The official publication of the Association of Physical Plant Administrators of Universities and Colleges

Facilities Manager

Volume 2 Number 1 Spring 1986

The Director as Planner: A Profile of Rhodes College

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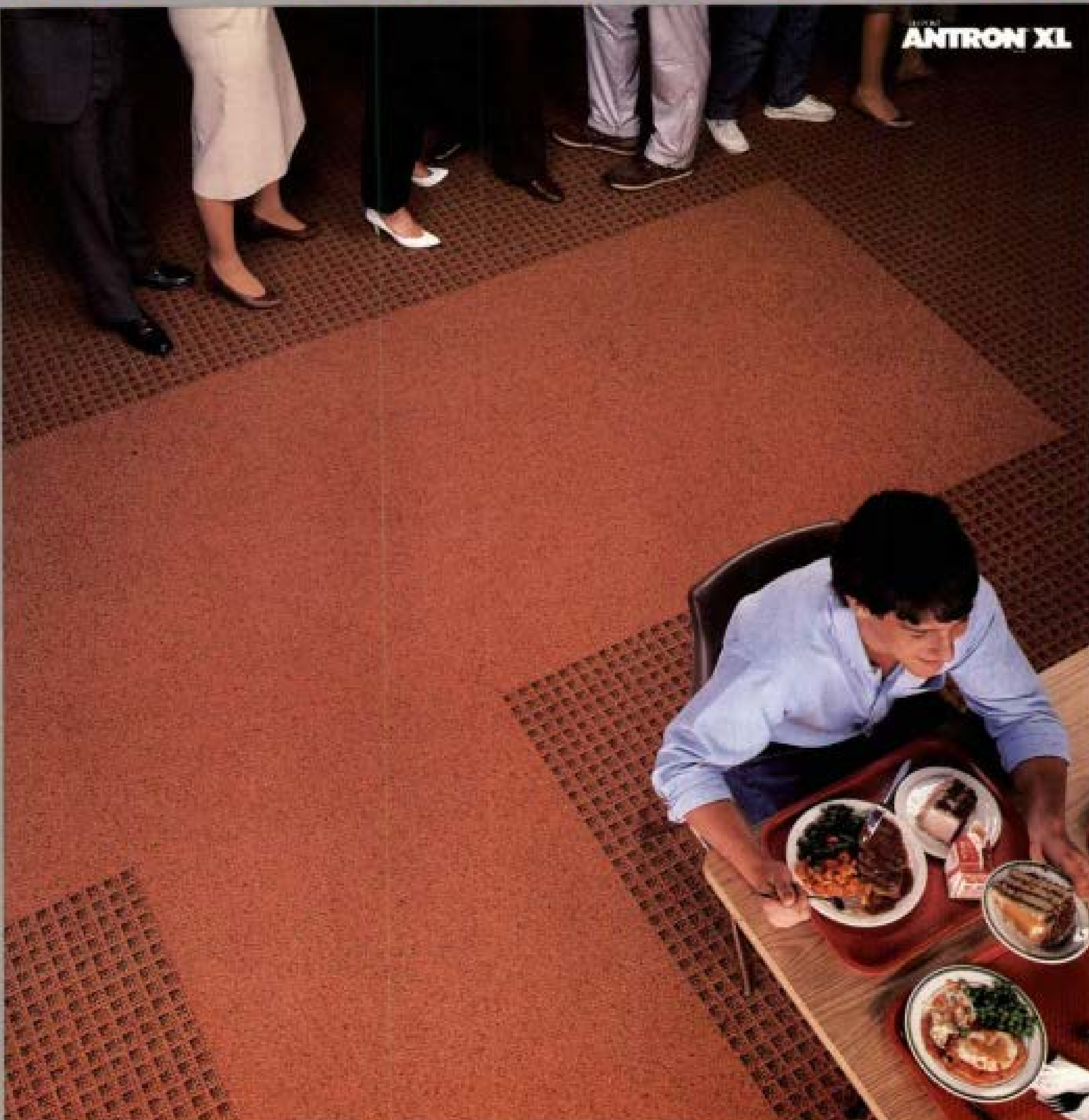

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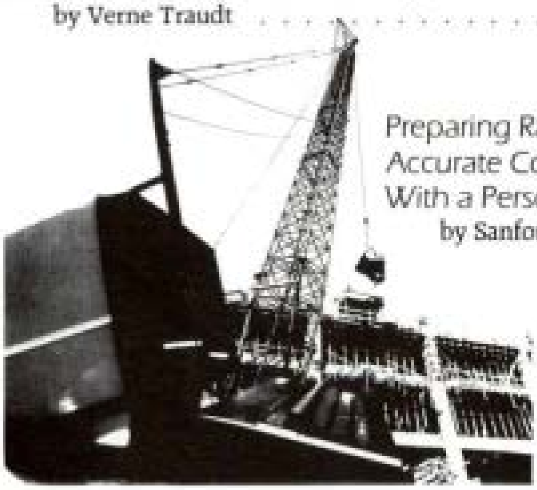
Features



Departments

COVER PHOTO

Planning team representatives, Rhodes College: from left, faculty member, board of trustees member, president, architect, director of physical plant, and dean of administrative services.

PHOTO BY TERRY SWEENEY

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Letters

To the Editor:

The Fall and Winter 1985 editions of *Facilities Manager* have been packed with useful information for facilities administrators in general and specifically for me and my staff. Future evolution of this informative publication will no doubt cause it to become a "must read" magazine for all of us associated with the management and administration of one of higher education's most valuable assets—its facilities. I eagerly await my next issue.

Congratulations. *Facilities Manager* is a terrific magazine!

Henry H. Dozier, Jr.
Director, Facilities Maintenance & Operations
Lamar University
Beaumont, Texas

To the Editor:

It should be of interest to your readers to know that the buildings used as a backdrop for Harvard University's organization charts ["Establishing Values With Pride," Winter 1985, pp. 18-19] are located in Providence, Rhode Island and not Cambridge, Massachusetts.

Peter H. Tveskov
Assistant Director, Plant Operations
Brown University
Providence, Rhode Island

To the Editor:

The "generic" college featured behind Harvard's before and after organization charts is really Brown University! The building on the far left is Hope College, a dormitory built in 1822. Next to that is Manning Chapel, a Greek Revival building designed by Russell Warren and built in 1834. The building on the right is University Hall, our original college edifice, which was designed by Robert Smith and erected in 1770. These three buildings are National Historic Landmarks.

Carol L. Wooten
Director of Physical Planning
Brown University
Providence, Rhode Island

To the Editor:

We are proud of the fact that our Energy Conservation Office is on the leading edge of energy saving technology ["Lighting Energy Management—With Reflectors," Winter 1985, p. 24]. We intend to stay in this position. The lighting reflector retrofit project is one example of the successful implementation of an idea that can be shared with others. *Facilities Manager* allows a valuable forum to share ideas with institutions affiliated with the Association of Physical Plant Administrators of Universities and Colleges. The University of California/Berkeley is proud to be a member of APPA, and we plan to continue to play an active role in the future.

Ronald W. Wright
Vice Chancellor, Business and Administrative Services
University of California/Berkeley
Berkeley, California

To the Editor:

I greatly enjoyed the interview with APPA's new executive director ["A Conversation With Walter A. Schaw," Fall 1985, p. 3]. Mr. Schaw's comments and views on why facilities management is so important to higher education were impressive, and they stated my feelings to a tee. I wish Mr. Schaw good luck in his new position.

Jack Armstrong
Director, Campus Facilities
Lawrence Institute of Technology
Southfield, Michigan

To the Editor:

Mohammad Qayoumi's article entitled "Preparing a Service Contract for Elevator Maintenance" [Fall 1985, p. 20] refers to eight classifications of elevators, one being "Oildraulic passenger elevators." The word "Oildraulic" is a registered trademark and is owned by Dover Corporation. The presence of the trademark, OILDRAULIC, on an elevator designates that it was manufactured by Dover and not by any other company. Thus, it is incorrect to refer to "Oildraulic" as a classification or type of elevator.

It is apparent that the reference to Oildraulic was not an intentional misuse of our trademark. However, many once-valuable trademarks such as aspirin, cellophane, and escalator are no longer trademarks because their owners permitted them to be used generically. I am sure you can appreciate our concern.

George E. Powell
Vice President-Secretary
Dover Elevator Systems, Inc.
Memphis, Tennessee

To the Editor:

Two photographs in "Asbestos Control Technology in Schools and Public Buildings" [Fall 1985, p. 13] show workers wearing respirator straps on the outside of the hood of their suits. This makes it impossible to clean the respirator in the shower as is recommended by all safety procedures, which state that "the last item to be removed is the respirator. After all contaminated clothing are removed, step into the shower, turn the water on, and, as the water flows over the respirator, take it off, remove the canisters, and rinse the mask clean." The photos shown, and much of the article,

continued on page 3

Readers wishing to respond to articles in this issue should send their comments to Letters, FACILITIES MANAGER, 1446 Duke Street, Alexandria, Virginia 22314-3492. All letters should be typed, double-spaced, and no longer than 500 words in length. Shorter letters have a better chance of being published, and the editor reserves the right to edit for clarity or brevity.

were taken from 1970s sources. The state of the art on asbestos information has changed and should be kept current.

Thomas F. Anderson
Director, Facilities Operations
University of Kansas
Lawrence, Kansas

[*Editor's Note:* Readers wishing to keep up to date on the latest information should consider attending "Asbestos Control Procedures for Physical Plant Administrators," a seminar set for May 14-15 in Kansas City, Missouri. Enrollment is limited to 50. For more information or to enroll, contact Lani Himegarner, National Asbestos Training Center, University of Kansas, 5005 West 95th Street, Shawnee Mission, KS 66207-3398; 913/648-5790.]

To the Editor:

I would like to compliment the staff of *Facilities Manager* on a fine professional publication. This magazine is a fine addition to APPA's professional contribution to its members and those interested in the field.

Gene B. Cross
Vice President for
Facilities Management
Columbia University
New York, New York

73rd ANNUAL MEETING JULY 13-16, 1986 BOSTON, MASSACHUSETTS

An exciting opportunity awaits you at APPA's 73rd Annual Meeting in Boston, Massachusetts. The Host and Educational Programs Committees have planned a stimulating program for professional development and an exciting schedule of social events.

Educational programs focus on new technologies and developments in facilities management. Subjects vary widely, but computer applications and management strategies are emphasized throughout the program. Other sessions will focus on cogeneration, variable frequency drives, hazardous waste management, and historic preservation.

The Host Committee has arranged for the first 500 registrants to see the Boston Pops at Symphony hall in their last performance of the season. On Monday evening select from two planned activities: a harbor cruise on the Spirit of Boston, or an exclusive tour of the Museum of Science. Boston offers a diverse selection of dining and entertainment from traditional New England seafare to Chinatown to Italian in the North End. If you love food, there's no end to the adventure.

Take time to walk along the Freedom Trail and discover sixteen historical sites, including Old North Church, Bunker Hill, and the State House. Or stroll in the beautiful gardens at Boston Common and enjoy a ride on the swan boats.

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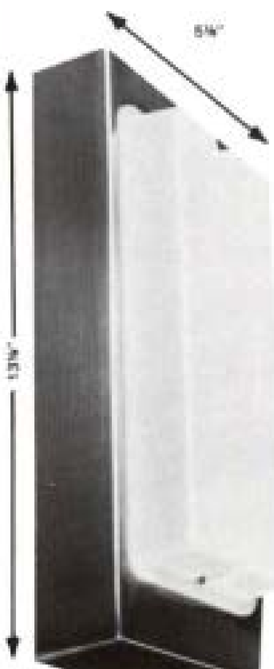

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The Director as Planner: A Profile of Rhodes College

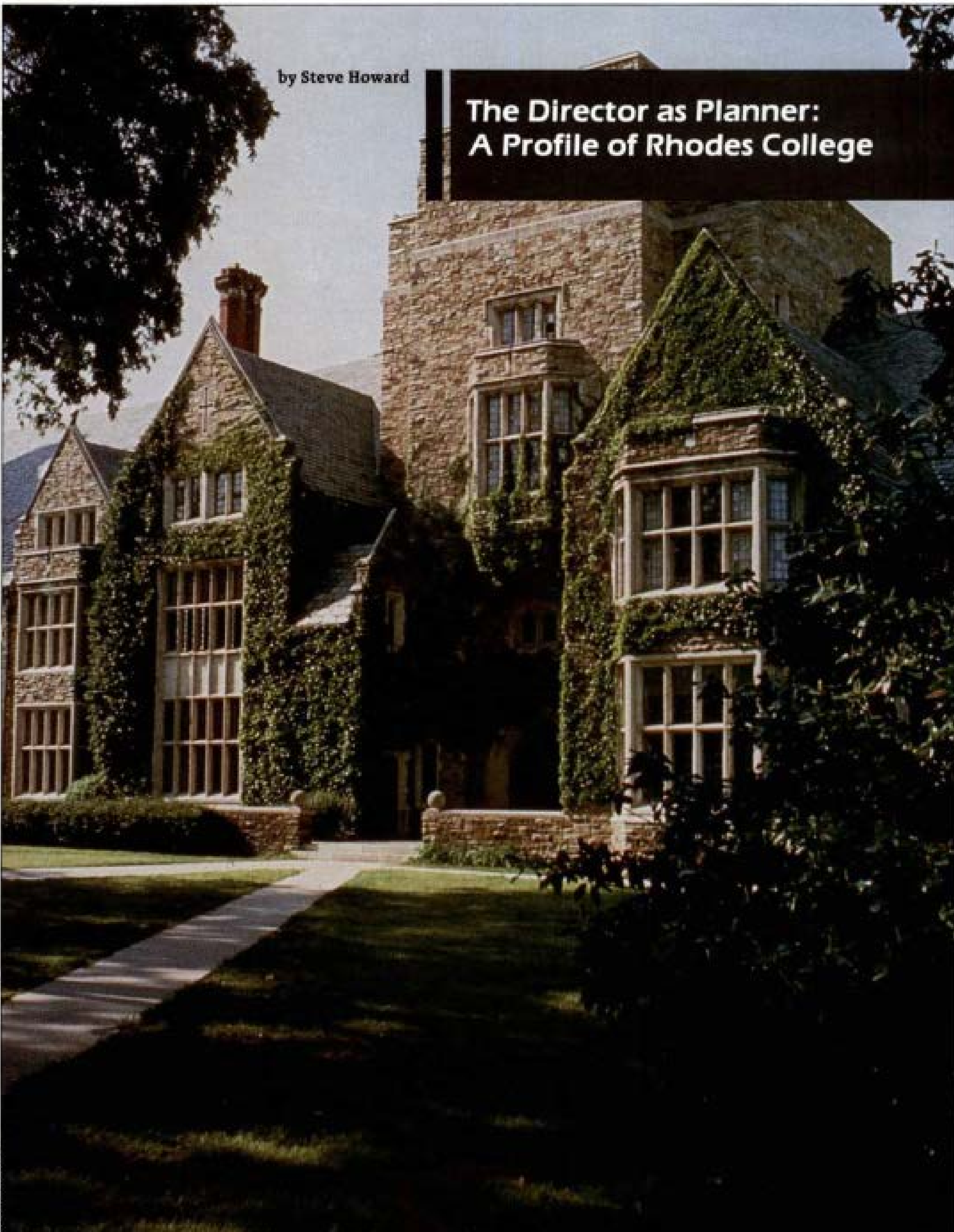


PHOTO BY RHODES COLLEGE

Palmer Hall, the oldest building on campus.

