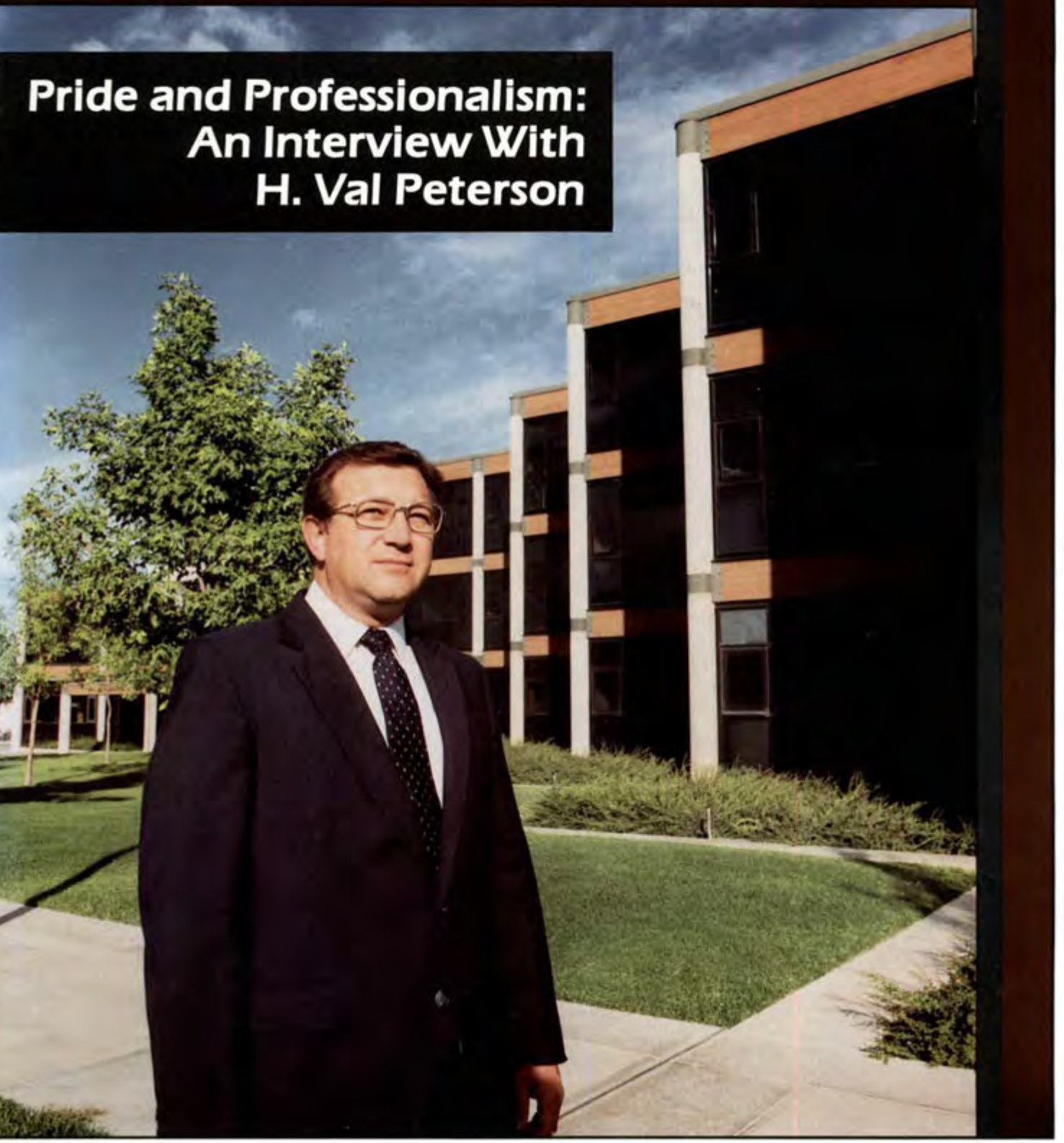
The official publication of the Association of Physical Plant Administrators of Universities and Colleges

Facilities Manager

Volume 2 Number 3 Fall 1986

Pride and Professionalism: An Interview With H. Val Peterson



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Facilities Manager

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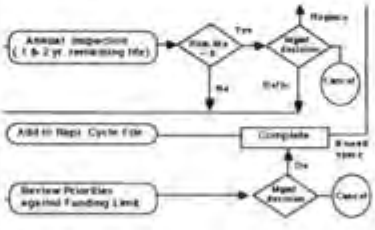

Departments

COVER PHOTO:
APPA President H. Val Peterson stands in front of the Natural Resources Building on the Utah State University campus. Photo by Ted Hansen, USU Campus Photography Services.

Pride and Professionalism: An Interview With H. Val Peterson

by Steve Howard

PHOTO BY DAVID K. SMITH

PHOTO BY UTAH STATE UNIVERSITY

Top: H. Val Peterson, left, is congratulated as APPA's President for 1986-87 by William W. Whitman, 1985-86 President. Bottom left: The Utah State University campus is situated in Logan in northern Utah.

H. Val Peterson began his one-year term as President of the Association of Physical Plant Administrators of Universities and Colleges (APPA) at the conclusion of APPA's 73rd Annual Meeting, which was held July 13-16 in Boston, Massachusetts. He has been a member of APPA and the Rocky Mountain Region since 1970, and he has served on the Board of Directors and the Long Range Planning Committee. Peterson is a past member of the Professional Affairs Committee and served four years on the Energy Task Force and NACUBO's Facilities Planning and Management Committee. He was awarded APPA's highest honor, the Meritorious Service Award, in 1984. Peterson is past chair of the Energy Task Force and past president of the Rocky Mountain Region.

Peterson attended Ricks College, briefly studied architecture, then received a bachelor of science degree in mechanical engineering from the University of Utah in 1962. He is a licensed professional engineer and spent five years working as a consulting engineer; his projects included designing HVAC and plumbing systems for all types of buildings, heating plants, and central chiller plants. He is still regularly called upon as a consultant in this area.

Peterson joined Utah State University (USU) as assistant director of physical plant, then in 1970 became one of the youngest directors of a major college or university

Steve Howard is editor of Facilities Manager *and APPA's director of publications.*

physical plant department in the country. In the period since 1970 he has seen a doubling of the number of students at Utah State (from 6,000 to 12,000) and size of facilities (from 2 million to 4 million gross square feet). Peterson's proudest achievement thus far at USU is the development and construction of a new comprehensive, centralized maintenance facility.

When asked what attracted him to campus facilities management, Peterson said, "Even with the politics and austere budgets associated with a university system, it is still a great place to work. The tremendous variety and change of pace of day-to-day activities make the work extremely interesting. There is always a challenge to your abilities and skills as a manager."

Read on to learn more about APPA's President for 1986-87, H. Val Peterson of Utah State University.

—S.H.

Facilities Manager: *What do you hope to accomplish during your year as President of APPA?*

H. Val Peterson: During my year as President-Elect I established a fairly lengthy set of goals for APPA. Many of these goals are the completion of projects already underway. The concepts of service, professionalism, capitalizing on new technology, and a commitment to quality will be stressed throughout the year. I hope to have a hand in the continued strengthening of APPA's position as a leader in the field of facilities management. I hope to be involved in developing many of the operating policies and procedures and financial guidelines for APPA that have never really been formalized.

Another area of emphasis this year will be a concerted membership "blitz" to try to reach those institutions that are not members of APPA and to solicit their support.

I also want to continue the review of the governing structure of APPA as initiated by last year's president, Bill Whitman. Times change and needs change. We need to take a good look at ourselves to see if we are organized to meet today's needs and to accomplish today's programs.

FM: *Could you go into more detail on the need for a review of APPA's governing structure?*

HVP: APPA's structure has been stable for at least the past ten years. We did create a new vice president office in recent years, for special projects, but otherwise it has been fairly stable. As I viewed the *APPA on the Move* videotape at the Boston annual meeting, I thought about how we've grown and how drastically some things have changed in the last decade alone. It made me wonder if we are keeping up with those changes—in the way we are structured and how we're organized to conduct business. Are we set up the way we ought to be? Are we properly maintaining and handling the growth that has taken place at APPA? Can we handle the growth that we see occurring in the future? I see things changing much more quickly in the next ten years than they have in the last ten years. It is an appropriate time to step back and take a look at the Board and all of the APPA offices to see if we're organized the best way we can be. I want to make sure there aren't ways to do it better.

In fact, we may want to go outside and obtain assistance from experts who are familiar with associations and who have the knowledge of a great number of associations and how they are organized.

FM: *What other long-term goals do you hope to lay the groundwork for this year?*

HVP: Most importantly, I hope to lay the groundwork for everything necessary to anchor APPA's position as *the* top authority and leader in the field of facilities management.

One activity I'm particularly excited about, and I really didn't know which way it was going to go until the Board approved the idea in Boston, is the concept of a foundation for APPA. We cannot look back and say, "Well, we haven't needed that in the past," and use that as an excuse for not foreseeing the value and potential of a foundation.

Things are accelerating so fast these days that we don't know what the issues are going to be even three to five years from now. APPA has a good reputation that is getting stronger. There are companies and organizations willing to contribute to a foundation devoted to facilities management in the higher education system. APPA owes it to itself to investigate this further; that's why I am excited that the Board authorized continuation of the foundation study. It will be a great benefit to APPA members as well as the higher education community in general, and it has my full support.

FM: *How did you first become involved with the Association?*

HVP: My predecessor at Utah State University, Harold Wadsworth, was active in APPA and the Rocky Mountain Region. He was instrumental in involving me, mostly with the Association's annual meetings. When I came to USU nineteen years ago, Mr. Wadsworth had been at the institution more than twenty years. I was working as his assistant at the time with the understanding that when he retired, which he was going to do in a very short while, I would take his position. I became director of physical plant at USU before I was thirty years old.

My involvement in APPA moved somewhat slowly at first, but as I learned what my job was all about I looked around for further involvement, which took the form of committee assignments. Things just evolved from there.

Because I knew next to nothing about facilities management when I took my job at USU, I learned a lot from APPA and its people. I suppose I am now considered an "old timer" in the business, and I would like to share what I have learned with newcomers who are now where I was nearly twenty years ago.

