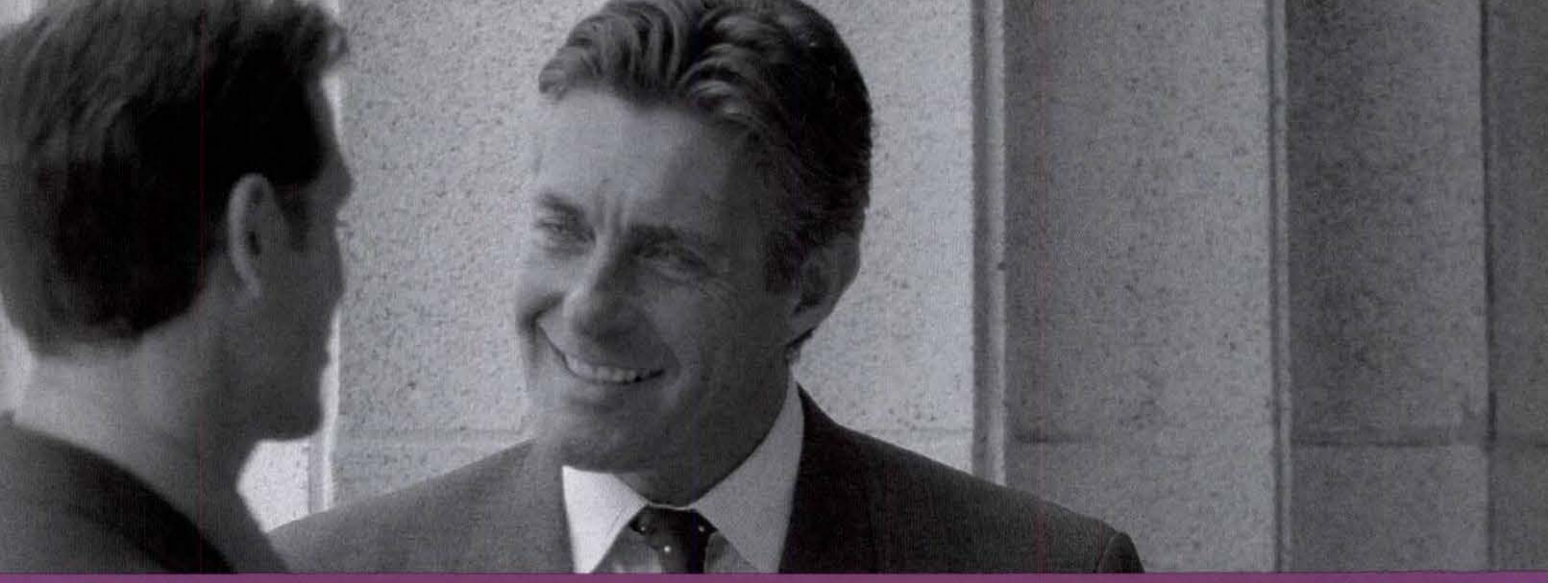

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