Imagine yourself as the director of physical plant at a college in which you serve as a planner with total responsibility for hiring architects, supervising new construction and renovation projects, and coordinating all related budgets and contracts. Imagine also that you have the funds and support from the administration necessary to be able to boast that your campus has virtually no deferred maintenance problem. And finally, imagine that your college develops and adheres to a long-range master plan in which you are an integral and active participant, a plan that guarantees a consistent campus appearance and the proper funding for facilities management activities.

This scenario may be seemingly logical, yet few physical plant administrators find themselves at an institution in which they and their departments have such support and control. Instead, they rarely select architects, are often excluded from construction planning (the building is turned over to them upon completion), their major maintenance and replacement projects are regularly deferred so that other campus projects can be funded, and many operate within a reactive mode only as immediate needs arise—putting out brush fires instead of being part of a campus-wide plan.

E. Dudley Howe, director of physical plant at Rhodes College in Memphis, Tennessee, considers himself unique in that he does serve as a planner and has the authority, support, and funding necessary to do his job properly. Howe, only the third physical plant administrator at Rhodes since 1925, has primary responsibility for all architectural work done on campus and recommends architects directly to the Board of Trustees. "When the board approves the architect, I pick up the project and carry it through to completion," says Howe. "I am *the* contact with the architects and am in touch with them on a daily basis. Rhodes has a lean management team. We go from the board to the president to management, then we fly."

Rhodes College consists of approximately 720,000 square feet of building space, valued at nearly $70 million, on 100 acres of land. Howe writes and administers the annual budget for all academic buildings, dormitories, and ancillary services such as the infirmary and refectory (dining hall). Howe's sixty-person staff has total responsibility for building maintenance, including housekeeping, painting, carpentry, repairs, and locks and keys; no services are contracted out.

Steve Howard is APPA's director of publications and editor of Facilities Manager. Photographs and much invaluable assistance were provided by Helen Norman of Rhodes College. Special thanks to Peggy Ann Brown for the initial article idea.

E. Dudley Howe, director of physical plant, oversees all construction and maintenance operations. He studied with Frank Lloyd Wright in the 1950s.

Howe also maintains the campus utility budget. "Every penny spent on utilities is my responsibility," he says. "When we build a building we make sure that it is going to be energy efficient and that its life-cycle cost is going to be very, very good. We're willing to put in the money up front. Our cost per foot for a new building is very high, but our cost for maintenance and utilities consumed is extremely reasonable."

The figures bear Howe out. The approximate cost to build Hassell Hall, the college's music building completed in 1983, was $115 per square foot, according to the architect. Howe estimates that average maintenance and repair costs at Rhodes have been approximately $.50 per square foot. Total utilities cost in 1985, including heat, water, electricity, and sewer, was only $.69 per square foot. In addition, roof repairs for the college's oldest building have cost only $300.

"There is no reason to shortchange a building as far as quality of equipment, electrical services, or anything," says Howe. "You're either going to pay for it up front or in the long run, and the college is willing to put the money up front so we can enjoy the high quality throughout the life of the building."

Rhodes College maintains a single-minded philosophy toward its facilities that reaches from the Board of Trustees, with its growing endowment and active Buildings and Grounds Committee, to the president, faculty, students, and other campus constituencies. This philosophy, reconfirmed in 1983 by unanimous board decision, includes a commitment to the collegiate Gothic style of architecture preserved since the college relocated to Memphis in 1925.

History and Tradition

Founded in 1848 in Clarksville, Tennessee, Rhodes College has long been affiliated with the Presbyterian Church. The college currently has an enrollment of approximately 1,100 students divided equally between men and women. In 1925, then-President Charles E. Diehl determined that all campus buildings would be built in the collegiate Gothic style. Thirteen buildings are now listed on the National Register of Historic Places. Rhodes built its reputation as Southwestern at Memphis, then changed its name in 1984 to honor Peyton N. Rhodes, president from 1949 to 1965.

"Dr. Diehl wanted to pattern this college after the Oxford and Cambridge models," says James H. Daughdrill, Jr., president of Rhodes since 1973. "He wanted the campus to be personal in its size and believed that keeping to home-like dimensions was humanizing. For example, our dormitories are small and do not have long, straight corridors with hundreds of rooms off the hallways. Instead, we break up the length with an 'L' and have multiple entrances. Dr. Diehl had the good sense of vision to hire the best architect in the country at that time, Charles Z. Klauder, and they were a good team—Dr. Diehl would raise the money and Mr. Klauder would add another cloister or Gothic accoutrement."

Rhodes has sustained its conviction to the collegiate Gothic style—which incorporates Arkansas sandstone, Vermont or New York slate roofs (each pitched at fifty-two degrees), leaded glass, and other details—even during its most difficult decades, the 1930s and 1970s. Says Daughdrill, "They held that conviction through the Depression, and they didn't build cheap buildings then or now." In fact, Diehl was tried by the Church for heresy and extravagance, according to Daughdrill. "The heresy charge stemmed from the fundamentalist surge after the Scope's monkey trial on evolution. Rhodes has never been a haven for fundamentalists," he says. "And because the Church at the time was providing a high percentage of the college's income, they thought he was squandering their money. He was completely exonerated, but just think of what he went through to stand his ground back then. We had to stand the same ground in the 1970s when energy and inflation were like two scissor blades, and our necks were stuck in the middle."

PHOTO BY RHODES COLLEGE

Charles E. Diehl, president from 1917 to 1949, prepared the first master plan and set the tone for Rhodes' support of its facilities.

PHOTO BY TERRY SWEENEY

President James H. Daughdrill, Jr. prides the college on its commitment to the collegiate Gothic style.

Support from the Board

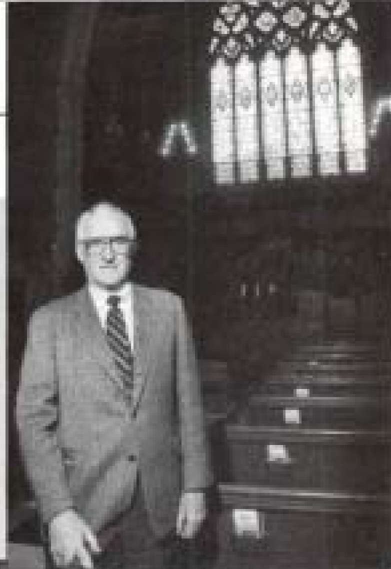
The commitment of the Board of Trustees to the integrity of the campus architecture helped ease the pressure on the college during stressful years. Much of this support is attributable to the work of the board's Buildings and Grounds Committee, whose purpose is to oversee the management of the buildings and grounds, recommend major maintenance and repairs, and determine new expansion for the college.

"The physical plant is one of our pride and joys," says Nancy Hill Fulmer, current chair of the Buildings and Grounds Committee. "The committee has always had an important place in the workings of the board. We are deeply involved.

Nancy Hill Fulmer is chair of the Buildings and Grounds Committee of the Board of Trustees.

PHOTO BY TERRY SWEENEY

PHOTOS BY TERRY SWEENEY



Board member Henry B. Strock, Jr. is pastor at Idlewild Presbyterian Church in Memphis.

Thomas R. Kepple, dean of administrative services, strongly supports the concept of the director of physical plant as a planner.

"An essential part of the Rhodes atmosphere of community is the appearance of the campus. The director of physical plant position has a strong history at Rhodes, and Dudley Howe fits in perfectly. Perhaps we give his position more importance than at many other campuses, but it is just a tradition at Rhodes. The tradition is so strong that it's exciting as a trustee to see inventive ways of staying within tradition—being innovative without being staid."

While fellow board member and past committee chair Henry B. Strock, Jr. believes that spending dollars up front for quality buildings reduces maintenance costs, this was not Diehl's initial intent. "Our primary goal was not so much for cheaper maintenance as it was the architectural integrity and unity of the campus," says Strock. "We feel it is worth the price to maintain that integrity."

PHOTO BY RHODES COLLEGE

Burrow Library will undergo a $1.7 million interior renovation beginning this spring.

The academic integrity of a college or university is, and should remain, the student's primary reason for choosing any institution. However, the appearance of a campus does not go unnoticed by prospective students, and their parents, and can contribute greatly to their decision to attend. Rhodes College is noted for its academic strengths in business administration, economics, the humanities, music, pre-law, and pre-medicine; the acceptance rate of Rhodes seniors to medical schools is around 93 percent. Rhodes maintains a student-professor ratio of twelve to one.

"When you're in a physics laboratory it doesn't matter if the outside is stone, brick, wood, or plexiglass," says Strock. "But the outside certainly enhances the spirit of academe on campus; the environment has a very real effect on education."

Current students agree that when weighing two schools with equal academic value, visiting the Rhodes campus helped tip the scales in its favor. "I fell in love with the campus when I first visited," says Brian, a freshman biochemistry major. "I like the consistency. It would look tacky if you had different styles next to these beautiful buildings."

Terry, a sophomore music/theatre major, agrees. "It feels good here. The school is so cohesive in its design and makes for a good study atmosphere."

And finally, "It's refreshing after I've been in a hard test to walk outside, and it's so beautiful," says Tracy, a junior psychology major. "Just walking around the campus is a way to get away from it all."

Architect Metcalf Crump designed Hassell Hall and other Rhodes projects.

Robert C. Eckert, chair of the music department, says enrollment has increased since the music building was completed.

The Director in the Planning Process

Dudley Howe joined Rhodes in October 1984. An architect who had apprenticed with Frank Lloyd Wright from 1956 to 1959, he worked directly with Wright on the Guggenheim Museum in New York City, Beth Sholom Synagogue in Philadelphia, and other projects. Howe was director of physical plant at Berea College in Kentucky from 1963 to 1973, then started his own practice.

From 1981 until 1984, Howe worked with Berea Hospital in planning and construction and set up the hospital's maintenance operations and revamped its purchasing and housekeeping procedures. Howe has degrees in business administration from Ohio State University and architecture from the Frank Lloyd Wright School of Architecture.

Howe's colleagues view him as an important part of the planning process for the college's growth. He is an official member of the board's Buildings and Grounds Committee and sets the agenda and prepares its minutes and reports. In addition, he works closely with Thomas R. Kepple, dean of administrative services, who serves as Rhodes' chief financial officer and oversees purchasing, personnel, food service, security, the endowment, and real estate investments for the college.

In explaining Howe's role in facilities planning activity, Kepple says, "Campuses are very emotional places. When you build or renovate buildings or take down trees or add or remove parking lots, there is an emotional response from the college community, as well as from alumni and other supporters. There has to be one person who understands the overall plan and who knows what we're trying to accomplish and where the campus is going in the future. Clearly, at most schools that person should be the director of physical plant."

In addition, says Kepple, "The physical plant director can substantially reduce the long-term cost of a building's maintenance simply by monitoring what goes into it. Just standardizing plumbing fixtures, for example, can help reduce the cost over a long period of time. I recommend that other institutions involve the physical plant director in the planning stages and put in the front-end money for construction. Anyone who doesn't is making a tremendous mistake."

Trustee Nancy Fulmer views as "vital" the director's position at campuses of any size. "To carry out your long-range plan, you have to involve the people who are going to carry it out," she says. "You can't just hand the physical plant department a building and expect them to do half the job they would to maintain it if they were involved at the planning stage."

Or as President Daughdrill puts it, "We want the input and experience of the expert whom we have carefully chosen for that position. We want that person to have ownership in what we do."

Howe emphasizes this view of his role at Rhodes. "Rhodes prides itself in a very high level of maintenance and appearance," he says, "and we insist that this is maintained from construction through completion. My department also knows how best to maintain or repair when we are involved from the beginning. You cannot control budgets if you're dealing with cheap materials, inferior construction, and poor hardware. It is vitally important that the facilities manager be involved on the planning team."

Financial support for Rhodes facilities comes from three sources. In addition to the annual facilities management budget. Rhodes builds a three percent renovation and replacement contingency into its total budget to cover the purchase of new air conditioners, for instance, or additional computers or lab equipment. Finally, there is a separate capital budget for specific construction and renovation projects. There are sufficient funds available, according to Howe, to cover most maintenance or repair and replacement needs. "We do not have a deferred maintenance problem or program," he says. "I can say that categorically, and I'd be happy to show anybody."