FM: *In what ways has APPA changed since you first joined the Association?*

HVP: APPA has obviously grown in membership and in activities. It has become more professional. APPA has become more international in scope and has improved all of its services and programs. It has become a leader in the field of facilities management.

FM: *How can members serve APPA and their profession? What contributions can they make?*

HVP: Since facilities management is not usually a formal discipline in which individuals are trained for employment in the field, many of us get a lot of valuable training through the school of hard knocks. Most of us in the business today had a mentor or a group of individuals who collectively imparted their knowledge of facilities management to us. We have an obligation to the profession to pass along what we have learned to those who follow.

APPA has always encouraged its members to get involved. Getting involved can mean volunteering for special projects, running for office, accepting a committee appointment or as-

signment, preparing a paper for *Facilities Manager*, making a presentation at a meeting, participating in the International Experience Exchange survey, and sharing significant successes with other members.

In order to get even more people involved, APPA is planning a special membership campaign this fall. This campaign will be unique in that we will be asking our current members to help in the effort by signing up a new member from their region.

FM: *You were president of the Rocky Mountain Regional Association of Physical Plant Administrators (RMAPPA) in 1981-82. What is the value and importance of the six regions within the structure of APPA?*
HVP: The regions foster an identity that allows more in-depth discussion and study of problems and situations unique to that region. The regions are extremely important. Because they are smaller they give their members a better opportunity to develop close friendships. And because distances are shorter, members from a given region can visit the institutions of another regional member to benefit from their work. They are also more apt to travel to the regtional annual meetings each fall. For the same reasons, it is easier for an institution to involve second- and third-level supervisors in the meetings.

FM: *What is the future of the regions?*
HVP: Each APPA region is unique and functions somewhat differently from one another. Yet they all have common interests. One of my goals for APPA is to improve communications with the regions and to look for ways in which APPA and individual regions can work together on certain kinds of projects. There are certain things that each can do best. A joint venture would benefit the membership.

The regions keep getting stronger and stronger. They often rival APPA in their educational programs. I see the regions continuing to grow and get stronger.

FM: *You chaired APPA's Energy Task Force during a complex and hectic period. Have you seen any significant long-term changes or outcomes from the 1970s energy crisis?*
HVP: People and institutions are more energy conscious now. However, the recent glut of oil has temporarily driven prices down and people have become somewhat complacent and relaxed. But the problem has not gone away. An awful lot of energy conservation measures have been accomplished not only on college and university campuses but throughout most commercial and industrial areas.

Energy conservation measures at USU, which were formally adopted in 1972, have resulted in a reduction of steam output at our central heating plant even with a 35 percent increase in campus facilities connected to the system. We have never hit the peak quantity of steam generated at the plant that we reached in 1972. This reduction has a marked effect on avoided utility dollars.

We used to us 12,000 to 14,000 tons of coal a year, but now we are using 8,000 to 9,000 tons. We are currently in the process of reviewing a cogeneration project that is being third-party financed. There are many projects that take a fair amount of expenditure of dollars that will in turn save many more dollars. Our state has been extremely conservative on allocating dollars for energy conserving measures.

PHOTO BY UTAH STATE UNIVERSITY

The Main Building contains offices, classrooms, and administration offices and was the first building constructed at USU.

FM: *Where do colleges and universities stand right now regarding energy? Do you see any trends that will help or hurt higher education in the next fifteen to twenty years?*
HVP: Most colleges and universities have done the easy and inexpensive things to reduce energy usage and costs. Typically, those projects still waiting to be done are those that involve significant expenditures of dollars.

Even though the payback may be relatively short, many institutions find it difficult to come up with the initial capital investment for energy related projects. Hard-to-find dollars tend to go into academic and research programs rather than energy conservation measures. Over the next twenty years most institutions will continue to make energy conserving improvements in their plants, and certainly the existing and future technology will be built into new facilities as they come along. The issue of energy conservation will be with us for the foreseeable future.

FM: *What will or should APPA's role be in tackling the problem of capital renewal and replacement/deferred maintenance on our nation's campuses?*

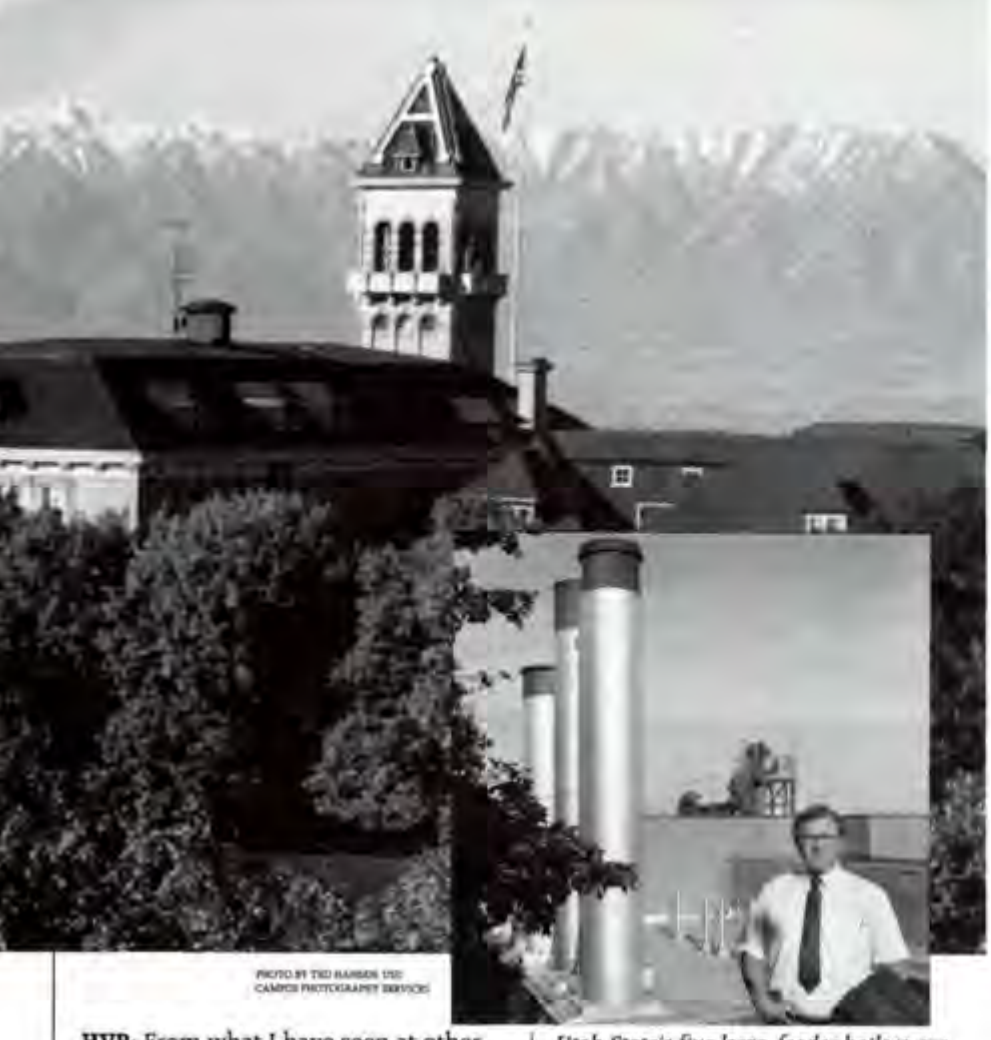

PHOTO BY TED HANSEN, USU CAMPUS PHOTOGRAPHY SERVICES

Utah State's five large feeder boilers run primarily on coal and produce 2 million pounds of steam per day during the winter months.

HVP: From what I have seen at other institutions and from first-hand knowledge of what is happening at my own campus, there is a large and growing problem of deferred maintenance in higher education. There are exceptions, of course, but more prevalent is the fact that maintenance budgets and even special appropriations are still not adequate to keep up with the work that needs to be completed.

APPA has hammered away at this issue for years, but it is still with us. Our challenge to the future is not to give up, but keep trying to find the right way to get this message to those in position to do something about it. APPA is presently developing a videotape that can be used to tell the story of deferred maintenance or capital renewal in higher education. This videotape would be available for individual colleges or universities to use "as-is" on their campus to tell the story, or they could use it as a pattern to develop their own presentation.

FM: *How important is APPA's role in collecting data to determine how large this problem is and how we might combat it?*
HVP: APPA has considered doing a survey to determine the magnitude of the deferred maintenance problem, but that is a tremendous undertaking given the fact that many institutions have not made detailed audits to determine the full extent of the problem on their own campuses. This is understandable if there are no funds available to do the work anyway; their priorities are placed elsewhere. The backlog of identified deferred maintenance items at Utah State University approaches $5 million. Perhaps such a sweeping survey would fall within the purview of the APPA foundation.

FM: *Describe the special rapport that exists between APPA and other education associations such as the National Association of College and University Business Officers (NACUBO)?*
HVP: It is healthy for associations to join together to discuss and attempt to solve problems of common interest. We have been doing that for years with NACUBO's Facilities Planning and Management Committee, which includes three APPA member representatives. The joining of business officers and facilities managers has wed the knowledge of both groups to work on facility-related problems of mutual concern, such as the Classification of Accounts for Physical Plant. Just getting together, face to face, and discussing the pertinent issues as seen from another point of view is extremely important.

The June 23 Executive Briefing on Natural Gas, jointly sponsored by APPA, NACUBO, and the American Council on Education, is another good example of how a program can be made more successful by the joining of forces. I would like to see additional cooperation between APPA and other associations to deal with areas of mutual interest.

FM: *What do we mean when we talk about professionalism in the higher education facilities management field? What do our members need to do to be more professional?*
HVP: It's no secret that professionalism is one of my favorite subjects. A professional is a person with special skills or experience in a particular field or activity. Professionalism in facilities management is merely the expression of professional status, methods, character, or standards that reflect the goals of facilities management.

A successful facilities management operation needs to build a team of workers that exemplify those special skills and have the experience needed to operate and maintain diverse facilities to the best degree possible. These facilities management professionals need to recognize the vital part they play in higher education and take pride in the contribution they make.

As professionals they need to do their work in a first-class manner and always within the limits of allocated resources. Limited resources should not be used as an excuse, however, for not being able to do the job that needs to be done. The true professionals usually find a way. The physical plant department should be a problem solver, not a problem maker.

At Utah State we work hard to develop these kinds of attitudes in our people. We work in a professional environment—everyday we work around the university administrators, professors, and researchers. Physical plant can't be anything less than professional if we are going to accomplish our jobs.

FM: *What will the future require of the campus facilities manager? How will that role change?*
HVP: The future will require more professionalism from the campus facilities manager. They will have to be better managers of people, better managers of resources, and better managers of programs. Institutions will require individuals to be better schooled. More and more institutions are asking for persons with master's degrees. Not too many years back a bachelor's degree was adequate.

Facilities management is big business on most campuses. More and more campuses are looking to the facilities manager to have sufficient business background to run the operation more like a business. The job of facilities manager is getting tougher and tougher all the time. APPA needs to gear up to provide better trained facility managers.

Many institutions have recognized the status and contribution made by the facilities manager by giving them the title of an assistant vice president. In order to attract the kind of people needed in these positions, colleges and universities are going to have to recognize the importance of the position. This higher expectation will tend to elevate the level of professionalism in physical plant, and that can only be positive.

FM: *How will the changing makeup of higher education affect the physical plant functions? In what ways can the director make a contribution to those changes?*
HVP: I'm not sure if Utah is typical of what is happening nationwide in higher education, but the funding is extremely tight at the present time. In my opinion, facilities managers everywhere will have to do a better job with fewer resources in the future. Directors are going to be called upon to be better managers. They are going to be expected to be more creative in getting the same job done at less cost.

In addition, funding for new facilities has been decreasing in recent years. Our building program has continued mainly because of funds coming from private donations, gifts, and grants rather than from state appropriations.

FM: *Will technology help or hinder your efforts? Have we come as far as we can in regards to how useful technology can be to the campus physical plant?*
HVP: The application of technology is becoming a given in higher education. Trying to accommodate changing technology always creates challenges for physical plant. Much of the technology being developed could be useful to the campus physical plant, and it is the job of the facilities manager to stay current of what is available and how it can be used to benefit his or her operation. APPA can assist in this area by encouraging firms who have applicable technology to exhibit at the annual meeting and participate in the vendor training sessions. New technology is not going to solve all our problems, but it is another useful tool to add to our arsenal.

FM: *How important, really, is the role of the physical plant department in supporting the mission of higher education?*
HVP: The college or university revolves around the student, without whom the institution hasn't much to offer. Even though we have many programs that go off in different directions, it still comes back to the fact that we are there to serve the needs of the student. Some physical plant operations feel that they exist without the need to recognize that service to this end is the driving mechanism in all of higher education. How well we do that determines how well we do our jobs.

A recent study published by the Carnegie Foundation showed that in a survey of high school students, 50 percent selected their college or university as a result of the campus visit. The survey went a step further and asked the resondents what specifically about the campus visit really drove the point home. Was it talking with students or faculty that helped finalize the decision, or possibly a visit to the library? Of that group, 62 percent said that it was the the appearance of the buildings and grounds. I am not sure that people fully realize how important and powerful that statistic is. Universities have complete organizations to recruit students, yet here with physical plant we have the ability to make a strong impact on the student's decision.

I think most college presidents recognize the importace of the physical plant, but many people on campus would like to think that high school students choose an institution for the reputation of the faculty or their department, or the fact that the institution is well-known for its research activities. I imagine that most students would view their decisions differently, because at that point in their career they oftentimes don't even know what their field of study will be. The real reason they come to our school is because they like what they see when they get there for a visit. The work performed by physical plant has a direct bearing upon the image of the institution.

This is important not only for prospective students, but also from the standpoint of current students, faculty, and staff. If they work and live in a comfortable and attractive environment, they will want to stay. If the place is a dump and equipment doesn't work, they are going to get discouraged and go elsewhere. We play a vital role in that. We don't contribute directly to the teaching or the research, but the contributions we do make are of such magnitude that we cannot minimize them.

The condition of the buildings, grounds, utility systems, and all related elements need to provide a conducive environment for students, faculty, staff, and the general public to carry out their designated responsibilities and university-related activities. Campus physical facilities need to be operated and maintained so that the surroundings are aesthetically pleasing, comfortable, and safe.

When all is said and done, the role of the physical plant department is to provide an appropriate physical environment for effective educational research and programs. Our own physical plant division is concerned with timely service, operations, maintenance, alterations, and related activity pertaining to the facilities portion of a total learning environment. The organization affects all segments of the university.

FM: *Is there anything you'd like to add in closing?*
HVP: Since the physical plant exists only to give support and service to the teaching, research, and public service activities of the institution, they would have no purpose without them. On the other hand, these same activities could not function without the services provided by physical plant. Both areas need the other to function properly. Each could do nothing without the other. ■

Facilities Manager

READER SURVEY

Please complete the following questionnaire regarding *Facilities Manager*, APPA's official professional magazine. The information obtained from this survey will be used to help guide future issues. Information is confidential and will only be released in aggregate form. We greatly appreciate your cooperation.

1. Please check the job description that best describes your position.
   ☐ physical plant director ☐ engineer ☐ assistant physical plant director
   ☐ maintenance management ☐ business officer ☐ grounds management
   ☐ housekeeping management ☐ architect ☐ energy management ☐ Other _____
2. APPA has six regions. Please check the area in which your institution is located.
   ☐ Eastern ☐ Midwest ☐ Rocky Mountain ☐ Southeastern ☐ Central States ☐ Pacific Coast
3. Please check the correct FTE enrollment category for your institution.
   ☐ fewer than 5,000 ☐ 5,000-11,999 ☐ 12,000-19,999 ☐ 20,000 or more
4. How often do you read APPA's *Facilities Manager*?
   ☐ always ☐ often ☐ sometimes ☐ occasionally ☐ never
5. How much time do you spend reading each issue?
   ☐ less than 20 min. ☐ 20-45 min. ☐ 45-90 min. ☐ more than 90 min.
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   ☐ save the entire issue ☐ pass along to others ☐ discard when finished
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7. Please indicate the number of people who will read your copy of *Facilities Manager* (including yourself).
   ☐ 0-1 ☐ 2-4 ☐ 5-7 ☐ 8 or more
8. For each section of the magazine, please check how interested you are in reading each.

Feature Articles (cover stories)	☐ very interested	☐ somewhat interested	☐ not interested
Technical Papers	☐ very interested	☐ somewhat interested	☐ not interested
Letters to the Editor	☐ very interested	☐ somewhat interested	☐ not interested
Data Base Update	☐ very interested	☐ somewhat interested	☐ not interested
Management Resources	☐ very interested	☐ somewhat interested	☐ not interested
The Bookshelf	☐ very interested	☐ somewhat interested	☐ not interested

9. What article over the past year was your favorite or offered the most useful information? _____
10. Please rate your interest in the articles that appeared in this issue of *Facilities Manager*.

LEVEL OF INTEREST:	HIGH	MEDIUM	LOW
Pride and Professionalism: An Interview With H. Val Peterson	☐	☐	☐
An Administrator's Guide to Installing a Telephone System	☐	☐	☐
A Time of Challenge: Physical Plant Administration in the PRC	☐	☐	☐
Integrating Capital Studies Within Physical Plant Operations	☐	☐	☐
Management Resources	☐	☐	☐
Data Base Update	☐	☐	☐
The Bookshelf	☐	☐	☐

11. How would you rate the general appearance of the magazine? ☐ appealing ☐ satisfactory ☐ poor
12. Please indicate your level of interest in reading about these topics in upcoming issues. Mark the appropriate number beside each topic. 1 = very interested, 2 = somewhat interested, 3 = not interested.
    ☐ deferred maintenance ☐ boiler management ☐ hazardous waste management ☐ HVAC
    ☐ asbestos ☐ lighting ☐ contracting ☐ roofing
    ☐ telecommunications ☐ safety ☐ training ☐ computer applications
    ☐ grounds ☐ budgeting ☐ custodial ☐ personnel management
    ☐ energy ☐ space planning ☐ preventive maintenance ☐ parking
13. What other publications do you read on a regular basis? (Check all that apply)
    ☐ Buildings ☐ American School & University
    ☐ School Product News ☐ Heating/Piping/Air Conditioning
    ☐ Chronicle of Higher Education ☐ Building Operating Management
    ☐ NACUBO Business Officer ☐ ASHRAE Journal
    ☐ Energy Management Technology ☐ Construction Specifier
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An Administrator's Guide to Installing a Telephone System

by Phyllis Rossiter Forbes

Some wag once said that the crucial element in life is knowing the difference between education and experience. Education is what you get when you read the fine print; experience is what you get when you don't.

The purpose of this article is to provide you some education on how to live through a change in telephone systems and still maintain your sense of humor. The key is in knowing your contract (who does what) and organizing for action.

Most of what I have to say is from personal, sometimes painful, experience. However, the telecommunications industry has an abundance of apocryphal fables; just ask any telcom consultant. Any criticisms of the industry are *not* vendor-specific. *All* vendors, sad to say, make variations of the same mistakes.

For the sake of this article I am assuming that you have already bid out your system and have chosen a vendor. If you have not, I would refer you to the talk I gave at APPA's annual meeting in Columbus, Ohio.[1]

In order for you to retain your sanity, I recommend that you keep your consultant on retainer for the implementation phase. This assumes that you are satisfied with the consultant you have used thus far. The industry is full of people who pass themselves off as consultants but who are really rank amateurs. Check references and any contacts you may have within the industry.

This is probably your first experience with a total replacement of a phone system, and by the time it ends, you'll hope it will be your last. Telcom consultants have guided many installations and know what the critical paths are and where the potential disasters occur. And I guarantee that disasters will occur. The telcom industry is a living example of Murphy's Law in action. With a little luck and a lot of hard work, your consultants will help you avoid some of the costlier mistakes.

Where to Start

Well, you've hammered out a contract and the hard part is over, right? *Wrong.* This is just the beginning. You will learn, to your endless dismay, that the learning curve in the telcom industry is straight up. And *you* are the guinea pig.

Read the contract you signed. Ten or twelve times. Highlight important spots. Put it in a three-ring binder and keep it close at hand. Make sure every significant player on your team has a copy and has read it.