Quality Facilities Improve Perceptions

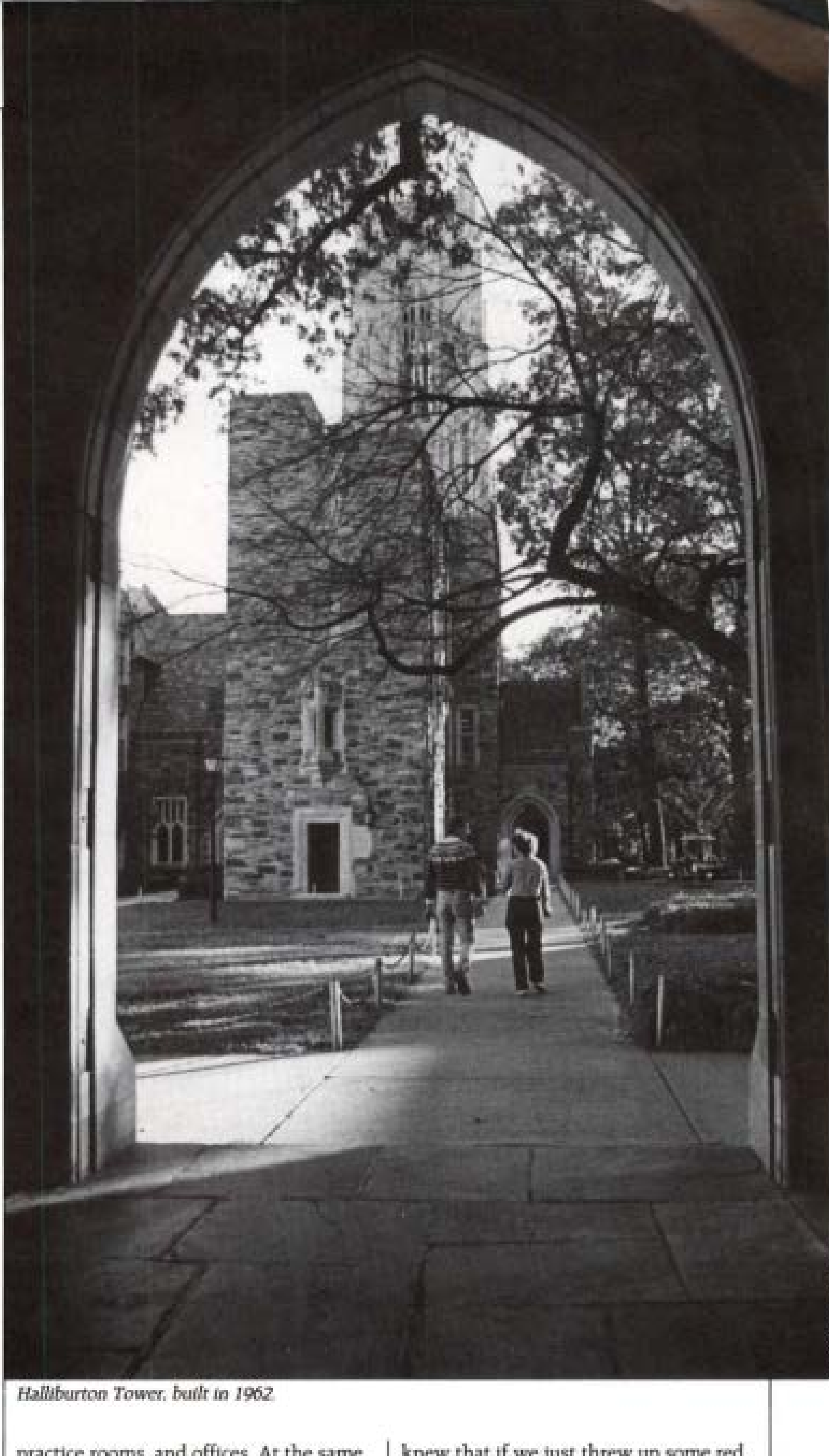
Hassell Hall, the 15,000-square-foot music facility, cost $2.4 million and houses faculty offices, classrooms, practice studios, an eighty-five seat recital hall, and a music library with state-of-the-art listening and recording equipment.

Project architect Metcalf Crump, president of The Crump Firm Inc., has worked with Rhodes for ten years on such projects as a complete interior renovation of four dormitories, a theatre built from a former sorority house, and a new residence hall complex scheduled for completion in late spring. Crump designed Hassell Hall as the first building in a planned quadrangle of three or four buildings in the northeast corner of the college grounds, which would be consistent with the campus' older section.

"This kind of architecture is emotionally charged and very strong in its character, color, and texture," Crump says. "These are not background buildings. You see very little graffiti or other signs of disrespect. It's really quite inspirational to work in and around so much beauty."

Crump has also designed the interior remodeling project for the college's library, which will be completed in two phases so that library functions do not have to be relocated. He meets regularly with Dudley Howe to review progress on the projects in design and under construction. "We have a good line of communication," says Crump, "which keeps projects going and cuts down on surprises."

During Hassell Hall's planning stages, the music faculty presented their space and function needs, including small classes, space for lectures and recitals,



Halliburton Tower, built in 1962.

practice rooms, and offices. At the same time, they had to work within the relatively high cost-per-square-foot budget. "We were limited to what we could spend per square foot, and that was frustrating," says Robert C. Eckert, chair of the music department. "But we also knew that if we just threw up some red brick thing, even though we'd probably have a building twice the size we have now, it just wouldn't have the style or the class or grace. Fortunately, however, we were able to argue a little bit more square footage before we built, and

More than 600 tons of Arkansas sandstone was used to build Hassell Hall.

PHOTO BY RHODES COLLEGE

Stone masons are moved around several times daily to avoid unconscious patterning.

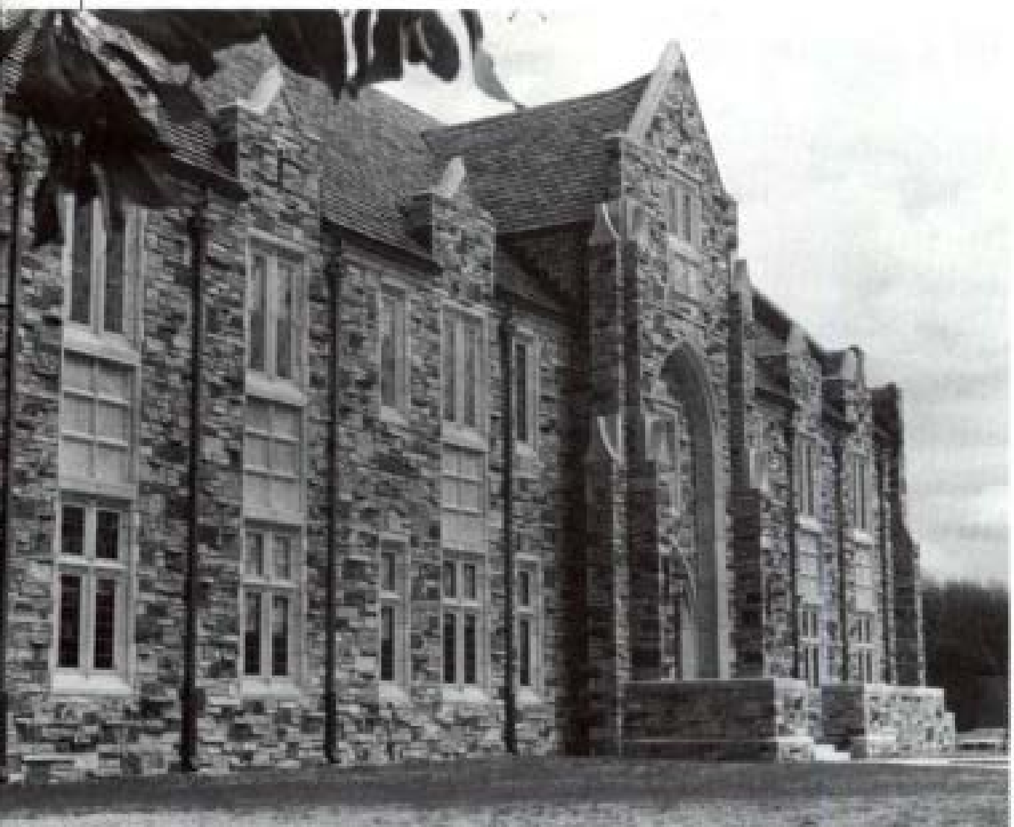


PHOTO BY RHODES COLLEGE

Hassell Hall upon completion in 1983.

added our music library and two studios above it."

The new music building has increased enrollment in the department, but that's not all. "It has brought about the most terrific change in morale and self-perception," says Eckert. "We were like second-class citizens in our old building, which was off campus. Students had to make a real effort to go over there. Now students and faculty have a lot of pride in our modern, well-equipped professional facility."

The Master Plan

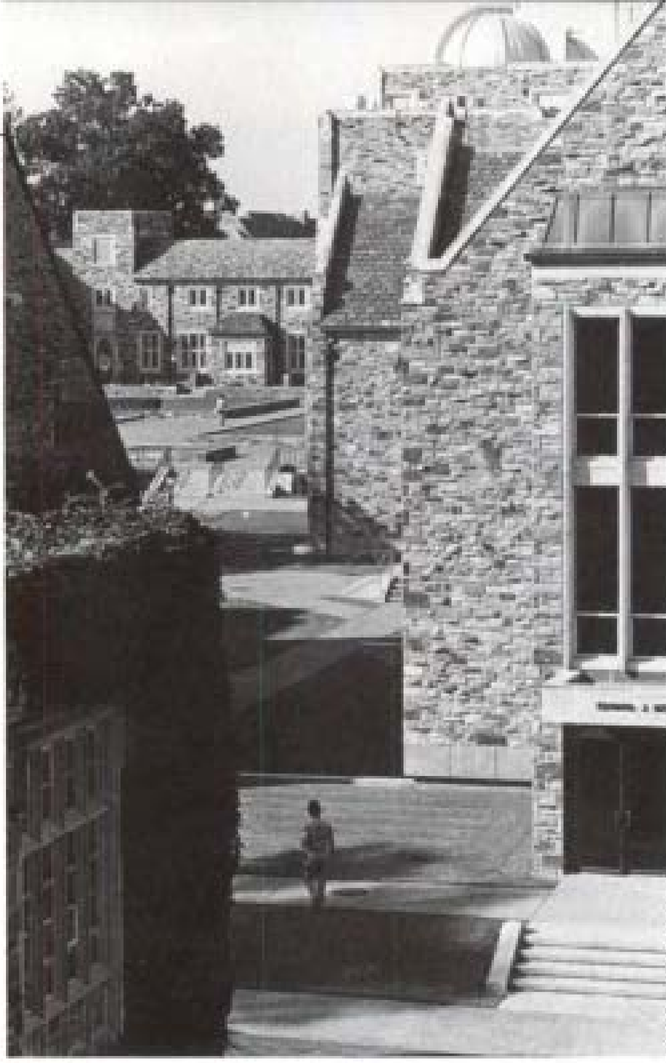
Since its move to Memphis in 1925, Rhodes College has operated within a long-range plan; it is currently finalizing the details for its third major master plan. The first was developed in 1923 and ambitiously blocked out the campus mostly as it is seen today. Upon Howe's arrival in 1984, work was being completed from the college's second master plan, which had been implemented in 1964.

Both Howe and Kepple view the newest master plan as a set of guidelines that will take Rhodes not only through the next fifteen to twenty years, but well into the twenty-first century. Says Howe, "We've actually gone further than I thought we would. I didn't know how receptive the board of trustees would be, but they just opened their arms and said, 'Go! Let's see how we can best utilize this land.'"

Rhodes has selected The Architects' Collaborative of Cambridge, Massachusetts to develop its new master plan within the style requirements of the college. As the director of physical plant, Howe does not feel restrained by the college's master plan or consistent style, and believes that good architects and planners will not feel restrained either. "We gave the planners twenty-five pages of directives of items that had to dovetail with what currently exists at Rhodes," says Howe. "But in a number of areas our minds were totally open, and they have come back with some valid, well-thought-out suggestions."

As for the importance of a master plan, President Daughdrill says, "An organization ought to know its values and where it wants to go. Once you start setting goals—and a goal is a hope with a deadline—something almost mystical takes place in any community of people. They begin to work toward its happening and essentially invent their own future."

Kepple attributes part of Rhodes' ability to develop and stick to long-term plans to their stable financial situation; the endowment currently stands at $53 million, a healthy figure for a small institution. However, he says, "I've seen many colleges with much better finances than we have that have lost their vision of what their campus should be. They've built buildings in the wrong place or in a wrong style, and clearly there has been no consistency carried out over a period of time. That has hurt



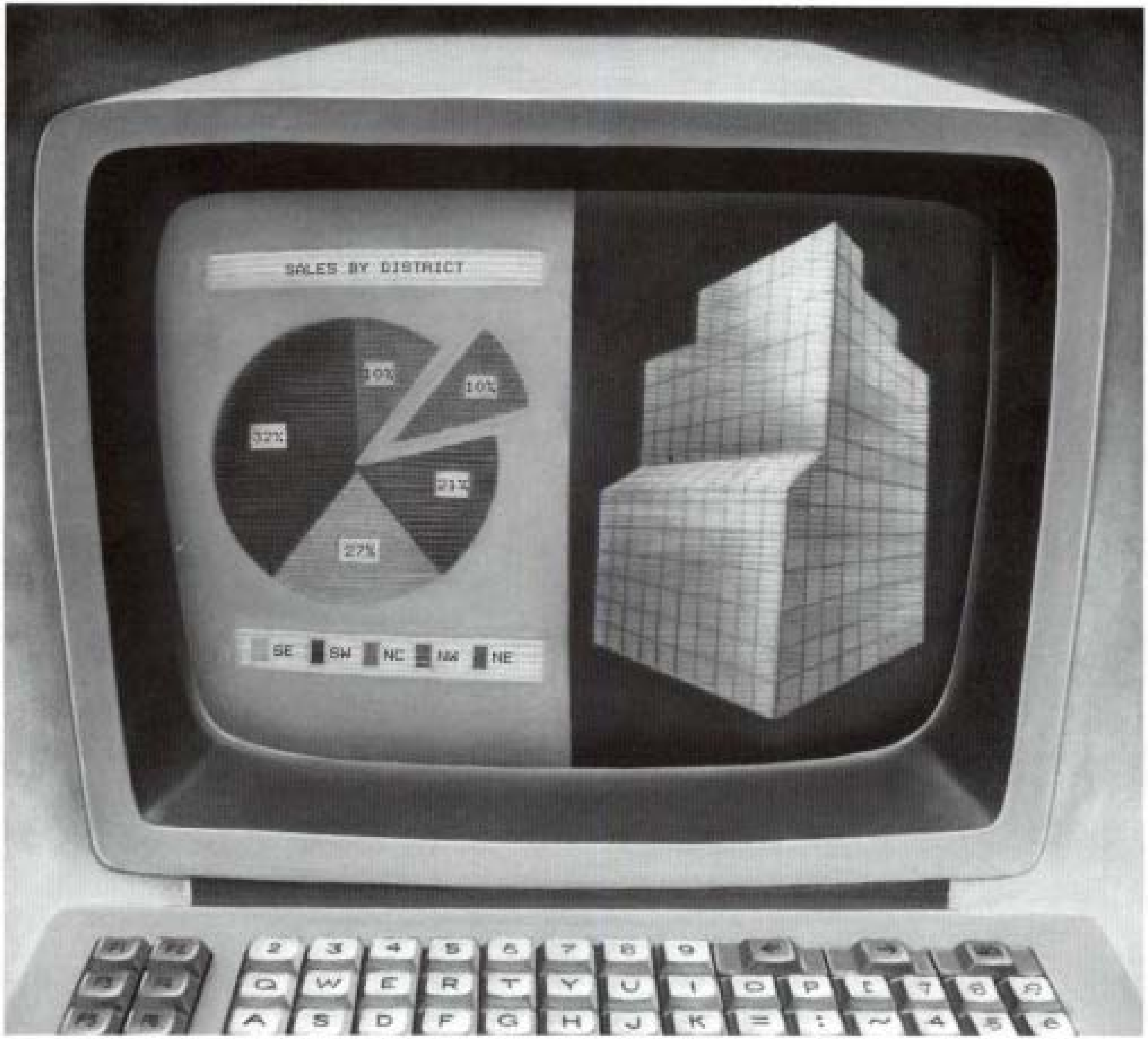
The Rhodes campus follows the Oxford and Cambridge models.

those campuses. They've lost something that they simply can never replace."