Insist that the vendor's project manager has a copy of the contract and see that he or she has read it. Here again, stories in the industry are legion, most of them having to do with the fact that vendors' project managers often have never seen the contract. Add that to the reality that they will cut every corner they can, and you will realize very quickly that *caveat emptor* reigns supreme. For your own protection, make the contract your Bible.

Location and Emergency Power

I cannot emphasize strongly enough the need to find a good location before you ever go out to bid. Some important considerations follow:

- Locate it as near as possible to the greatest concentration of telephones. This reduces cable runs.
- Avoid rooms that are damp, subject to flooding, and have overhead steam, water, or condensate pipes. A modern switch is a computer and computers don't like water or dampness.
- If you have not already done this before you went out to bid, hire a consultant who specializes in outside plant configuration work to plan with your facilities people a cable layout that avoids all existing obstructions and to suggest a switch room location. Many colleges and universities have complex systems of man-made obstructions, such as steam tunnels and utility congestion, which are not easily crossed.

Before You Turn The Page...

If you think that this article does not apply to physical plant administrators, consider this:

- With a phone system, you hit every nook and cranny of the campus. You have a central switch (like the mainframe computer) and tiny computers (phones) everywhere.
- If you are installing a completely new cable system, you are digging up main thoroughfares, crossing lawns where students play frisbee, and having to acquire rights of way from many different entities.
- Then, someone will enter *every* building, potentially compromising the building shell.
- Once inside, literally every corner is penetrated. Aesthetics and life safety matters arise.

You may think this article is not speaking to you, but you will be involved in any installation that others undertake. Unfortunately, often this involvement does not occur until *after* some major mistake has been made. After you read this, you may wish to share it with your colleagues in the telecommunications office.

[1] Forbes, "An Administrator's Guide to Changing Telephone Systems," in *Proceedings of the Seventy-First Annual Meeting of the Association of Physical Plant Administrators of Universities and Colleges* (1984), pp. 318-326.

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• It may be cheaper in the long run to build a new building to house the switch and the telcom department than renovating existing space and trying to deal with planning a cable plant around some significant obstructions.

The matter of an uninterrupted power source (UPS) is one that needs to be considered. The switch itself must have electricity to operate, as must the climate-control system. Providing a generator to back up the batteries may be required if there is the probability of significant power failures due to weather. Sometimes co-location of the computer center, telecommunications, and any emergency communications will make a UPS more cost-effective.

Another detail to keep in mind is that ring-down phones will not work without power and, if you have them in elevators and do not have a complete UPS in each building where there are ring-down phones, they will not work in the event of a power failure. The most economical alternative may be to continue to rent them from the local operating company.

The Project Team

Your project team is crucial to your success. It should be put together with great thought. From my own experience, the players needed are:

1) A *Project Manager*, usually the telcom manager. This individual should know the contract inside and out and should have good organizational skills.

2) A *Staff Engineer for Outside Plant*, whose job will be to assist the vendor in locating utilities and ledge, suggesting routing for cable, interfacing with local entities regarding Rights of Way, and checking work daily. This individual should provide daily reports which should be kept in a three-ring binder. It goes without saying that this person should have an intimate knowledge of the campus. If staffing on campus is too thin to allow a staff engineer to undertake this job, look for an outside engineer who has already done work on the campus. Since most installation jobs have multiple sites in progress simultaneously, this engineer ought to have one or two clerks to help him or her keep an eye on the work.

3) A *Clerk of the Works for Inside Plant*, whose job will be to locate equipment/mechanical rooms in buildings; wall space for punchdown blocks; acceptable routings for risers; accompanying the vendor reps while they do an actual inventory of the number, type, and location of existing phones; and checking installation work daily. This individual should also provide daily reports which should be kept in a three-ring binder. This person should know the campus, too.

4) A *Project Assistant*, whose job is to schedule meeting rooms and notify parties regarding meetings; to keep notes on all meetings; to maintain the log sheet (to be discussed later); to maintain careful records of *everything*; and to take care of notifying departments when work is to be done in buildings. This person is critical to the day-to-day tracking of the nitty-gritty details. Many projects have succeeded or failed based on the efforts of this person.

5) Someone to *interface with your space planning group*, or whoever is the "building owner" on your campus. This individual's responsibility will be to keep the vendor informed of requirements for penetrating building shells, aesthetics, Life Safety requirements, and local and state ordinances.

6) Someone to *interface with your security force* who can help with routing traffic and securing blasting and excavation sites.

Expect to spend some money to hire extra help. Most university and college telecommunications/plant maintenance offices are not flush with staff who have nothing else to do and can be assigned to such a project full-time. Failure to staff the project adequately can cost more in the end when mistakes have to be corrected.

Important Paperwork

Insist on an Implementation Plan (major tasks and critical paths) within thirty days of contract signing. If you don't get an acceptable one, call a halt to *everything* until you have it in hand *and* it has been approved. This may mean paying your consultant to work with the vendor's project manager to get one, since very few vendors seem able to do it to an acceptable level of detail.

Insist that the vendor send the Project Manager to the consultant so you don't have to pay for the consultant's travel, meals, and lodging, in addition to his or her time. Construct the Implementation Plan on the basis of how long it takes to do a good job. Don't set dates on the basis of preconceived time frames. The "bottom line" is the driver *on both sides*.

Under the best circumstances, the vendor will cut as many corners as possible, and unrealistic time frames add to the urgency on the vendor's part to do this. Most institutions change phone systems to save money as well as to update technology. Your side will push to "cut"—or put the new system into operation—sooner rather than later in order to save equipment rental fees to the local operating company. *Remember:* a bad cut costs you more in the acceptance of the system by the people using it than a month's rental fees.

Another important item is an "escalation" list. It is the list of people you (or the vendor) begin calling when something out of the ordinary happens or when something goes wrong. This is essentially the organizational chart for the project.

Documentation is Everything

Have the Project Assistant develop a "library" of three-ring binders which include:

a) the original Request for Proposal (RFP)
b) the vendor's bid
c) the contract
d) originals of all forms, the implementation plan, the escalation list, etc.
e) all correspondence
f) the budget for the project
g) log sheets and notes from the meetings
h) field reports from the engineers and clerks
i) all job change orders (JCOs)
j) anything else you might consider important

Although this is a very mechanical thing, from my own experience I can assure you that having everything in the same place and within easy reach is crucial to keeping the project moving. If you ever have to go to court, having complete and current records makes the difference.

Appoint your own Project Manager (usually the telcom manager) to be the single point of decisional contact for the vendor. Avoid, if possible, setting up situations where "end-runs" become commonplace. This usually means that the person with the least information ends up rendering political, rather than technical or operational, decisions. Make sure all your people adhere to the principle that the Project Manager is the main check point.

Make sure all exceptions (additions and deletions) are documented with Job Change Orders (JCOs). Don't leave anything to "gentlemen's agreements." Establish some formal route for signature approval and have the project assistant responsible for seeing that both sides take care of it. The press of time and things to do will make it easy to "forget" or depend on gentlemen's agreements, which will disappear into thin air when the bill comes. Each and every change should be documented on a JCO, and it is your responsibility to see that you do yours and the vendor does theirs.

Develop a log sheet on which *all* items that require *any* kind of action are recorded and numbered consecutively. Include date entered, due date, and who is responsible. When an item is completed, add completion date, resolution, and print it out for the next meeting so everyone can be informed of what happened. Then archive the items that are finished. In addition to providing the agenda for each week's meeting, this system provides a record of who asked for what and when and whether or not it was accomplished. Together with the notes taken at each meeting, this log sheet will provide credible evidence if you ever have to take the vendor to court. (See **Figure 1.**)

Establish a log-in/log-out procedure for approving all drawings. Your log sheet should include the name of the building and spaces for Telcom, Facilities Planning, and Vendor. Ask for drawings as they are done, *not* all at once. Vendors love to drop thirty-five buildings on you and then gripe when you can't meet a forty-eight-hour turnaround. Insist on seeing the outside cable plans first because these determine building penetrations. Make sure the drawings are to scale or they are worthless. Don't accept the liability, which belongs to the contractor, by marking out the routes for them.

Keeping Lines of Communication Open

Establish regular weekly meetings where *all* involved come together to discuss progress and problems. The cast of characters at the weekly meetings should include:

—the Project Manager/Telcom Manager

—the Project Assistant

—the Clerks of the Works and their assistants

—the facilities interface

—the security interface

—five or six people from the vendor, including the Project Director

Devote at least one weekly meeting a month for the consultant to come on-site, as well as the campus administrators up through the responsible vice president. The types of issues to address at these meetings are:

a) the reliability and accuracy of the Implementation Plan

b) cable plans

c) tracking job change orders (JCOs)

d) types of presentations to be made to groups on campus

e) any necessary retrofit of your local operating company's central office to provide direct-inward dialing (DID)

f) data base construction (station features, types of phones, how much information to give the customer)

g) billing options

h) guidelines on interior station wiring:

–routings

–conduit, wire-molding

–coring/penetrations

–how far spare cable goes into buildings

–amphenol connectors vs. punch-down blocks

–segregating voice/data pairs

i) protection, where and what kind

j) grounding

k) field decisions (pressure the vendor to give the project manager authority—more often than not, the project manager *does not* have the authority to make even the simplest field decisions.)

If some of these issues appear rather trivial for such a meeting, I would only note that they are often the issues on which the vendor will try to cut corners. It helps to have the "big guns" there to back you up.

There are a number of points at which informing the community becomes very important. Mass confusion results very quickly unless you anticipate several things:

a) All vendor personnel look the same to those on campus. It means little to the average member of the community that you may have two or three different groups of vendor personnel surveying *different* things. (One group locating phones for station wiring, another group locating groups of phones for routing risers, and so on.) It's all for the telephone system (right?) and therefore it's all the same. WRONG.

b) The various vendor groups do not necessarily communicate with each other, so when a departmental secretary asks a question, she may get two or

Figure 1
Project Resolution Log Sheet

ITEM #	DATE ENTERED	REQUESTED BY	REQUEST OR PROBLEM	ASSIGNED TO	DUE DATE	RESOLVED DATE	RESOLUTION/PROGRESS
1.	4/28/86	Vendor	Right of Way-Railroad	Physical Plant Liaison	6/27/86	7/18/86	5/6/86—Contact made. Paperwork in progress. 6/10/86—Paperwork proceeding.
2.	4/28/86	Vice President	Meet with Deans & Dept. Heads	Telcom Manager	6/27/86	6/27/86	Meetings held to inform & answer questions.
3.	4/28/86	Telcom Manager	Set up procedures for blasting	Vendor Safety & Security	5/5/86	5/5/86	Done.

three different answers, and then you'll get a call.

c) Most of the notices you send out won't get read anyway, but at least you will have made an effort to communicate.

Inevitably, you will have multiple activities going on simultaneously and the resulting questions and problems may leave you wondering if anyone talks to anyone else. A few well-timed letters, letting people know who is doing what, and a few articles in the campus media can be extremely useful.

Keep the Maintenance and Buildings and Grounds departments informed of trenching schedules. Nothing is more demoralizing than planting something only to have it dug up two weeks later, or to paint a wall, only to have coring occur the next day.

Working With Your Local Operating Company

What items need to be ordered from your local operating company?

a) Upgrading your current central office to accommodate direct-inward dialing (DID). This can be a very sticky issue. Most colleges and universities have Centrex, whose revolutionary characteristic was DID. Many central offices equipped for Centrex cannot provide DID for the new switching equipment without an expensive upgrade.

If you are a large customer and represent a major portion of the company's installed base, they are not going to want to move very quickly to lose you. You will have to be very persistent.

b) Ordering trunks, WATS, and foreign exchange (FX) lines should be done well in advance. Although it costs more to have these "additional" trunks operating ahead of the cut date, it alleviates the need to make a potentially critical, and irreversible, cut when you don't have two systems operating in tandem. It's money well-spent.

c) Purchase of current station wiring.

Existing Station Wiring

A major issue with respect to the interior cabling will be the purchase and reuse of existing station wiring. You will be encouraged by your vendor to buy your existing station wire from the local company. This is not bad advice, but not for the reason for which the vendor is likely to make the recommendation. The reason they want you to buy it is so they can then suggest that you reuse major sections of it, thus saving them having to string new wire. Always remember that if you've bid a completely new universal cable plant, approving the reuse of existing station wire should be done on an area by area basis building by building. It should only be done under the following conditions:

—when the cable is good
—when it is easily traced
—when aesthetics suggest it is desirable
—when the wire is 24-gauge and they are all home runs (no riser closets)

You should ask for credit for each station counted in the contract for which the vendor does not have to string wire. It will not be equivalent to a per-station cost, but it is a savings and you, not the vendor, should realize it. Insist, however, on a bill of sale from the vendor, which warrants the wire. Then any

post-cut problems are the vendor's, not yours.

The major reason to purchase the existing station wire is to avoid any legal hassles after cutover that may be caused by tariffs which appear to allow the local operating company to charge you for the station wire on premise, even if you are not using it. A secondary reason is that it may represent a cost avoidance to you. Often, the purchase of existing station wire will pay off within one year, when you will no longer have to pay monthly rental.

External Cable Plant

The ideal situation with respect to the outside plant is to hire an engineer before you go out to bid or, failing that, while you're haggling over the contract. Have a suggested cable routing that takes road crossings and utility congestion into account.

Try to locate building entrances below grade as much as possible. Be sure equipment rooms are dry and there are no pipes nearby that will produce moisture in the summer. Insist on cabinets where the punchdown blocks are not secure, or where they are near slop sinks, etc.

Typical headaches in the installation of the outside plant include getting decent drawings, determining a reasonable radius for any turns in cables (contractors do this to avoid extra manholes), and the type of conduit to be used (metal vs. PVC), specifying the types of splices to be used, proper grounding in this age of PVC pipes, sump-holes in manholes that are not pre-cast, and getting a schedule out of the contractor so that you can let people know where parking spaces will disappear, blasting will occur, and movement will be curtailed. The inconvenience will be tolerated by the community with more good humor if they are told what to expect.

Insist on as-builts as you progress. Don't get stuck with the technicians' best recollection six months after cut. It is a common tale in the telcom industry of as-builts that are not forthcoming for as much as a year after cut. If you are smart, acceptance (and the final payment to the vendor) will include having the as-builts in hand.

Interior Cable Plant

Enclosing interior cabling in conduit is a potential area of disagreement between you and the vendor. As a physical plant administrator, you know that aesthetics and the security of utilities are important issues. Always maintain your right to require conduit if the contract calls for conduit.

Some vendors will try to pull the old Ma Bell trick that "you get what we give you." Don't let them maintain that as an operating principle. However, be reasonable. Fishing walls, suspended ceilings and crawl spaces can be permitted when reasonable, i.e., when walls and ceilings are fishable. (Note: I understand that the National Fire Protection Association is getting ready to require that even 6-pair station wire be suspended and secured in ceilings, not draped.)

Many new systems are bid with spare cabling included, equivalent to 30, 40, or 50 percent of total installed capacity. When is it wise to eat into the spare capacity? This can be a tough judgment call. One school of thought is that things will never be as cheap to wire as when you have the trenches open, and that is certainly true. However, if you've planned to put in extra four-inch conduit with pull wires to meet future expansion, then this school of thought may not be the wisest, especially if the vendor is running close to the profit margin (a common situation

in open bid situations). It may, in fact, be cheaper to eat into the extra cable and pull additional wire through later.

My experience has been that people go wild planning for "futures." Once you've sorted out what is a realistic future and what is sheer fantasy, there are some buildings where it may make sense to eat into the extra cable to accommodate additions. Specifically, those would be buildings where the extra pairs were beyond the spare specified in the contract (this happens because of cable sizing), the likelihood of major growth in the future is unlikely or where the existing station-wire, which you thoughtfully purchased from the local operating company, could be used for local area networks (LANs) for data transmission. If your switch is capable of voice over data and you have purchased a uniform cable plant, then eating into spare capacity is possible.

Special Needs

Every campus has some special needs that rely on the telephone system. Some typical examples are:

a) Punchdown your voice pairs on separate boards from all others (data, alarms, special circuits). This is true especially when you have amphenol connectors. It facilitates distinguishing them later and providing you easy access to them.

b) Data: most data communication on a campus *does not* need to go through the switch. Local area networks (LANs) can be set up, using the new cable plant or the existing station wiring purchased from the local phone company. Many new switches allow voice over data, multiplexing, LANs, etc. (If you have twenty terminals or more per building, MUXing over direct wire to a port selector is often the most economical way.) Be creative.

c) Emergency Numbers: If you have emergency numbers, consider how their use may change in the cutover. Given the fact that it may take time to train people to add or drop digits on all phone numbers, anticipate the likelihood of someone in an emergency dialing incorrectly and program the switch to interpret *both* numbers as the emergency number.

d) What to do about buildings being built, or in the planning stages, which were not included in the contract. Additions can be very expensive, so if you did not plan far enough ahead to include the building, *don't* include it under the contract. Include the cost of station wiring and sets in the cost of the building, *but* do put the cable in while you have trenches open and stub it where it will enter the building (or building to be).

e) If you have Federal Telephone Service (FTS) lines or autovon lines on your campus, you will have to make special accommodations to avoid interruption of service.

f) Lines that are not billed through your Telcom Office—finding out what's out there can be a problem. What you don't want to happen is to overlook any of these and then have service terminate at cutover because the key sets no longer work. These types of lines include FTS/autovon, inward WATS (800), and others.

g) Academia being what it is, offices will be moved or new phones desired *after* the station-wiring in any building has been completed. Although most contracts call for additions up to thirty days prior to cutover, someone will want a new number within that time period. The easiest solution is to request from the local operating company that they put aside twenty to thirty phone numbers that can be assigned after the cut-off and which *would not* be cut dead at the time of cutover. Then, after cutover, go in and wire those few stations into the new switch.

h) Amphenol connectors in building risers should be used with discretion. They provide a neater job and are a cost savings, but they leave you with less flexibility for the future if you need to change usage.

Training Your Users

One of your major cost-saving goals is to keep the number of single-line sets high (90 percent), and the number of electronic (multiple-line) sets low (10 percent). These days, everyone is used to the 1A2 key sets (that line of buttons on the phone) and even consider it a status symbol. They simply will not believe that the new single-line sets will do everything (and more) than the old 1A2s. You need to be *very firm*.

When you do your "dog and pony" show, take along an "executive workstation." This is a plain old single line telephone. But what you call it matters.

When you collect the data base, do *not* outline options. Simply collect your data (number of lines, people, locations, what happens to calls, etc.) and design the system back in the office. For the recalcitrant, ask them to "try it our way" for sixty days after cutover. If at that time they are still unhappy, they can request changes—for a price and with a vice president's approval.

As far as possible, keep departmental numbers the same. Publish all numbers. Lots of people will insist that they don't want their number published, which defeats the purpose of the new system (and getting rid of the 1A2s). Sell them by pointing out that the secretaries can do more important work if they don't have to screen a call when someone is in his or her office and not in a meeting.

If cutover doesn't occur at the same time that the annual directory appears, prepare a photocopied version. Remind people that any staff and/or location changes will require that they notify the Telcom Office.

Training should take place on campus with phones that work. One of the biggest ways to assure that the new phone system will not be accepted is to do an inadequate job of training people to use it. Getting people to come to the training sessions will stretch your ingenuity.

The preferred mode everywhere has been to send a departmental secretary or business manager and expect them to go back to the department and train everyone else. This may work, as it does for so many things in academia. But, then again, it may not. A letter from the president inviting everyone to attend is a good idea. A special session for vice presidents, deans and department heads,with a pep talk to get them to "encourage" their people to attend is another idea. The best idea, to my mind, is to buy some cordless phones and raffle them off at the end of training sessions. Only those who attend are eligible to win, and the phone can be used however the winner wishes. Carrots always work better than sticks.

Conclusion

I have tried to hit some of the high points in installing a telephone system. No one lives through an installation and cut without developing a sense of humor in a crisis and some very careful methods of keeping multiple tasks going at once.

Each installation is slightly different. However, establishing efficient, manageable systems to track the details is the most important aspect for the administrator to be concerned with. ■

A Time of Challenge: Physical Plant Administration in the People's Republic of China

by William D. Middleton, P.E.