Howe is emphatic that no one at Rhodes is going to look out for the interests of the college better than he is as far as design, detail, and construction are concerned. "We can make decisions that may be challenged occasionally, but we're not going to get the carpet pulled out from under us at any point," he says. "There's open communication and enough information received far enough in advance that I feel comfortable making commitments, authorizing contracts, and so on.

"The president is looking for quality in everything we do at Rhodes. That kind of enthusiasm just reverberates throughout the entire institution. Everything we do is so positive, it's just a pleasure to be here. It's exciting and stimulating; you just look forward to the next day." ■

Detail of wall. "Eyebrows" add texture and form.



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Spatter Gun Technique for Resurfacing Walls

by Robert L. Wells

The use of topping compound applied with a spatter gun to resurface walls in renovated buildings, particularly residence halls, is an integral part of Linfield College's growing concern with the quality of its physical plant. In the past eight years Linfield has made a firm commitment to maintaining and restoring its physical plant in order to provide a better living and learning environment for its students.

Linfield College is an independent, four-year, liberal arts college with a main campus in McMinnville, Oregon and a satellite nursing school in Portland. Linfield is committed to the teaching of undergraduates in an atmosphere of academic freedom that fosters intellectual rigor, creativity, and a sense of personal and social responsibility. There are just under 1,900 students enrolled in Linfield programs, and the college employs approximately 350 people, fourteen of which are tradespeople in the physical plant department.

Since 1978 the amount budgeted for physical plant operation has increased over 100 percent as deferred and preventive maintenance projects have been undertaken. We have analyzed our operations and reallocated resources to maximize cost effectiveness.

Among changes made is the staffing of the physical plant department at the journeyman level in all craft areas. Subsequently, permanent college employees have handled all renovation and remodeling projects, which was formerly done by outside contractors. This has not only led to direct cost savings, but it has encouraged physical plant staff to explore ways in which they can cut costs and increase quality. In addition, it has given them an opportunity to take greater personal pride in the overall physical appearance and condition of the campus.

Renovation is particularly important, and difficult, in college residence halls. Even under the best conditions, the damage done by generations of students—pounding nails into walls to hang up pictures and posters, bulletin boards, and sports equipment, and denting and chipping walls with furniture, doors, and other objects—can be hard to undo. General student disregard for property, which may be higher in residence halls that are not well kept up, also causes problems.

When Linfield crews renovate an area they repair and replace damaged ceilings, patch and paint walls, refinish doors, lay new flooring, repair or replace furniture, and clean the area thoroughly. However, prior to summer 1983 there was often lingering dissatisfaction with the overall result because of the poor condition of the walls. Years of patching and repatching had left unsightly bumps on the walls that detracted from the visual impact and quality of other renovation work.

In 1983 Linfield first experimented with the use of topping compound applied with a spatter gun to resurface walls. The results were excellent; the topping compound not only covered the patched, pitted, and bumpy walls, but it gave the rooms and halls the fresh look of new construction. The rooms had new-looking walls at a fraction of the cost of the other alternatives considered, which were to:

- continue to grind, patch, and repaint walls;
- remove old walls and replace them with new sheetrock; or
- overlay existing walls with sheetrock.

The first alternative did not produce high-quality results, while the other two were much more time consuming and expensive.

The Procedure

This process is used to resurface badly scarred walls to cover holes, bumps, and old patched areas. The total renovation job looks complete, and the method is cost-effective and simple.

1) Patch holes as large and larger than an 8-penny nail size. Do not leave high ridges or large mounds on the wall. On the smaller holes use joint

Robert Wells is director of physical plant at Linfield College, McMinnville, Oregon. The procedure described in this article shared the top award in the 1984 Cost Reduction Incentive Award Program, cosponsored annually by the National Association of College and University Business Officers and the United States Steel Foundation.

compound, and on the larger holes use a hot mud such as Dura-bond 90 brand. Sanding is not necessary.

2) When filling in large areas of a wall that require sheetrock and taping, make sure that the filler is flush with the existing wall. Tape the joints around the filler piece and let dry thoroughly. Then spread a second coat over and around the tape seam and let it dry. Use the taping process also when hanging new sheetrock. Omit any sanding, the third coat, and touch sanding.

3) Grind unsightly patches that protrude from the wall surface. Use a disc sander with 60-30 grit aluminum-oxide discs; vary according to the type of finished surface on the existing wall. Mask off areas not to be spattered and cover windows with clear plastic. A piece of cardboard can be used as a dropcloth.

4) The mixture used for spattering must be thinned to a ratio of one-half gallon of water per a 50-pound box of topping compound. Depending upon the size of the area to be covered, the topping can be mixed in a large capacity mixer or a bucket.

5) To apply the first coat of spatter, use a pattern gun with an attached hopper and a compressor capable of supplying large volumes of air with quick recovery. This equipment combination can be used for smaller jobs such as one or two rooms so as to save time and the cleaning of material. For the larger jobs the commercial equipment with a separate hopper and an automated fluid line would be preferable. A second person is needed to hold a spatter shield against the ceiling for its protection.

6) Adjust the pattern gun to the smallest opening for a close, tight pattern, then start on a wall at the ceiling using a horizontal, sweeping motion across the wall. Use the same motion to fill in just above the floor. Next, start at one corner of the wall at the floor and back to the ceiling making sure that the strokes are overlapping. Clean the equipment thoroughly and allow the walls to dry overnight.

7) A second application is necessary for best coverage, and this is applied the same as the first and must be allowed to dry overnight also. The walls can then be smoothed off using a small taping knife to remove any bumps or knots, and then the paint may be applied. Two people can completely refinish the walls of a 22′ × 17′ room, applying two coats, in under ninety minutes total time. A room of this size requires 125-150 pounds of topping compound.

The appearance of a finished wall depends upon the condition of the old wall and the desired texture of the new wall. The spatter gun can be adjusted through the operator's experience and training to create a texture ranging from smooth to rough.

Linfield will continue to use the spatter gun/topping compound method to resurface walls for four reasons.

- The annual savings are, depending on the area resurfaced and the alternative approaches considered, from $5,000–$15,000.

- The quality of resurfaced and repainted walls far exceeds previously repaired and repainted walls.

- The physical plant crews who do renovation can take more pride in their work because the overall results are better.

- The students' living environment is more pleasant. Thus, we hope that students will take better care of their rooms. In addition, more attractive residence halls help with student recruiting.

The spatter gun/topping compound technique can be widely used by other institutions. Equipment and supplies are inexpensive, using the spatter gun is not difficult, and the results are aesthetically satisfying. Applying topping compound with a spatter gun is a cost-effective way to resurface damaged walls, a problem facing all institutions of higher learning. It is also recommended for preparing new walls.

The low cost, ease of application, and quality of results make this technique important. The workers who renovated the affected areas can take pride in their work because the overall effect of the renovation project is better than before this technique was used, and the quality of students' living environment is improved.

Financial Details

In 1983 the college resurfaced approximately 35,000 square feet of wall space for a total savings of between $5,075 and $13,825. The following are the costs of alternate methods of resurfacing walls; the first three are based on contractors' bids, the fourth on Linfield experience.

Straighten walls, fill, and sand (no texture)	$.30/square foot
Install new half-inch sheetrock (with old walls removed by Linfield crew)	$.50/square foot
Overlay new sheetrock	$.55/square foot
Apply topping compound with spatter gun	$.155/square foot

The spatter gun technique saves, on an average, $.145–$.395 per square foot, compared with resurfacing techniques that would yield comparable results in terms of quality. See **Figure 1** for specific costs of implementing this method.

In 1984 the college used the spattering method to resurface approximately 60,000 square feet of wall and ceiling areas; about the same amount was resurfaced in 1985 as well, with savings growing each year.

We have since upgraded our equipment to effectively handle larger projects, yet we still use a two-person crew. Our equipment now includes the same compressor used in 1983, a new pattern pump with 16-gallon hopper and pattern pistol with an on-and-off switch, and an electric-powered plaster mixer.

The reason for purchasing new equipment was to maintain the two-person crew while spattering larger areas—when using a handheld, combined spatter gun and hopper becomes too inconvenient and time consuming in the weight and constant refilling. Also, the time consumed in mixing one-half to one gallon of water to the one container of premixed joint compound—using a paddle and electric drill in a mixing container—is fine for small jobs, but for larger applications the electric-powered plaster mixer has proven to be a labor- and time-saver.

Figure 1
Costs of Spatter Gun/Topping Compound Method

Equipment	
Compressor	$560
Spatter gun (Goldblatt #13301M5)	89
Hoses	35
	$684
Supplies	
Topping compound (need 2-3 boxes for a 22' × 17' room)	$7/box

At present we are still using sheetrock taping mud and top coating for the spattering finish, but we are experimenting with other products on the market that can be mixed and applied in the same manner to develop a harder-type of finished surface for better surface wear.

This method of resurfacing scarred walls was developed by Brad Gill, carpenter foreman at Linfield, based on his concern about the quality of results achieved with previously used methods of resurfacing walls. In addition, he felt that his workers were dissatisfied with the results of their efforts and that students lacked respect for the renovation done in their rooms.

Gill's concern with developing cost-effective ways to produce high quality results in physical plant operations is representative of Linfield employees' attitude toward the campus. The spatter gun/topping compound technique is a success and will be used in all future renovation projects. ■

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Boiler Blowdown Heat Recovery

by Verne Traudt

What are you doing with your boiler blowdown? I know—you're probably running it to the sewer to get rid of the solids and boiler scale. Have you thought about the heat you're wasting and whether it might be economical to recover that heat?

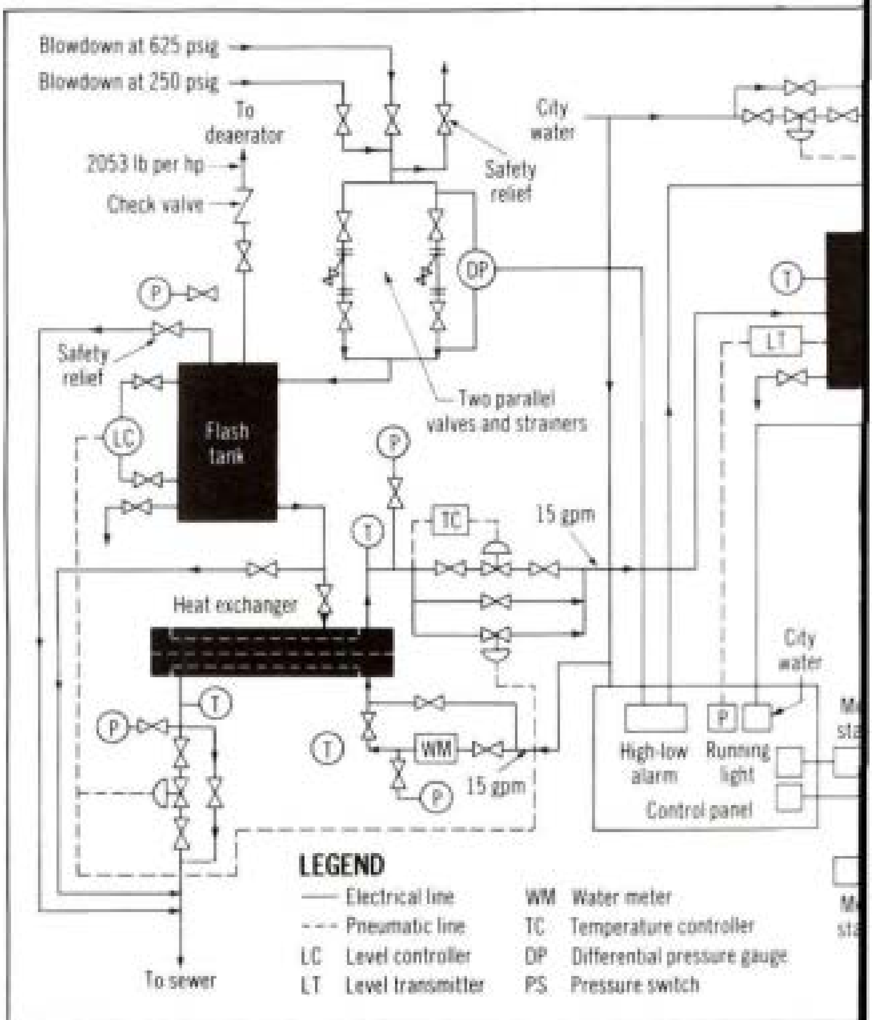
There is no easy answer, as we found out. In the first place, how many plants have a blowdown line that permits the amount of blowdown going to the drain to be determined? Who can furnish a meter that will measure water in the process of flashing off steam as its pressure is reduced from boiler pressure to atmospheric? Where can you find a meter that will withstand the water temperatures or the solids and scale coming from a pressurized boiler for any length of time?

The temperature of the boiler blowdown water can be quite accurately determined from the boiler operating pressure via steam tables, and the temperature, in turn, can be readily converted to BTUs going down the drain—*if* you can determine the quantity of blowdown.

Probably the most accurate method of calculating boiler blowdown quantity

This article was originally published in Heating/Piping/Air Conditioning *and is reprinted with permission. Verne Traudt, P.E., was manager of utilities at the University of Nebraska/Lincoln and is now retired.*

Boiler blowdown heat recovery system sends flash steam to deaerating heater and hot water to heat exchanger that heats makeup water for water softening system.

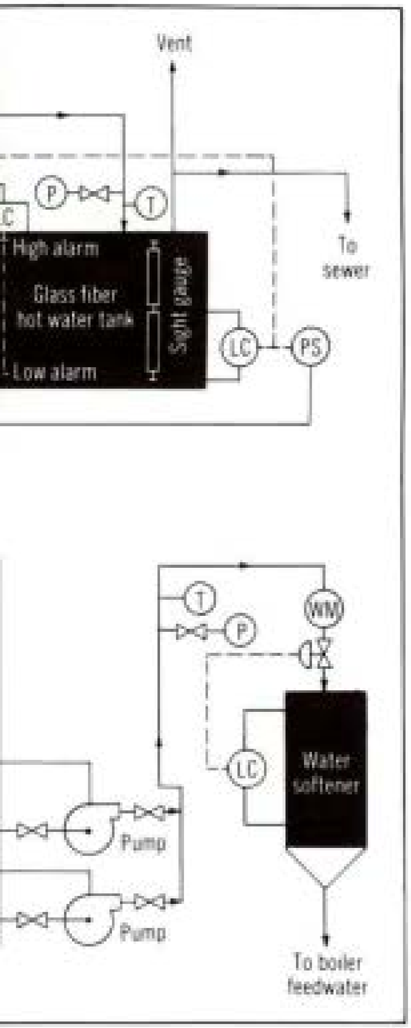


is through cycles of concentrations of total dissolved solids (TDS) as compared to solids in boiler makeup water. This can be a bit sticky, and laborious, when many boilers are operated on an intermittent (when available) schedule.