ALL PHOTOS BY WILLIAM D. MIDDLETON

Top: This library, completed in 1985 at Northeast Technical University in Shenyang, will house more than 1 million volumes and will be the fourth largest university library in China. Bottom: Designed in a western style, this auditorium is located at Beijing's Qinghua University.

"We've said on many occasions that China's economy might approach that of the developed countries by the centenary of the founding of the People's Republic. This prediction is based, among other things, on China's ability to develop education, raise its scientific and technological level, and train hundreds of millions of qualified people at all levels and in all spheres of work within this period of time."

—Deng Xiaoping
in an address delivered
at the National Education
Conference on May 19, 1985.

William Middleton is assistant vice president for physical plant for the University of Virginia, Charlottesville, Virginia, and serves as APPA's 1986-87 Vice President for Educational Programs. He traveled to China in 1985 as a member of a World Bank team studying management and finance, which took him to seven college and university campuses in several areas of China, as well as to the State Education Commission in Beijing. He has traveled extensively in China on two previous visits.

Bicycles provide the principal means of transportation on Chinese campuses.

The People's Republic of China is now in the midst of a period of dynamic change and growth in its economy as the world's most populous nation sets out to achieve its ambitious goal of taking a place among the world's developed nations in the 21st century.

Few institutions in China's society will be more profoundly affected by this period of reform and change, or by growth, than will higher education. The years ahead are bound to be a time of great challenge—and opportunity—to physical plant administrators on China's college and university campuses.

In their drive for economic growth, China's leaders hope to quadruple the value of the nation's industrial and agricultural production over the two decades from 1980 to the end of the century. To do this they recognize that China must significantly expand and improve its educational system, with particular emphasis on higher education. China's planners have estimated an annual enrollment growth rate between 1983 and the year 2000 of 10 percent or more. They have projected that the system of higher education will have to grow by a factor of five by the turn of the century.

Higher Education in China

Despite what is still a comparatively low enrollment ratio, higher education in China is an enormous undertaking. In 1983, for example, total enrollment was estimated at 1.2 million students. By 1985 the number of institutions had grown to about 900 from a level of only 630 in 1979. By western standards, at least, most Chinese colleges and universities are relatively small with an average enrollment of 4,000 to 5,000 students. An enrollment of 10,000 is considered extremely large by Chinese standards.

Established in the 1950s along Soviet lines of highly-centralized planning and management, governance of China's colleges and universities has been strongly directed and controlled by central government agencies. Overall administration of higher education has been provided by the Ministry of Education (now the State Education Commission). The Commission directly manages a number of comprehensive universities of a national character, while other more specialized colleges and universities are managed by various ministries of the central government. The Ministry of Railways, for example, operates several specialized universities that train professionals for careers in the railway industry. The Ministry of Foreign Economic Relations and Trade manages the University of International Business and Economics at Beijing. Still other colleges and universities are under the direct management of provincial or municipal governments. Teachers colleges and universities, for example, are typically controlled by municipal or provincial governments.

While this basic structure is not likely to change, major changes are taking place in the way institutions are managed. Elevation of the former Ministry of Education to the status of a State Education Commission in 1985, with vice-premier Li Peng as its chair, gave education an important and much-strengthened status. At the same time, strong central control of educational institutions is being relaxed and colleges and universities are being given much greater autonomy in their management.

China's Colleges and Universities

The typical Chinese college or university campus has much in common with, and many differences from, its North American counterparts.

While landscaping is not as extensively developed as it is on most American or Canadian campuses, almost every campus has an elaborate Chinese garden with a pond, ornamental plantings, decorative racks, and the like. Almost every road or street is heavily planted with street trees. Virtually everyone travels on foot or by bicycle, and Chinese campuses are spared the problems of faculty and student parking.

Building construction tends to be austere by western standards. Most buildings have plain concrete, tile, or terrazo floors, and painted, cement walls and ceilings. Lighting is dim, and heating is limited.

The architectural style of China's educational buildings varies widely and is usually dependent upon the date of its construction. Contemporary buildings are typically simple rectangular structures with a minimum of embellishment or detail. Buildings from the 1950s, when Soviet advisors strongly influenced Chinese construction, are usually built in the heavy Soviet "wedding cake" style. On some campuses older buildings dating from the pre-World War II period show a strong western architectural influence. Several of the buildings on the Qinghua University campus at Beijing were designed by American architects during the 1920s.

Students are housed eight to a room on double-deck bunks outfitted with straw mattresses. Faculty members live in modest flats in six-story walk-up apartment buildings. Typically, the

entire student body and faculty are housed on campus.

Internal organization within Chinese colleges and universities tends to be rather simple, with finance, facilities and most supporting services typically under the management control of the equivalent of a vice president for administration. Most often the functions of facilities planning and construction and facilities maintenance are provided by separate divisions of this organization. In at least some colleges and universities, however, they have been combined into a single, comprehensive facilities organization.

Facilities Planning and Construction

Unlike the planning criteria typically used by western institutions, planning for facilities construction in China is typically based upon various per-student space allowances established by the State Education Commission. Because of the "closed" nature of China's institutions of higher education, which provide virtually every type of support service on campus, these allowances include such diverse needs as faculty and staff housing and dining facilities, primary and secondary schools, health care facilities, and the like. Thus, space standards vary from as little as 33 square meters (355 square feet) per undergraduate liberal arts student to as much as 50 square meters (538 square feet) per graduate science and engineering student.

In establishing construction budgets for new facilities, the State Education Commission similarly establishes unit construction cost standards. A current standard for construction of facilities for undergraduate and graduate liberal arts students is Yuan 280 square meter ($9.00 per square foot). These standards are adjusted for regional cost variations and for such geographic considerations as heating requirements. Dormitory construction cost allowances, for example, range from a low of Yuan 140 per square meter in the warm southern part of China, to a high of Yuan 200 per square meter ($6.45 per square foot) in the coldest regions of northeast China.

Once a facilities construction project has been approved, design development is the responsibility of design institutes that are often units of a provincial or municipal government, or of a technical ministry. Sometimes a design institute is affiliated with a university and, on occasion, design projects are undertaken by the architecture department of a university.

Administrative offices at Qinghua University are housed in this building of traditional Chinese architectural style and faces a lotus pond.

Soviet-style architecture characterizes the main building of Qinghua University, a technical university in Beijing.

In China's socialist economy, facilities construction has historically been accomplished under a radically different system than that familiar in the west. Projects are normally assigned to a specific construction team that is available for the work, and a contract is then negotiated for performance of the work. Lacking the incentives of a competitive process, problems of high cost, poor construction quality, and completion delays are frequent. In some areas, colleges and universities have had construction quality problems because the rapid increase in construction work that has paralleled China's economic growth has led to a shortage of adequately-skilled construction workforce.

Facilities Utilization

In the traditional method of classroom utilization still employed at many of China's colleges and universities,

each class of students has its own permanently-assigned classroom. All classes are taught in that room, and the space is utilized for student study when classes are not being conducted. At many larger institutions, or at ones where enrollment growth has exceeded the availability of classroom space, more conventional methods of space assignment are used, with classes being assigned to available space for each actual class requirement. High utilization of classroom and laboratory space is usually hindered by a preference for scheduling academic classes in the morning only and laboratories in the afternoon, as well as by a long lunch period of two to two-and-a-half hours during which neither classroom nor laboratory facilities are in use.

Facilities Maintenance

By comparison with typical North American institutions, facilities maintenance at China's colleges and universities appears to be largely at a basic level. For most Chinese physical plant administrators, the overall shortage of resources prevailing in a developing nation has been further aggravated by the competing financial needs of higher education's rapid growth.

For many of China's colleges and universities, an accumulation of deferred maintenance has become a significant problem. On some older campuses, pre-1949 facilities have suffered both from the normal problems of age and the neglect of the turbulent years of the 1937-1945 war with Japan and the Chinese Civil War that followed. More recently, resource shortages, combined with more than a decade's neglect of higher education during the Cultural Revolution of the 1960s, have contributed to a significant deferred maintenance backlog for many institutions. Several major universities visited in 1985 reported deferred maintenance backlogs in the range of 12 to 13 percent of plant replacement value. Only one, a comprehensive provincial university, reported a backlog as low as 2 percent of plant replacement value.

While the principles of modern maintenance management are recognized by many of China's physical plant administrators, few of them have been able to make much progress in implementing them. Some of the larger institutions have been able to establish some form of periodic facilities inspections or rudimentary preventive maintenance programs. One major normal university visited had been able to implement a system of time standards for maintenance workers. But at most institutions a lack of resources has precluded establishment of the modern maintenance management procedures that have become commonplace in the west.

The Challenges Ahead

As China embarks on a period of unprecedented growth in higher education, facilities managers in colleges and universities are facing some exceptionally difficult challenges.

In order to accommodate the enormous planned growth in enrollment at an affordable cost, both new and existing facilities will have to be utilized at a much higher level of efficiency. Some of the changed and improved facilities planning and management procedures that are likely to be needed include the following.

- The present per-student space allocation utilized for planning of new facilities requirements will probably have to be replaced with planning procedures that are based upon much more specific analysis of actual needs.
- China will probably have to meet a large part of its increased enrollment capacity through utilizing the economies of scale in larger institutions. Thus, while some new institutions will have to be established, most of the existing colleges and universities will probably be greatly increased in size. This, in turn, will bring a need for the more sophisticated management techniques that are needed by large institutions.
- The Chinese concept of a closed institution, which houses and feeds all of its faculty, staff, and students and provides a wide range of support services, will have to be greatly modified with a much greater dependence upon community support for housing and other support services. Already this is beginning to occur at some institutions.
- Policies for the assignment and utilization of academic space will need to be revised in order to attain a higher level of utilization of classroom and laboratory space. Centralized assignment and the use of computers are

some of the alternatives already beginning to be used or considered. In order to permit a higher level of teaching space utilization, design of new university facilities will probably include more study hall or library reading room space to free classrooms for use in instruction. These practices have already been adopted in recent projects such as the 16,000 square meter library recently completed at Northeastern Technical University at Shenyang, which incorporates large student reading rooms in the new facility.