In our particular case, five 250 psig boilers and one 625 psig boiler operate on a "most efficient" and "when available" schedule. The next complication involves a decision as to where you plan to transfer the heat you intend to recover. It stands to reason that much more heat can be transferred to 51°F domestic water than can be transferred to 160°F boiler feedwater going to a deaerating heater.

When you think about it, the economics of the operation start grabbing your attention. If you try for the maximum possible heat recovery, you must provide a storage tank for the heated domestic water, pumps to utilize the water when needed, and controls to regulate the heat recovered from the erratic supply of boiler blowdown water. If you are satisfied to recover a lesser amount of heat, you can transfer it to the hotter boiler feedwater; then the job becomes much simpler—and less expensive.

Over a period of approximately six years we managed to get four engineers (graduate and/or operating) to make studies of the economics and feasibility of transferring recovered heat either to domestic water or to the warmer boiler feedwater. Two of the engineers said it would work and the economics would be good; the other two said that neither the concept nor the economics were good. Considering the dirty, intermittent water flow involved, the boiler pressures, the costs, and the conflicting engineering opinions, one could truly say that the answer was not obvious.



Go Decision is Leap of Faith

When some energy savings dollars finally became available, we hired an engineer with the understanding that *we would* recover the boiler blowdown heat; *we would* put the heat recovered in domestic water; *we would* provide a nominal 10,000 gal capacity storage tank; *we would* send the flash steam to the deaerating heater at approximately 12 psig; and *we would* require a variable control system to permit a maximum range of domestic water temperatures depending on the quantity of blowdown available. Even though we had some serious doubts about the final outcome of the design and the practicality of meeting all of our project desires, everyone maintained a positive attitude.

An analysis of system operations indicated that 9270 lb per hr (18.5 gpm) was the maximum peak system blowdown over the previous six years. Duplicate incoming lines to the flash tank were designed, complete with strainers and isolation valves to allow maximum flow on either line while strainers were cleaned. One pressure gauge was installed across the boiler blowdown inlet line to the flash tank, with isolation valves, as a means of indicating when the strainers should be cleaned.

Instead of building a horizontal flash tank, as first conceived, we designed and installed a vertical tank. Incoming water enters near the top of the tank at one end, and flash steam is piped to the deaerating heater from the top of the tank. A ½-inch thick by 12-inch wide steel "wear plate" covers a 180 deg arc of the tank at the incoming water end, and a 30 psig steam safety valve is installed on top of the tank near the other end.

A vortex breaker and level controller maintain a regulated flow of water out of the tank despite the variable water level inside. This regulated flow of water from the tank is essential to maximum heat recovery. An adjustable, temperature sensitive, water flow controller is included to regulate the flow of domestic water to the heat exchanger. When peak system blowdown occurs, 190°F heated domestic water can be obtained from the system. During periods of low blowdown, the output water temperature can be adjusted to as low as 90°F.

Boiler blowdown water at 493°F from the 625 psig boiler and at 406°F from the five 250 psig boilers is piped to the heat recovery system via a common header. Both the constant blowdown and the manually controlled blowdown go into the common heat recovery system. Nominal water temperature from the heat exchanger to the sewer was 68°F during early 1983. This is a far cry from the 400° to 490°F water previously discharged to the holding tank and then to the sewer.

Heat exchangers in a contaminated atmosphere can be a constant problem. From the time the concept of the project started taking shape, the design of the heat exchanger loomed large. Chelates in plant boiler water leave chlorine in the water. This eliminated the possibility of using stainless steel heat exchanger tubes.

Serious doubts existed as to the capabilities of copper or copper-nickel tubes. So the design was left to the ingenuity of the design engineer. He and the contractor who got the bid to furnish and assemble the entire heat recovery unit recommended a plate type heat exchanger as an alternate to the shell-and-tube unit originally specified. This plate type heat exchanger, as bid and purchased, is constructed of thirty titanium plates with an epoxy coated frame and medium nitrile rubber gaskets. The unit has two passes and measures 12 inches wide by 24 inches high by 6⅝ inches long.

Guaranteed (quoted) values for this miniature looking heat exchanger for boiler blowdown water at 7500 lb per hr flow were 243°F water in and 108.2°F water out. The quoted values for domestic water at 7100 lb per hr flow were 60°F water in and 202.4°F water out. This does not necessarily constitute an energy balance. We found these values hard to believe; however, the unit appears to be meeting or exceeding the quoted values.

Our experience has been that we can (and we do) convert the outgoing boiler blowdown water temperatures to an average temperature of 68°F with our present winter load. During a "test" period, the domestic water temperature changed from 51°F water in to 102°F water out. The unit has not been tested at full load to date because of mild winter temperatures and below-peak system steam demands.

The blowdown water temperature to the sewer is very encouraging, however. The titanium heat exchanger plates, rather than stainless steel, remove the hazard of stress corrosion cracking, which would have been present in our chloride-contaminated system. It should also be noted that the calculated pressure loss through the heat exchanger was 3 psig on the boiler blowdown side and 2 psig on the domestic water side at full flow. We consider these very low operating pressure drops.

A unique feature of the system is a storage tank level controller that, by design, keeps the water in the storage tank above a minimum level through controlled entry of cold domestic water as needed. This permits a more even warm/hot water source to the water treatment system in case of a shortage of hot water due to low quantities of boiler blowdown or excess treated water makeup requirements.

The system hot water storage tank ended up with a capacity of 8330 gal. It was constructed of glass fiber by a local manufacturer to fit the space available. The insulated glass fiber tank was cheaper than a corresponding steel tank, and it eliminates the possibility of tank corrosion. The tank was designed for 200°F hot water and has 2-inch wall and topside insulation with ¾-inch tie rods both ways to minimize tank wall deflection. An oblong tank was designed to utilize all available space and give maximum storage capacity.

System Benefits

If a plant burns sulfur-bearing oil, it is extremely important that the temperature of the incoming water to the

During periods of low blowdown, the output water can be adjusted to as low as 90°F.

boiler be controlled, especially if an economizer has been added or is contemplated for the future.

Use great caution when installing and operating an economizer. For simplicity, remember that you had better examine your economizer for correct bottom-to-top flow and the tube temperatures at *both bottom and top* if you want to avoid costly economizer tube replacements in the future. Here is where your flash steam from boiler blowdown can be used to best advantage.

If you burn gas, a minimum of 6 psig steam blanket over the deaerating heater is required to remove the oxygen from the boiler feedwater. When burning two percent or lower sulfur-bearing oil, however, the steam blanket, as we determined, has to be in the range of 12 to 13 psig to remove the oxygen from the boiler feedwater and provide a safe economizer tube operating temperature.

The flash steam picked up from the boiler blowdown saves quite a few dollars over a year's time in this application. You really have no choice. If you operate boilers, you must remove the oxygen from the boiler feedwater via costly chemicals or a deaerating heater. In other words, you either remove the oxygen or you replace economizer and/or boiler tubes after they are pitted by the oxygen in the water. The flash steam from the boiler blowdown provides the necessary steam to a single deaerating heater to remove *almost all* of the oxygen, and it regulates boiler feedwater temperature at the same time. We found the economics to be very good and the operation very simple.

Our records indicate that 14,606,500 lb of 625 psig blowdown at 480 BTU per lb and 11,145,000 lb of 250 psig blowdown at 382 BTU per lb (figures rounded) per year contained a total of 11,268.5 million BTU of usable heat. With the deaerating heater operating at 12 psig in winter and 8 psig (slightly above minimum) in summer, between 15.6 and 25 percent of the boiler blowdown flashes to steam. In all, the energy utilized in the deaerating heater over a one year period is equivalent to 1,904,500 lb of 250 psig steam at 500°F.

At the current per-Mcf cost of natural gas and 81 percent average boiler efficiency, the calculated yearly saving in fuel costs is $47,522. As the price of fuel increaess, which is a foregone conclusion, the yearly savings will increase on an equal percentage basis.

Heat salvaged from the boiler blowdown water that does not flash to steam is transferred to domestic water, which is stored and utilized as makeup water to a hot lime zeolite plant water softening system. This warm/hot water entering the water softening system reduces the chemicals required for good operation as compared to the former cold domestic water into the system. Additional pumps, motor starters, and piping were required for this added benefit to plant operations.

Total costs for engineering, heat recovery system, instrumentation, controls, control panel, motors and motor starters, valves, and hot water storage tank amounted to $59,020. In-plant costs for pipe, valves, check valves, and labor came to $14,711 as nearly as we could determine. Total project cost, therefore, was $73,731 with a calculated yearly saving of $47,522.

No attempt was made to figure the yearly saving in chemicals or the added efficiency of the water softening process with the warm/hot water instead of the previous cold domestic water. Total capital cost recovery every eighteen months—with a decreasing time period as fuel costs rise—looks very good in our operation.

The boiler blowdown heat recovery system has now been in operation for more than three years. This should be sufficient time to answer the age-old question: What would we change if we had it to do over? The honest answer is: Nothing—absolutely nothing! ■

The official publication of the Association of Physical Plant Administrators of Universities and Colleges

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Preparing Rapid, Accurate Construction Cost Estimates with a Personal Computer

by Sanford M. Gerstel

The purpose of this paper is to describe an inexpensive and rapid method for preparing accurate cost estimates of construction projects usually encountered in today's university setting, using a personal computer, purchased software, and one estimator.

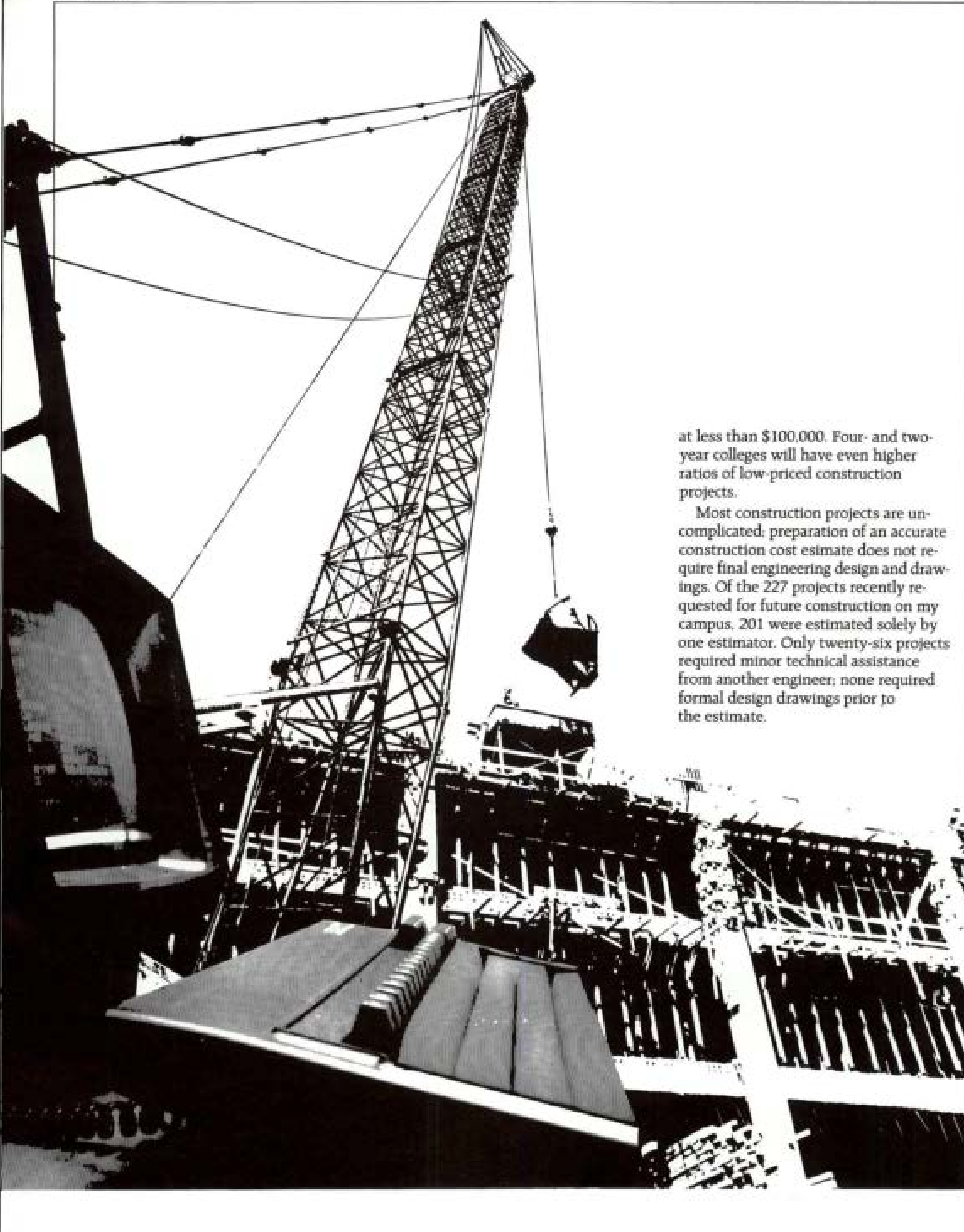
I will argue that cost estimates based on itemized material lists taken from completed or semi-completed engineering drawings (usually referred to as defined estimates), are generally not worth their preparation effort and cost and are not necessary in today's universities. I'll describe an easy-to-set-up automated rapid estimating system, tailored to your needs, using an inexpensive personal computer and purchased spreadsheet software. Finally, I will suggest that a high quality construction cost estimating department in today's university setting can consist of one estimator supported by a personal computer, some purchased software, and several reference books.

Sanford Gerstel is director of facilities engineering at the State University of New York/Stony Brook.

The Nature of Construction Projects on Today's Campuses

Gone are the days of seemingly endless funds for constructing new, massive, sophisticated buildings to house exploding instructional and research programs. Declining enrollments, rising operating costs, and shrinking budgets limit current campus construction to energy conservation retrofits, projects necessary to prevent or reverse deterioration of existing buildings and utility distribution systems, conversions of buildings and rooms to accommodate changed instructional and research programs, and a potpourri of other physical alteration projects.