- Construction contracting practices will need to be improved to provide for greater efficiency and reduced costs. As an example of what can be done, in 1984 the construction bureau of the State Education Commission began competitive bidding for constrution projects on a trial basis. Both local construction units and those from other areas have been asked to submit bids for projects. Where this has been tried for a few major projects, cost savings have been obtained and the construction was completed on or ahead of schedule.
- In order to deal effectively with deferred maintenance that already exists, as well as the maintenance needs of greatly-expanded institutions, modern practices in maintenance management will have to be developed and installed in order to provide effective programs of preventive maintenance, facilities inspection, productivity, and work planning.
- In order to develop the skills needed to effectively manage these expanded facilities programs, the Chinese have already recognized that they must initiate extensive programs of training and development for their staffs. Foreign study and observation visits to see modern management practices first hand are one way to do this. A recent example was a visit by a Chinese campus design and management study team to a half dozen U.S. colleges and universities and to APPA headquarters in January 1986. The development of professional associations, much like APPA and its counterparts, is another way that the Chinese can help to meet these needs. Late in 1985 China's Society of Higher Education set up a physical plant association concerned with all of the basic campus support services, and a similar association concerned with facilities planning and construction is planned.

Conclusion

As China moves into its new era of reform and growth in higher education, the challenges to its physical plant administrators are indeed formidable ones. Nevertheless, the Chinese whom I met with at every level seem ready to take them on. There is a refreshing eagerness to learn more about and to apply modern practices of physical plant management to China's needs. The opportunity to exchange views and share experience with my Chinese colleagues was a memorable experience. I expect that many more APPA members can look forward to similar opportunities in the years ahead as China continues its drive to catch up with the developed world. ■

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Integrating Capital Studies Within Physical Plant Operations

by Douglas K. Christensen

PHOTO BY BRIGHAM YOUNG UNIVERSITY

Brigham Young University, located in Provo, Utah near the Wasatch Mountain Range, has an enrollment of nearly 26,000 students.

A capital renewal and replacement program can be an important part of the maintenance program. It can provide a continuity of maintenance purpose or it can be a missing link that drastically affects the ongoing maintenance program and resources within an institution. The following is a general review of the principles learned at Brigham Young University (BYU) about managing a total program of integrating capital renewal and replacement concepts within the physical plant operation. These principles have basically been in effect since 1981. The purpose of this article is to share the procedural steps and principles of organization that have been adopted and have improved the way facilities are managed at BYU.

Douglas Christensen is director, business support, at Brigham Young University in Provo, Utah.

The Scope

In 1981 a challenge from the Commissioner of Higher Education became the driving force behind the establishment of a capital renewal and replacement program at Brigham Young University. This capital renewal and replacement program is called the Capital Needs Analysis Program (CNA). The scope of the CNA program determined the following: 1) what the capital replacements needs and trends were for the next forty years; 2) how the institution would manage for capital needs given a funding limit each year; 3) how to create an annual, detailed list of *all* capital needs that would be funded and completed that given year; 4) how to incorporate this program within a physical plant operation and deal with the decision of when to repair vs. replace and establish a replacement standard or maximize useful life; and 5) how to establish an ongoing capital needs program to maintain building integrity and usefulness.

Given the challenge above and having the understanding that the first priority in capital funding would be replacements, followed by retrofits and then improvements, we realized there was an emphasis to develop a total capital needs program. Once the scope had been defined, we proceeded to establish what was needed in a study of capital needs on campus.

The Study

A lot of information and detail went into the capital needs study. The proper organization of information and details was the key. All of the information dealing with the study was collected into three computer data bases: the Building/Area File, the Replacement Cycle File, and the One-Time-Only File.

BUILDING/AREA FILE The purposes of the Building/Area File were to describe the buildings and campus areas that were included in the study, and to use this information to verify data entry in the Replacement Cycle and One-Time-Only files. This file assures that all information in the capital program relates to a building or area. Figure A shows the resources and

elements within the Building/Area File.

REPLACEMENT CYCLE FILE This file represents the main file in the study program. It is organized in such a way that includes all replacements for buildings and campus areas (see Figure B). The resources of information for interiors came from floor plans; building exteriors came from building plans; major equipment in buildings and facilities came from equipment inventories; utility and telecommunication systems came from system plans; and general site items came from campus plans. The replacement study consists of two main elements: an *inventory* of all of this replacement information, and an *evaluation* of the inventory.

Inventory Part of the Study As shown in Figure B, the inventory consists of a number of items that relate to the location and classification of the inventory. Defining how far and how much to inventory is a significant part of the study design. Careful consideration as to how much *detail* to incorporate into the study was of the highest concern. We struggled and settled on a level that would give enough information to manage replacements.

There are two key elements that helped to minimize the detail in our study design. First, we chose to collect information by room number, but summarized it by room type. These room types were such things as classrooms, hallways, offices, etc. Within each building we related these room types to a floor. The worst case scenario that we would have to manage would be by room-type by floor. An example: we would not replace carpet in one office, but would consider all of the offices on a single floor within a building. When all of the offices on that floor needed carpet replacements, we would replace *all* of the carpet. There are a number of benefits to the room-type summary. We wanted to take advantage of volume work and be consistent in the type of carpeting and architectural integrity of the offices on a floor. Managing by room-types on a given floor helps to reduce the detail substantially and be consistent in what our approach is to maintaining the integrity of a building.

The second area that we examined to minimize detail closely was our approach to utility systems. Our approach was to identify the major component parts of a system, or those items that have a different life cycle

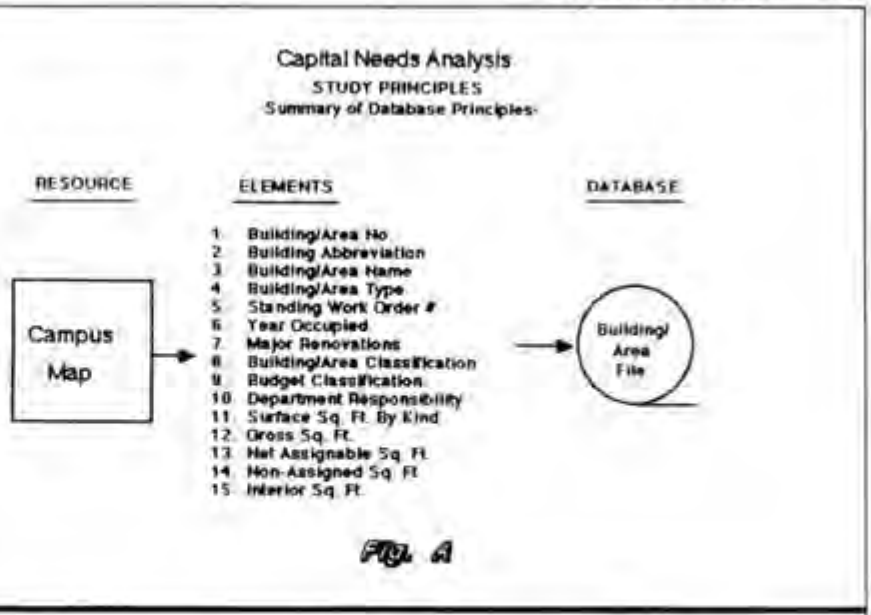

Fig. A

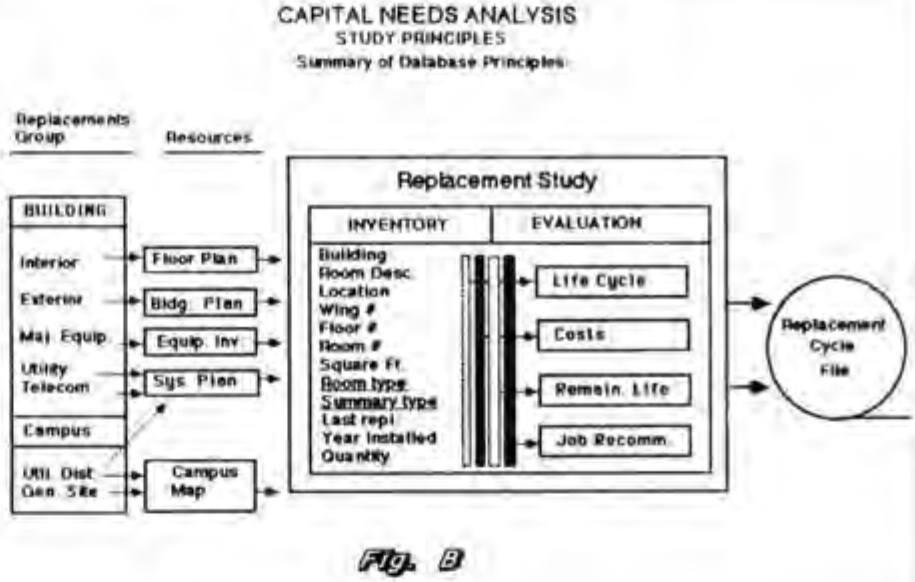

Fig. B

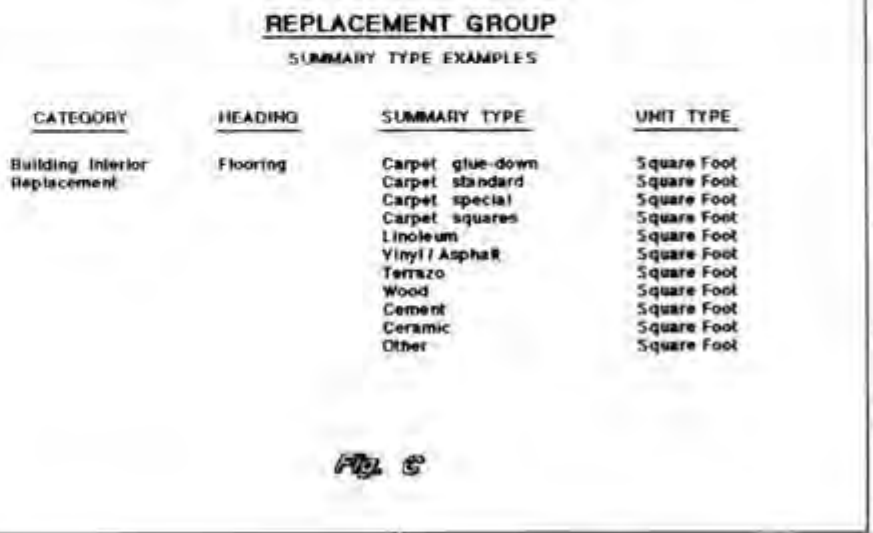

Fig. C

than the total system. An example would be chillers and compressors within the total air-conditioning system. These component parts would have a different life cycle than the total system. The piping, fittings, and other parts of the system that would have longer life cycles were grouped together as one long-term component of the total system. The study would show the total system cost by identifying the components. Component life cycles were identified so that they could be managed within the total system. This classification of systems helped greatly in understanding the replacement cycles within a system. The room types and system component elements helped reduce the detail and confusion dealing with replacements inventory.