Most construction projects are small. At my campus, a major research university including a 540-bed hospital, 80 percent of the projects currently under design, construction, or being considered for future construction are valued



at less than $100,000. Four- and two-year colleges will have even higher ratios of low-priced construction projects.

Most construction projects are uncomplicated; preparation of an accurate construction cost esimate does not require final engineering design and drawings. Of the 227 projects recently requested for future construction on my campus, 201 were estimated solely by one estimator. Only twenty-six projects required minor technical assistance from another engineer; none required formal design drawings prior to the estimate.

Why Prepare a Construction Cost Estimate?

Although there may be instances where cost of a construction project is open ended, such boundless funding in a college is rare. The estimated cost of a proposed new building, an addition to an existing building, or a physical alteration project is generally needed in advance of project consideration and approval.

A research grant proposal that includes physical alterations of a laboratory must usually include the estimated construction cost of the alteration. Academic departments planning office renovations must usually include estimates of such costs in their proposed budget presentations. State university campuses funded by tax dollars, required to seek political approval of construction projects, must submit capital project requests, including construction cost estimates, to their state legislatures for approval.

Even after approval is available to construct a project, cost estimates are necessary to evaluate the "reasonableness" of contractors' bids: lowest competitive bid does not necessarily imply a reasonable bid. Construction cost estimates are necessary to evaluate alternate methods for accomplishing an objective. A slightly less desirable office layout may emerge as most desirable after construction cost estimates are compared.

Not only are estimates required for evaluation of cost objectives, time schedules of construction time duration require preparation of a construction cost estimate. To emphasize, rarely, if ever, can the start of a construction project without a cost estimate be rationalized.

The Case Against Defined Estimates

Several years ago I analyzed fixed price project bidding activity (job award batting average and profitability outcome versus type and cost of estimate prepared) of a major international engineering and construction company. I found the cost of preparing defined estimates—the preparation of preliminary construction drawings, take-off of material quantities from these drawings, material priced by total or unit costs obtained by vendor quotes—to be extremely high, three percent of project cost. But more significantly, the probability of job award and end profit on awarded projects was invariant to type of construction estimate prepared. Investing in detailed, defined estimates was a waste of money, time, energy, and a drain on company profits since defined estimates were no more accurate than simpler, less expensive types of estimates.

The company immediately abandoned preparation of defined estimates for bidding fixed cost work on all but a handful of unique projects. Disaster did not strike; profits rose. (Several years later, as competition tightened, company management lost their spirit of adventure and reverted to the preparation of expensive, defined estimates for bidding construction projects. At last report, hard times had befallen the company.)

I don't prepare defined estimates of construction work at my campus. I don't

FIGURE 1

ESTIMATE WORKSHEET

PROJECT NO: 85262 BY:SMG
DESCRIPTION:REMODEL OFFICE BLDG DATE:

QUANT	UNIT	CODE	DESCRIPTION	MAT'L$	LABOR$	TOTAL$
250	LF	1001	8' SHEETROCK WALL	5,000	5,000	10,000
2500	SF	1101	SUSPENDED CEILING	2,500	2,500	5,000
2500	SF	1201	ASPHALT TILE FLOOR	2,500	2,500	5,000
10	EA	1301	SINGLE DOORS STL OR WOOD	4,000	2,000	6,000
35	EA	2001	OUTLET - NON DEDICATED	875	1,750	2,625
63	EA	2011	CEILING LIGHT FIXTURE	4,688	7,813	12,500
20	EA	2012	LIGHT SWITCH	500	1,000	1,500
5	EA	3001	SINGLE SINK	1,250	1,750	3,000
			SUB TOTAL STANDARD COST	21,313	24,313	45,625
0	%		MARKET FACTOR	0	0	1,066
5	%		CONTINGENCY	1,066	0	1,066
15	%		INDIRECT MATERIALS	3,357	----	3,357
15	%		CONTRACTOR'S PROFIT	3,860	0	3,860
			TOTAL PROJECT COST	29,595	24,313	53,908

SCHEDULE DERIVATION	
ESTIMATE APPROVAL	1/31/85
COMPLETE FINAL DWGS	4/15/85
FINAL DWGS APPROVAL	5/15/85
REQUISITION MATERIALS	5/22/85
MATERIALS DELIVERY	6/21/85
CONSTRUCTION START	7/21/85
CONSTRUCTION FINISH	10/10/85

have the staff to spare for preparing expensive, time-consuming defined estimates. The need for precisely detailed estimates at a college or university is unnecessary; we don't bid construction work for profit. In addition, I do not believe that defined estimates produce more accurate results than the rapid estimating system I'll describe later.

I use two methods to measure the accuracy of the rapid estimates prepared for construction work on my campus:

1. Comparing contractors' bids to our estimates, for work bid out.
2. Comparing actual material and labor costs to estimated costs, for work we do with our in-house construction staff.

For work bid out, our cost estimates are almost always slightly above the lowest bid, indicating a good cost estimate. Our cost estimates for in-house work likewise compare favorably with actual job costs.

I do not want to give the impression that our estimates are never wrong. From time to time our estimates are low, rarely high. Absence of competitive bids makes some estimates low, while project scope misjudgments by the estimator accounts for the other infrequent error.

What is the cost penalty of these errors? NOTHING! Since defined estimates are no more accurate than those produced by the rapid estimating method I use, I am ahead by the time saved by not making expensive defined estimates. At my campus, where $3 million of construction work is estimated each year, preparation of defined estimates, at three percent of project cost, would cost $90,000. The actual cost of preparing rapid estimates is only $15,000; the $75,000 saved buys lots of technical talent.

An indirect but extremely important benefit of our rapid estimating system is our ability to prepare accurate preliminary estimates of contemplated physical alterations and forward the estimate to the requestor, allowing a go/no-go decision to be made without wasting scarce engineering resources on work that will not proceed because its cost exceeds budget. We don't waste time preparing detailed material lists for purchasing unless the project is funded for construction!

The Rapid Estimating System

Defined estimates have been previously described as estimates based on itemized material lists taken from completed or semi-completed engineering drawings. They are accurate but extremely costly to prepare. Excluding guesses, the least expensive but least accurate construction cost estimate is the "square foot" estimate, where total estimated cost equals square feet of affected area multiplied by a total unit cost per square foot figure. An example of a square foot estimate for renovating a 5,000 square foot space could be 5,000 square feet times $50 per square foot = $25,000.

Square foot estimates would be acceptable if all construction projects were similar in proportional nature; for example, if 25 percent of the work in all projects consisted of new 8' high sheetrock walls, 15 percent for installation of new non-acoustical suspended ceilings, etc. Unfortunately, the world of construction work at colleges and universities is not so uniform. Project costs can vary from $10 per square foot to $200 per square foot, depending on the scope and type of materials for each project's work.

The computerized estimating system I use at my campus maintains the accuracy advantage of a defined estimate while avoiding its high expense disadvantage, and maintains the speed advantage of a square foot estimate while avoiding its inaccuracy disadvantage.

Figure 1 is a printout, using our computerized rapid estimating system, of a completed cost estimate for a small construction job. Except for the CODE column nothing on the spreadsheet should be unfamiliar to a construction cost estimator. Construction contractors having an actual cost feedback system will usually use codes to group and identify different types of work items.

Material, labor, and total costs of each row of material commodities or tasks equals quantities shown multiplied by material and labor unit costs. Quantities are variable, entered by the estimator; unit costs applicable to the specific item described, are predetermined. I use fixed (standard) unit costs for each material commodity, adjusting the total standard cost estimate by a "market factor," which I'll soon describe. Rather than standard unit costs you may decide to periodically update your unit costs as market conditions change.

Automatically calculated schedule dates at the bottom of the estimate sheet are a function of the DATE, at the top of the estimate sheet, and predetermined time durations between each milestone event. For example, ESTIMATE APPROVAL date equals DATE plus thirty days; CONSTRUCTION COMPLETION date equals START OF CONSTRUCTION plus a time duration formula based on estimated labor costs. Calendar dates are automatically calculated by the software. Predetermined activity durations should, of course, be modified for unusual project conditions.

Each material commodity I use is actually a "system" of related materials. For example, unit costs for the 8' sheetrock wall include costs of studs, screws, sheetrock, spackle, paint, and cove base—the finished wall. Ceiling light fixture costs include the fixture, mount-

FIGURE 2

ESTIMATE WORKSHEET

PROJECT NO: BY:
DESCRIPTION: DATE:

QUANT	UNIT	CODE	DESCRIPTION	MAT'L$	LABOR$	TOTAL$
	LF	1001	8' SHEETROCK WALL	0	0	0
	SF	1101	SUSPENDED CEILING	0	0	0
	SF	1201	ASPHALT TILE FLOOR	0	0	0
	EA	1301	SINGLE DOORS STL OR WOOD	0	0	0
	EA	2001	OUTLET - NON DEDICATED	0	0	0
	EA	2011	CEILING LIGHT FIXTURE	0	0	0
	EA	2012	LIGHT SWITCH	0	0	0
	EA	3001	SINGLE SINK	0	0	0
			SUB TOTAL STANDARD COST	0	0	0
	%		MARKET FACTOR	0	0	0
	%		CONTINGENCY	0	0	0
	%		INDIRECT MATERIALS	0	----	0
	%		CONTRACTOR'S PROFIT	0	0	0
			TOTAL PROJECT COST	0	0	0

SCHEDULE DERIVATION

ESTIMATE APPROVAL	30
COMPLETE FINAL DWGS	105
FINAL DWGS APPROVAL	135
REQUISITION MATERIALS	142
MATERIALS DELIVERY	172
CONSTRUCTION START	202
CONSTRUCTION FINISH	202

COMMONLY USED COMMODITIES STANDARD UNIT COSTS:

UNIT	CODE	DESCRIPTION	MAT'L$	LABOR$	TOTAL$
	1000	WALLS:			
LF	1001	8' SHEETROCK WALL	0	0	0
LF	1002	10' SHEETROCK WALL	0	0	0
SF	1012	CONC BLK WALL, 8"	0	0	0
SF	1021	GLASS/ALUM WALL	0	0	0
EA	1022	ADD FOR DOOR	0	0	0
SF	1032	SOUNDPRF WALL,EXPENSIVE	0	0	0
MD	1091	DEMOLITION & REMOVAL	0	0	0
	1100	CEILINGS:			
SF	1101	SUSPENDED CEILING	0	0	0
SF	1111	3" SOUNDPROOFING	0	0	0
SF	1121	PLASTER/LATH CEILING	0	0	0

FIGURE 3

CALCULATION OF FACTOR TO ADJUST STANDARD MAT'LS COSTS TO CURRENT PRICES
DATE OF CURRENT UNIT COSTS:

TYPICAL JOB MATERIAL ITEM DESCRIPTION	QUANT	UNIT	STD UNIT COST ($)	TOTAL STD COST ($)	TOTAL COST MIX (%)	CURRENT UNIT COST ($)	TOTAL CURRENT COST ($)
EQUIPMENT RENTAL	20	DAY	500	10000	9	510	10200
CONCRETE	25	CY	75	1875	2	70	1750
LUMBER	10000	BF	.5	5000	5	.6	6000
BRICK	1500	SF	.75	1125	1	.85	1275
WINDOWS	25	EA	25	625	1	30	750
DOORS	4	EA	150	600	1	150	600
1" PIPING W/FTGS	3000	LF	.25	750	1	.3	900
4" PIPING W/FTGS	1000	LF	6	6000	5	7.5	7500
SINKS	25	EA	75	1875	2	65	1625
BOWLS	6	EA	100	600	1	85	510
METAL STUDS	5000	LF	.5	2500	2	.5	2500
SHEETROCK	15000	SF	.2	3000	3	.25	3750
ROOFING	5000	SY	1.5	7500	7	1.6	8000
ELEC FIXTURES	50	EA	25	1250	1	30	1500
WIRING	5000	LF	.25	1250	1	.3	1500
CONVECTION UNITS	3000	LF	5	15000	14	5.5	16500
DUCTWORK	10000	LB	5	50000	46	5.5	55000
NAILS, SCREWS, ETC	1	LOT	750	750	1	750	750
TOTALS				109700	100		120610

MARKET FACTOR = 120610 / 109700 = 1.10

ing hardware, bulbs, and wiring. Quantities are approximate since, in most cases, finished drawings are not made. Some will be high, others low; highs and lows usually balance in the overall estimate.

While some quantity figures are based on rough floor plans, other material quantity figures are "second generation." For example, square feet of ceiling tile will usually be based on a floor plan area; the number of ceiling light fixtures, however, may be equal to ceiling tile area multiplied by 2 watts per square foot divided by 80 watts per fixture. Changing the ceiling tile quantity (area) figure will automatically change the number (and costs) of ceiling light fixtures.

The master estimate worksheet file you set up in your computer, shown in part in **Figure 2**, consists of the estimate worksheet followed by descriptions and unit costs of commodity items commonly used in construction projects on your campus. (Absence of quantity figures causes display of zero cost figures in Figure 2.) It is not difficult to rapidly prepare an accurate and neat construction cost estimate using the master estimate worksheet file you have set up in your computer, with unit cost and time duration formulas appropriate for you. All that's involved in using this computerized estimate system is to copy the appropriate commodity items from the reference listing to the worksheet area (upper portion), enter quantities and percentages of additives to bare costs, and watch in amazement as total costs and schedule dates automatically and immediately appear on your screen. You can save the estimate worksheet on disk and print a professional looking copy of your construction cost estimate.

If the reference listing does not include a commodity needed for the estimate, type it in. If the item is something commonly used, add it permanently to the reference listing.

Use the job number as the filename for your estimate worksheet, and save only the estimate portion of the worksheet. The reference table can be reloaded if the estimate has to be changed.

Adjusting Standard Unit Costs for Current Market Conditions

If you have chosen to use an estimating system based on standard unit costs, you will have to periodically adjust the estimated total standard cost for current market conditions. The uncomplicated spreadsheet illustrated in **Figure 3** quickly calculates the factor for adjusting costing systems based on standard unit costs to current market conditions. The Cost of Living Index is a similar application.

Not only can this standard cost adjustment method be used for converting standard cost estimates to current market conditions, it can also be used by campuses that use standard unit costs for inventory value calculations to convert standard cost inventory value to current prices.

The worksheet illustrated in Figure 3 contains a list of typical materials assumed to be used in construction work at a campus and their quantity, standard and current unit costs, total costs, and financial weight of each item (TOTAL COST MIX column). The material list and quantities shown in the worksheet represent a shopping basket of items used on a typical construction job.

One of the most important columns of number on this spreadsheet is the TOTAL COST MIX column. For the price adjustment analysis to be relevant, the cost mix percentage should represent the mix of items actually used in a typical job or included in a typical inventory.

Calculating a standard cost adjustment factor (market factor) is not difficult. To your worksheet that already includes the list of typical material items, quantities, and their standard unit costs, enter the current market unit cost of each item on your list. The market factor needed to convert your standard cost estimate to current costs is automatically calculated. Your standard cost estimate, when multiplied by the factor, is converted to a current market estimate.

Conclusion

Don't be intimidated by the thought of having to be a computer programmer to set up the estimating system I have described. You do not have to be a computer programmer; in fact, you don't need to know the slightest thing about computer programming. Just buy a popular priced personal computer, any of the popular spreadsheet software that can run on your computer, and away you go. ■

Management Resources

Diana L. Jeffery

Cogeneration News

Ohio State University expects to save $398,000 a year in electric costs by using cogeneration for electricity. Using a general revenue bond for financing, a back pressure steam turbine will be installed to operate in conjunction with a coal-fired boiler. The system will pay for itself in 6.5 years. The turbine will use the steam from the boiler to operate and will be used as a backup unit in peak demand times.

The University of Richmond plans to save $129,000 a year through cogeneration. Their electrical rate structure is based on demand charge and charge for actual usage. The highest demand level reached during any thirty-minute period during May, June, July, or August is the demand charge for the next twelve months; monthly charges for the following twelve months are 90 percent of highest peak demand charge. A cogeneration system will be used to reduce summer peak demand and thus reduce electrical rates. The system consists of a natural gas-powered engine generator, a waste heat recovery boiler, and an absorption chiller. Pay back is expected in 4.1 years.

Northwood Institute in Midland, Michigan is undertaking a cogeneration project with Decker Energy International. They installed three units, two in the boiler room for a dormitory, administration building, and cafeteria; the other in the large sports complex. Decker owns the system and sells the electric and hot water output to Northwood at prices guaranteed below regular sources.

Human Resources

The University of Nebraska Medical Center won AIPE's Fame Award of Excellence in 1985 for its training program for building operators. It is a two-step program, which consists of formal classroom training in Systems Maintenance Administration (eight courses) and a series of in-house training sessions on the specialized skills necessary to operators' actual work environment.

The results speak for themselves. There are no more band-aid solutions; instead, problems are solved and anticipated. Environmental control systems, formerly blamed for lack of comfort, now perform as requested. In addition, heating season fuel consumption was reduced by 18 percent when systems were properly adjusted to compensate for normal air temperature. This savings alone paid for the cost of training in a matter of months.

The Georgia Institute of Technology trained its custodial and maintenance personnel in fire emergency procedures. Employees were instructed on how to react if the fire alarm goes off in a building in which they are working and what to do if they discover a fire. Emergency phone numbers are posted in every custodial and maintenance supply closet. Classroom instruction was followed by procedures on what to do if hair or clothing catches on fire and when and how to use a fire extinguisher. Each person was given the opportunity to put out a fire under the guidance of the fire marshal. The university expects to repeat the course at least once a year.

Franklin Pierce College has a seventeen-member student volunteer fire department. They are on call twenty-four hours a day and attend weekend sessions at firefighters school. Last spring they put out a dorm fire before the town's fire trucks arrived. For their efforts, the school bought them a 1955 Ford engine front-end pumper truck. The students carry electronic pagers and participate in dorm inspections. They have been valuable in fighting real fires and sparing the town fire department from being tied up with false alarms.

Energy Management

An article in the January/February 1986 AIPE magazine cites the top ten suggestions for energy savings. The results are drawn from information collected in over 200 energy audits by the Oklahoma Energy Analysis & Diagnostic Center. Suggestions include:

- eliminate compressed air leaks
- reduce combustion air flow to optimum
- night setback of thermostats
- energy efficient lighting sources
- insulate bare tanks, vessels, & pipes
- delamp unneccessary lights or reduce wattage
- computerized HVAC control
- optimize plant power factor
- use energy efficient motor
- switch to high efficiency lighting

Other suggestions: install air compressor intake in coolest location, generate power through waste heat recovery, use radiant heaters for spot heating, and improve the building envelope.

Industry Applications

The Houston Center Complex in Texas uses a bright, color-coded mechanical plant to save time and money. It assists in training new workers, locating problems quicker, and brightens the atmosphere. In addition, the paint itself is a bonus because it is durable, inhibits rust, and is easy to clean.

Security Suggestions

Following a number of security violations on campuses nationwide, several schools are rethinking the keylock and passcards systems. The University of Wisconsin/Eau Claire has installed combination locks in all of the dormitories and, because of the success, is also installing them in administration buildings. The combination lock eliminates lockouts from lost or stolen keys and cards and is easier to administrate. The locks can be changed easily by authorized personnel and have brought a greater sense of security to the student and faculty populations.

Parking Problems

The University of Oklahoma has tried a new approach to collecting on the high number of unpaid parking tickets. They took out a full-page ad in the student newspaper and published a "Tow List" with license plate numbers of all cars with unpaid tickets. They issued a warning that these cars would be towed but offered a "back-to-school special" discount of 50 percent off the fine if tickets were paid within two weeks. The university reports that many current tickets were paid in full; however, only a small percentage of the long-term outstanding tickets were paid.

Student Training

Purdue University's Department of Building Construction & Contracting in the School of Technology has an innovative approach to teaching construction practices—they have students build their own building. Students erect a 1400-square-foot structural steel building within the Knoy Hall of Technology. The training takes each student through every phase of construction work including cost management, estimates, labor productivity, job-site safety, and meeting schedules. The materials for the project are donated by local manufacturers.

Send us your ideas, projects, and other facilities related accomplishments. Get recognition for your hard work and ingenuity. Share your successes with other administrators. Send your ideas to Diana L. Jeffery, *Facilities Manager*, 1446 Duke Street, Alexandria, VA 22314-3492; or call 703/684-1446.

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Data Base Update

Howard Millman

This issue of *Facilities Manager* marks the introduction of our newest column, Data Base Update. Here we will feature articles geared to help you use computers to your best advantage, including reviews of software for preventive maintenance and maintenance management, spreadsheets, word processing, energy management, security and key control, and other important areas. If you have any questions about computers and their abilities, please contact the author at the address listed in this article. Or, if your physical plant department has developed a software program and would like to have it reviewed in these pages, send a copy with your documentation directly to the author. We hope to make Data Base Update a useful and enjoyable addition to your library of computer related information.—Ed.

Computer Literacy Can Enhance Your Future

If you are like most professionals, you're curious yet cautious when it comes to computers. Curious because you suspect computer technology really is a step into tomorrow, and cautious because it's costly, complex, and even a bit alien. Nonetheless, computers are an exciting new way to meet tomorrow's business and management needs, and they need not be either exotic or expensive.

Inside its silicon soul a computer is nothing more than a machine, a high-tech servant that knows only three things—how to add, subtract, and compare. Your $9.95 calculator adds and subtracts too, so a question arises: is the capacity to compare so critical to justify spending another $2,000 or more? The answer is yes, but only if that ability reduces your drudgework.

But computers aren't miracle machines, and the truth is, they're dumb but fast. Conversely, people are smart (well, most of us) but slow. By blending these traits together we achieve the ideal marriage of Human and Machine—a high-tech hybrid that is both fast and smart. The computer executes your instructions at rates up to a blinding one million operations per second.

And time is money.

Remember Superman, who traveled "faster than a speeding bullet?" With a computer's help you travel at the speed of light! For example, budget updates previously taking five hours to finish will now be completed in five minutes. Add fifteen seconds more if you need it neatly printed. More importantly, you're offered access to vital data equally fast. That means you can cover more ground in less time.

But this promise to ease tomorrow's tasks is just part of the story. Now let's see how this applies to you.

A functional computer system in your office:

- Supplies accurate, valid information— instantaneously.
- Minimizes the drudgework of record keeping, such as tracking expenses and income, tallying purchase orders, and preparing financial forecasts as well as interim budget reports.
- Organizes, stores, and sorts your correspondence: corrections and rewrites are now comparatively effortless.
- Stores complete personnel records, from anniversary date to vacation days.
- Maintains inventory, chargeback, and material cost data.
- Oversees your preventive maintenance program.
- Helps manage major construction, architectural, or engineering projects by tracking schedules, costs, and critical paths.
- Provides strategic assistance in decision making and planning.
- Enhances the impact of your reports and presentations with professional grade graphics and charts.

These are fundamental everyday applications. For those who venture into telecommunications there are even more remarkable uses, such as sending or receiving electronic mail and accessing vast storehouses of information via online data bases such as Compuserve, Delphi, and The Source.

In return, here's what these benefits cost:

- Between $2,000 and $6,000 for a computer system complete with a monitor, printer, and essential software.
- Investing the time and effort in learning to control the computer and the programs. (My choice of the word investing is not casual; by becoming computer literate you're investing in yourself.)
- Allotting time for you, your secretary or foreman to keep the computer's files current. Instead of penciling your accounts into ledgers, now you use a keypad to list it on a screen. Even though this transition from the familiar to the new is straightforward, I suggest you implement it gradually. You may feel more comfortable using both methods in tandem for a while.

Software: The I.Q. Transfusion

Let's dispense with the lack-of-smarts issue. After all, if a computer's so brainless how can it help you? It's because that condition is only temporary and quickly remedied; that's the software's job. Good software asks you pointed questions, then skillfully translates your answers for the silicon to execute. Restated, the *software* tells the machine *how* to do something; *you* tell the software *what* to do.

A computer without software is like a bird without flight (remember the fate of the Dodo?); the software is more important than the computer. Obviously then, the important part of getting the right system is getting the right software *first*. Granted, computer shopping can be challenging and rewarding. When those bulky boxes arrive at the office everyone knows your hunt was successful—you brought home the electronic groceries. But even if it's less glamorous you're still better served by first finding the software you want to run. Emphatically, I urge you to expend your time and best efforts in locating useful functional programs. *Then* choose the machine to best run it.

A note of caution when purchasing the computer—buy a bundled system. Unless you're exceptionally knowledgeable, adventuresome, or masochistic, buy the entire system assembled and tested. The insides of a computer are complicated, demanding, and often intolerant. So skirt a potential headache

Howard Millman is a senior facilities manager at Columbia University/Palisades. He has published more than a dozen computer related articles in Powerplay, Commodore Microcomputers, *and* Run. *Millman has also written for* Grounds Maintenance *and* Heating/Piping/Air Conditioning.

by avoiding the arcane world of operating systems, compatibility, and dip switches.

I also suggest you buy the least expensive machine you can. The quality of the Big Blue clones are increasingly more reliable and compatible as they are inexpensive. Furthermore, try purchasing it locally from an informed responsive retailer. Granted, a retailer's quote will be higher than a mail order house, but nearby service can be invaluable when you need qualified help.

Incidentally, just as the Controller's Office plays "The Price is Right" with your first pass budget requests, so then should you with your retailer. Modest to deep discounts are usually available even from local vendors.

I'll repeat a statement I made earlier; it's important. Telling a computer what to do is your job, telling it how to do it is the software's. Truthfully, most software is not good. In fact, many of the horror stories you've heard about computer snafus are not the computer's fault but can be traced to the software or even the operator. Maybe the manuals are vague, the error trapping poor, or the program is written in Basic so it crawls instead of flies.

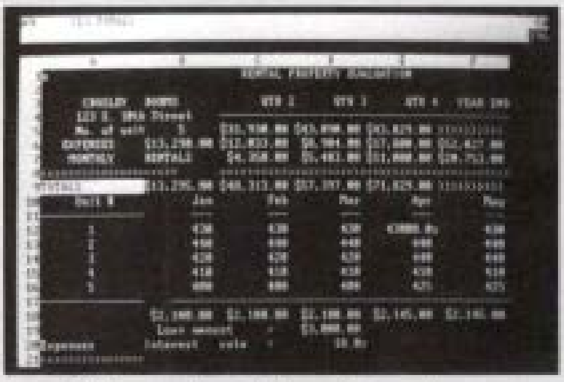
In future articles we will review specific software packages including spreadsheets, word processors, graph makers, letter and memo generators, preventive maintenance, as well as decision support programs. We'll compare and contrast programs that can deliver the critical data you need to make intelligent, effective management decisions.

We will evaluate innovative hardware as well, from complete systems to peripherals and addons. Finally, we'll decode the jargon by supplying clear-cut definitions for computerese. No, you won't get watered-down definitions, just fog-free translations.

In the meantime, we encourage you to send in your requests or suggestions for future columns. Have some questions? Write us and we'll answer as many as we can. Send your letters to Howard Millman, Senior Facilities Manager, Columbia University/Palisades, Route 9 West, Palisades, NY 10964. Sorry, the author cannot answer individual inquiries. ■

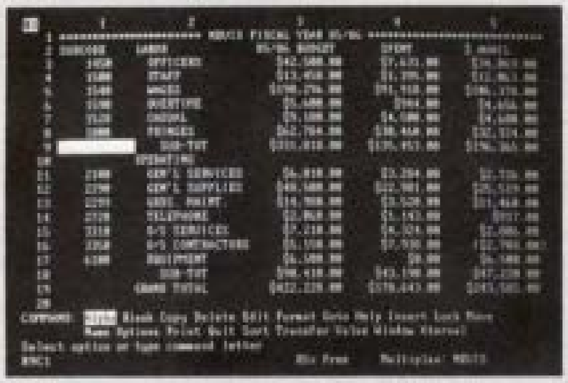
Budget Spreadsheets

Drafting next year's budget? Here's an overview of two worthwhile spreadsheet packages that can minimize the drudgework and accelerate your response time.



Flashcalc is a full-featured spreadsheet designed to organize, track, forecast, recap, and print nearly every aspect of your budget.

Like the program itself, Flashcalc's manual is clear, concise, and compact. Surprisingly, the streamlined "Quick Start" chapter is true to its name. With this tutorial you'll likely be up and running within an hour of cracking open the manual. Overall, the program is easy to learn and easy to live with. Flashcalc is best suited for budgets up to $2 million with fewer than twelve accounts. If you need more horsepower, then consider . . .



Multiplan, the turbo-V8 version of spreadsheets—but with an increase in cost and complexity.

The major difference between these two is Multiplan's optional ability to search through related supporting files for information and consolidate that data into a recap file. It tracks and transfers the information automatically. Multiplan also offers other features unavailable in Flashcalc: for instance, a context-sensitive Help menu, macros, mouse cursor control, and a limited compatibility with Lotus and dBase II files.

With either of these packages you'll coast through the "what ifs" of financial forecasting. Both offer flexibility in layout, content, and format. With the powerful versatility of electronic spreadsheets at your fingertips, you'll achieve near perfection in the golden "Art of Creative Accounting."

Availability:

Flashcalc:

Paladin Software, Santa Clara, CA, 408/970-7300
Available for Apple ($99), IBM and compatibles ($129).

Multiplan, Ver. 2.0:

Microsoft Corp., Bellevue, WA, 206/828-8080
Available for every computer (prices vary).

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Hollister, Inc., Corporate Headquarters, Libertyville, IL; Holabird & Root, Architects, Chicago, IL

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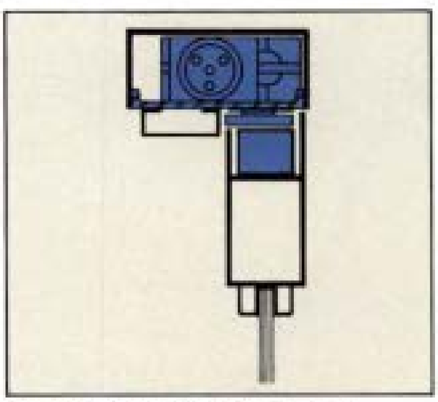
For complete information, see Sweet's Section 8. Or contact LCN Closers, Princeton, IL 61356; (815) 875-3311. In Canada, Ingersoll-Rand Door Hardware, Mississauga, Ontario L5E-1E4; (416) 278-6128.



LCN CLOSERS

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The Bookshelf

Combating Ageism in the Workplace

Older Employees: New Roles for Valued Resources, by Benson Rosen & Thomas H. Jerdee. Homewood, Illinois: Dow Jones-Irwin, 1985. 201 pp., $12.95, softcover.

In the midst of limited resources, physical plant administrators struggle to keep their organizations operational. While often the most available in terms of physical presence, human resources are rarely fully utilized. And perhaps the least utilized human resource is the group of workers labeled as "older employees." Yet, this untapped resource offers significant potential contributions to an organization. In *Older Employees: New Roles for Valued Resources*, Rosen and Jerdee examine the effective management of older employees from the viewpoints of both managers and the workers themselves.

The authors discuss the process of stereotyping, which they define as making judgments about others on the basis of their membership in a particular group. Indeed, stereotyping is a common practice in American life. The connotations of "age" create a vivid stereotype in many managers' minds that is not easily overcome. Managers subconsciously restrict the potential of older employees; workplace decisions affecting these persons are often made based upon misconceptions rather than fact. Research substantiates that "stereotypical thinking can lead to false impressions, poor judgments, and inappropriate actions." Certainly, age stereotyping leads to a wasteful underutilization of valued resources. The authors attempt to combat the age stereotyping process by dissecting misconceptions for what they are.

While stereotyping tempts managers into making erroneous decisions, the law imposes guidelines that counteract age discrimination. Recent legislation created enforcement procedures and penalties when judgments sustain age discrimination charges. The passage of the 1978 amendments to the Age Discrimination in Employment Act forced employers to reassess personnel practices. Key to making decisions affecting older employees is an emphasis on performance and potential, not age. Managers must become well versed and sensitive to older employees' rights and legislation that supports them.

Common sense dictates a corporate value system that respects and supports the contributions of individual employees in every age category. Logically, managers relate human resources to dollars and cents. A comprehensive program of career planning provides long-term benefits for the company as well as for the employee. Mapping career plans based upon individuality rather than uniformity is paramount in developing productive employees. Rosen and Jerdee emphasize the need for special sensitivity to the career problems of older employees.

The book reads easily with frequent headings and summary paragraphs. Case studies and research are interspersed throughout to illustrate potential pitfalls. Concepts are straightforward; information is factual. The presentation is a valuable tool to managers facing decisions concerning the careers of older workers.

Older Employees adapts easily to a physical plant environment. Plant administrators face the same biases, legislation, and constraints as managers in industry. The book provides food for thought in helping overcome the age stereotyping process. Since the book reads quickly, plant administrators have an opportunity to pick up a great deal of information in a short period of time. And if likely personnel problems can be warded off, the time is well spent.

Older Employees is available from Dow Jones-Irwin, 1818 Ridge Road, Homewood, IL 60430.

—**Larry E. Nokes**
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Pittsburg, Kansas

Coping With the Ongoing Energy Crisis

Energy Management Handbook, ed. by Wayne C. Turner. New York: John Wiley & Sons, Inc., 1982. 714 pp. $45, hardcover.

The energy crisis has been here for quite some time and it appears likely to remain for a while longer. *Energy Management Handbook* is a colossal work that directly addresses the energy problem. It is a collection of twenty-one articles by individuals who are leading authorities in their fields. Yet, despite the large number of authors the book flows smoothly and uses clear, precise language. In addition, it is full of pertinent graphs, charts, examples, tables, diagrams, and forms that can be adapted to an individual operation.

This book is an excellent reference containing all the information any physical plant would need to successfully formulate and conduct an effective energy management program. It is quite suitable for the plant just beginning an energy management program and in need of basic information, but it is also advanced enough for a plant that already has a fairly sophisticated program.

Editor Wayne Turner believes that a plant just starting an energy program can easily save 5 to 15 percent in energy consumption. Yields of 30 percent, however, are not uncommon for dedicated programs, and some companies have reported 40 to 60 percent savings by utilizing the principles and techniques outlined in this book. In these times of high energy costs and reduced budgets, *Energy Management Handbook* can help plant administrators reach their objectives of cost reduction and survival.

The beginning chapters focus on how to get the ball rolling and includes a discussion of how to implement, organize, and manage a successful energy management program. Steps for performing energy audits and an evaluation of conservation potential are outlined as well.

A significant portion of the text deals with energy management conservation techniques in mechanical systems as they pertain to central plant systems and buildings. The authors point out that a fairly large savings can be realized through properly designed and operated boiler and fired systems. The key points of the boiler discussion are on testing procedures for relative efficiency, suggestions on where energy saving opportunities may be found, and the economics of getting the most out of day-to-day operations. Also, this section discusses combustion equipment, alternative fuels, and federal and state regulations.

continued on page 37

continued from page 35

Since the production of steam consumes almost half of the energy used by plants, another section looks at steam and condensate systems. The target is to achieve an energy efficient steam system. Variables that may make the operation of a steam system inefficient are listed, as well as measures that may be taken to correct these problems. Methods for economical energy recovery and reutilization of waste-heat that can reduce thermal pollution and save dollars are also considered. How energy is consumed and wasted in a building's HVAC system is examined, with particular attention focused on why energy is wasted in some buildings heating/cooling distribution systems and not in others and the various methods of temperature control. The guides for figuring energy usage by type of system are also helpful.

As the text states, cogeneration has been around a long time supplying power and process heat. The most proven and reliable prime movers are discussed. A presentation of the methods used to develop an effective system and the levels of performance one may expect are shown. Looking at the present and forecasted energy situation, cogeneration deserves careful review.

Other chapters give information on the building envelope and industrial insulation. The chapter pertaining to building envelopes primarily addresses ways to improve existing buildings, however, much of its information is applicable to new buildings as well. Information is provided to aid in the computation of energy saved for comparison to the cost of making building envelope changes. Many aspects of thermal energy transfer and infiltration are related to the various elements of a building that encloses the conditioned spaces. The portion on industrial insulation describes the insulation materials most often used. Procedures for selecting the right product and determining the proper insulation thickness, while taking into account initial insulation cost and energy savings, are described.

The chapters on electric energy management and lighting should also be useful to physical plant administrators. "When you don't need it, turn it off," is the savings motto of this section's author. Electric motors are discussed in detail, which is valuable since they are probably the most costly electrical device in a commercial building (outside of lighting). A discussion on power factor improvement, fine tuning the electrical system, and computer technology as related to electric energy management and conservation rounds out the chapter.

As noted by the author of the lighting chapter, even though lighting consumes only five percent of your total energy resource, it makes up 30 to 50 percent of a building's operating cost. Therefore, large savings can be readily obtained by taking a closer look at lighting systems. A great majority of buildings that are fifteen years or older have inefficient lighting designs compared to today's standards. As mentioned in the text, the building owners improving their building's lighting system may be in for a pleasant surprise as they not only save operating dollars, but also improve the quality of the lighting. This chapter details how to meet both of these objectives.

Plant managers should find chapter 12 on controls and chapter 14 on energy systems maintenance valuable. Even the best system components are limited in their ability to save energy if they are not properly controlled. Optimizing control of a system at the lowest level, so that all of the main components can be consolidated into an efficient unit is the goal of the chapter on control systems. Numerous control schematics are also presented.

Many dollars can be saved through a well organized preventive maintenance program. Chapter 14's mission is to assist the plant manager in setting up such a program. First the author outlines a practical format as to how an energy management preventive maintenance program can be organized. The main systems and major components found in a typical physical plant are explained and detailed descriptions of the maintenance for these components are included. Instruments often used in energy management are covered as well as materials handling for systems maintenance.

The remainder of the book is devoted to various topics such as current renewable alternate energy sources, which includes wind, solar, and refuse-derived fuel. The integration of health and safety considerations into an energy management program is emphasized in another chapter. Finally, the chapter on fleet management may be quite beneficial to the plant manager who is responsible for the university motor pool. Several practical tips are given on saving money and resources.

The book concludes with more than 150 pages of useful appendices. Areas covered in this section include a review of the thermal and electrical sciences. One appendix contains pertinent conversion factors, property tables, and charts. The last appendix contains utility rate studies and interest factors.

Energy Management Handbook is a readable text with a great deal of practical, hands-on materials for the plant administrator either wanting to start or improve on an existing energy management program.

Available for $45 from John Wiley & Sons, Inc., 605 Third Avenue, New York, New York 10158.

—Rick J. Beal
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Ethics in Management

Essentials of Management: Ethical Values, Attitudes, and Actions, ed. by James S. Bowman. Port Washington, New York: Associated Faculty Press, Inc., 1984. 208 pp. $22.50, hardcover.

The simplest and most useful definition of ethics is "a set of standards by which human actions are determined to be right or wrong." With this as the premise of a book entitled *Essentials of Management*, I expected to read an in-depth presentation of present-day ethics and attitudes. However, while the papers cite numerous cases of unethical practices, only a small and inconclusive portion of the text focuses on how to improve ethics in management.

The book is subdivided into five sections and includes articles that approach ethics from an individual, government, and business standpoint. The authors define the problem areas and suggest how to get results, but with the subject matter being so indefinite, the chapters with suggestions for dealing with ethical problems fall short of addressing the topic directly.

The book's first section addresses the study of management ethics by asking, "Are management ethics worth studying?" Looking at Watergate, it appears that the affairs of state are sometimes more important than the truth. Seeking the "truth" is an unrelenting task, as Plato reminds us. We cannot give students and employees their values; they come to us with basic premises. The text states that the Constitution of the United States contains the ethical principles by which managers and government officials should abide. All too often, however, the oath of office is a meaningless and perfunctory recitation.

The second part of the text, Management Ethics in Transition, opens with the statement, "One of the reasons why ethics occupies an uncertain place in the study of management is because some people believe that in today's pluralistic society there can be no overall set of standards or sense of value." Managers of large institutions in both the public and private sectors practice attitudes, ethics, and actions other than they preach. The "protestant ethic" of hard work, thrift, and obedience seems to be lost.

The trend towards management as a profession is well underway. Managers of the future must be professional in the best sense of the term, which includes being ethical. Fortunately, several ethical standards have survived many hundreds of years of human experience—"Treat all human beings with fairness." "Do unto others as you would have them do unto you." "Act so that your act will produce, over the long run, maximum personal happiness."

In his chapter, Ethical Chic, Peter Drucker states, "There is only one ethics, one set of rules of morality, one code—that of individual behavior in which the same rules apply to everyone alike." Business, however, denies this fundamental axiom. Business ethics have their origin in politics rather than in ethics. This means that business believes that its responsibility stems from the fact that it has social impact and therefore determines ethics.

The ethics of prudence makes it the duty of the leader to exemplify the precepts of ethics in his or her own behavior. There is no "social responsibility" overriding individual conscience. Society must expect its managers, executives, and professionals to demand of themselves that they shun behavior they would not respect in others, and instead practice behavior appropriate to the sort of person they would want to see in the mirror in the morning.

The third part of the text, The Organization and the Individual: Ethical Dilemmas, states that democracy relies upon personal integrity as well as trust and, furthermore, "People's value systems adapt to the environment in which they find themselves." A study by Steven N. Brenner and Carl A. Mollander of Portland State University concluded, "Executives studied believed that while ethics constituted good business, most executives would tend to be unethical in much of their business behavior."

Establishing proper and realistic goals for all personnel is an important first step in developing an ethical organization. A number of other steps are also outlined to encourage ethical behavior; however, after reviewing the study by Brenner and Mollander these principles seem too idealistic and material for academics. These steps include: setting realistic objectives, establishing a code of ethics, disciplining violators of ethical standards, creating an "ethical advocate's" role, providing a whistle-blowing mechanism, and training managers in business ethics. Having reviewed my definition of ethics, it appears that it might be best to hide and watch rather than undertake the principles for improving ethics.

Part four, Ethical Attitudes in Business and Government, includes a survey of 1,500 individuals in which fewer than 10 percent felt that the organizations in our society encourage their members to behave ethically, honestly, and humanely. Many believe they are under pressure to compromise personal standards in order to achieve organizational goals. The survey found that business executives see their profession as less ethical than professors and doctors, but more ethical than government agency officials, lawyers, elected politicians, and union officials.

Sixty-five percent of the respondents felt that "society, not business, has the chief responsibility for inculcating ethical standards into the educational and legal system, and thus into business decision-making." Fifty percent of the respondents felt that one's superiors often do not want to know how results are obtained as long as the desired outcome is achieved, thus allowing competitive pressure to push ethical considerations into the background.

Part five, Conclusion: Actions to Deal with Ethical Problems, embraces the Golden Rule, "Thou shalt love thy neighbor as thyself," also expressed by Thomas Hobbes: "Do not that unto another which thou wouldst have done to thyself." The Golden Rule and its implications are more likely to be practiced in democratic organizations than in other types.

Whistle-blowing was introduced as a positive action for establishing ethical behavior. This seems to be a simplistic approach and totally shies away from the concept of group dynamics. In a study of family interactions and relationships, the whistle-blower was quickly identified and excluded from the group. This appears to be a last resort effort. Although there is some valid information to be received from the whistle-blower, their ulterior motive must also be investigated.

As managers and supervisors we need to look around us and see what is going on, take stock of the situation, our surroundings, and our search for the truth. For most of us this will be different as we are each directed by our own ideals. How we are performing is an answer we each must assess for ourselves.

Essentials of Management is available from Associated Faculty Press, Inc., 90 South Bayles Avenue, Port Washington, New York 11050.

—**T. R. Wray**
Assistant Director, Physical Plant
University of Houston
Houston, Texas

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