The inventory is the key to the replacement study. We chose to have a detailed inventory to allow detailed tracking of items. This was accomplished by a careful establishment of approval summary types or items that are approved replacements. In Figure B, under "Replacements Group" and "Buildings," is a category called "Interiors." Figure C shows the breakdown of the "Replacement Group," the category "Building Interior Replacements," the heading "Flooring" and the "summary types" used for each area. "Summary type units" were defined so that all items were measured the same. The design and approval of the summary types is a significant part of a replacement inventory. We have an approved list of approximately 150 replacement summary types used in the inventory.

Evaluation Part of the Study Once the inventory and line items were identified within each building, we evaluated each line on four points (see Figure B): 1) life cycle (the recommended or proven useful life), 2) the cost of the line item (standard cost for similar items or a unique cost for the particular line items), 3) remaining life (how much useful life is remaining), and 4) job recommendation (identifying whether the replacement would be completed by a contractor, by physical plant, or whether it was a direct-purchased item that would require no installation).

The evaluation process is critical to the replacement study. The *remaining life* identifies when the next funding will be needed. The *life cycle* suggests how often that item needs to be replaced over a forty-year cycle. The *costs* are set at the current replacement cost and the *job recommendation* identifies who will complete the replacement. The replacement study as a whole includes the inventory and the evaluation of each line item, which is in the total replacement cycle file. The importance of the replacement cycle file is that it allows use of a data base to evaluate and project replacement needs. It gives the flexibility of looking at this information either by building, total campus, certain floor, or certain room-type, such as a classroom, office, or hallway. The data base file allows flexibility in looking up replacement items. Example: if you wanted to look at all the carpet in a building or on campus, the data base allows you to access that information. If you are dealing with the replacement of building utilities, you could look up compressors or chillers, roofing, elevators, or lawn sprinkler systems.

The critical part of the Replacement Cycle File is defining what is considered a capital replacement and then making sure that those items are organized in a way that makes the information available and useful. Many times, studies are completed and put on a shelf for review periodically, in terms of bottom-line or funding needs. The flexibility of a Replacement Cycle File data base is that, based on your remaining life evaluation, a determination can be made of what is going to happen in the future and how to deal with it now.

ONE-TIME-ONLY FILE The purpose of a One-Time-Only File is to collect information about projects that need a one-time funding. Figure D describes how we establish a one-time-only file. Under "groups," we have two types that we are dealing with. One is classified as *retrofits*, the other as *improvements*. Retrofits are defined as those projects that will extend the useful life of an existing replacement and is operationally cost effective. An example of retrofits would be the upgrading of a utility system to make it more energy efficient, and that also extends the useful life of the current total system. This may be accepted by adding new controls that will extend the system's useful life. We have learned that there are other retrofits, such as general site retrofits for roads, parking lots, cement, and curbs; exterior retrofits, such as pointing, and sealing brick or stone; and major equipment retrofits such as elevators, which may always be retrofitted and never replaced.

Improvements are classified as One-Time-Only projects and deal with *mandatory/compliance*, which tracks and builds a facility master plan on regulatory issues (i.e., local codes, Handicapped 504, EPA); *general site improvements* (i.e., new roads, new sprinkler systems); *extension of utilities/telecommunications*; *remodeling* existing space for functional use or change; and *new space* (i.e., additions to the building or new buildings). As needs arise, such as demands, upgrades, and requests, a scope approval is required (see Figure D). Scope approvals at Brigham Young University follow the line responsibility through a department chair, then dean, to a vice president. If the scope of the project is approved, then the next question is funding. If funding is available, then the project is completed and the effects of that project are added to the Replacement Cycle File. If there is no funding, but the scope of the project is such that when funding becomes available, it would be a high priority, then the project is put into the facility master plan.

Figure D notes items listed as part of the facility master plan. These elements allow evaluation of items within the facility master plan: i.e.: items by benefiting college, by building, by priority—either the college level, the vice president level, or the university level. This data base is a great tool in managing requests, whether funded or not. This is an ongoing, day-to-day process. As new items are added, they are evaluated in terms of previous items in the facility master plan, and a priority relationship is established. This makes available a current and complete listing of all scope approval requests and what the status is of each. The facility master plan is an excellent tool in identifying the retrofit and improvement capital needs.

Study Summary It is important to understand that all three of these data base programs relate to each other. With proper information and coordination, the physical plant department can evaluate replacements and one-time-only projects within a building and coordinate and plan better what ought to happen. The additional information learned from the study of capital needs gives Physical Plant a tremendous tool in understanding better what pressures and desires there are for a given facility.

The Information

Due to the way in which the replacement study information is collected,

there are two tools that have been successful in the management of the total capital needs program: the building spreadsheet and projected funding graphs.

The building spreadsheet is strictly a listing of items within a building and the years in which they will be replaced. You will note in our example, in Figure E, that all of the items are grouped as "Replacement-Floor-Carpet/Special" for the Smoot Building. All of the special carpet is listed together by room-type by floor. This information identifies what year similar items are currently due for replacement. The spreadsheet has three purposes: 1) to be able to answer requests and give direction to questions about replacements within a certain building, 2) to assist in planning and evaluating what replacements or one-time-only items are being suggested within a building, and 3) to allow the opportunity to group together replacements if useful lives are close. Example: whenever a ceiling replacement comes up, consideration is given to any utility work that may be in the ceiling, or any light replacements that may be due. It is appropriate to group together similar replacement types by either deferring the ceiling, or bringing the other replacements forward. The important point about building spreadsheets is that they provide a detailed picture of what is happening and what type of items may need to be grouped.

Another use of the building spreadsheets is assisting in our remodeling costs. When we receive a request to do remodeling, we look at the replacement file to see if there are any replacements that need to be considered. In some cases replacements can offset some of the costs of remodeling. It is important to note that we do not automatically replace items because of remodeling. The only time we use the capital replacement funds is if useful life has been expended. This principle is also helpful when we are dealing with a total building renovation. Replacement funding can assist greatly in major renovations of older buildings.

The projected funding graphs use the information from the data base to project a graphic representation of funding for all capital needs. You will note in Figure F that there is a graph being represented. Each graph contains two graphs overlaid. Line A (which is a vertical line and then a horizontal line) represents the first graph. The high

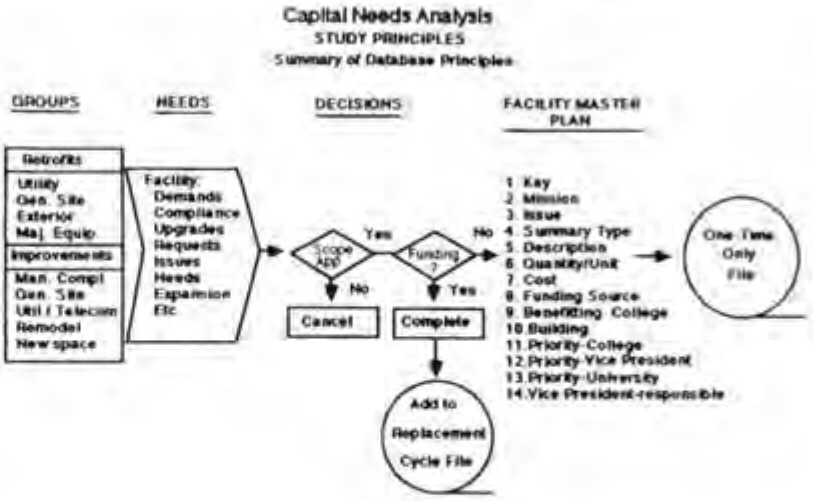

FIG. D

FIG. E

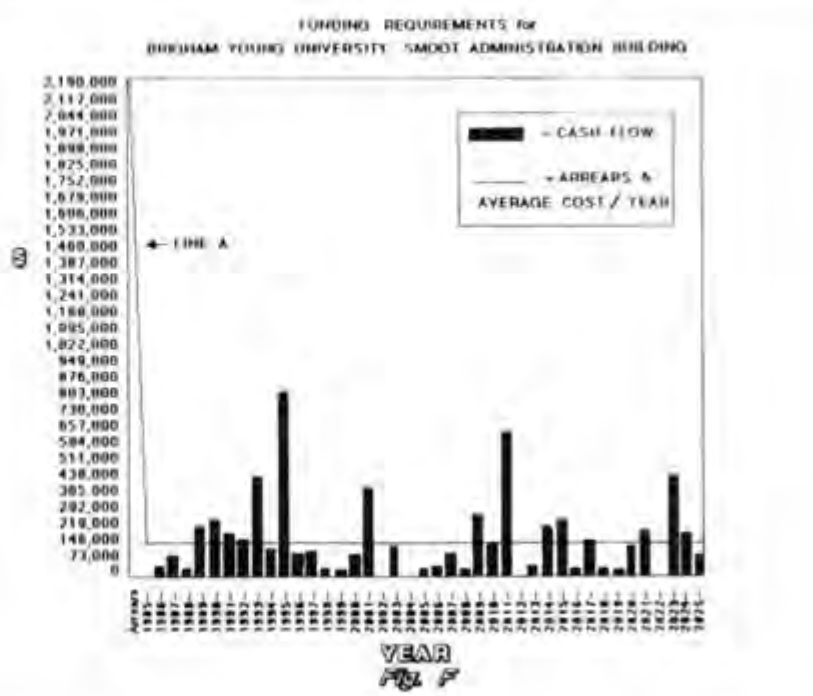

FIG. F

point represents the amount of arrears or useful life that has been spent within the item or building being graphed. For instance, if the projected life cycle of carpet is ten years and seven of those years have been used, then our remaining life would be three years. Therefore seven years would be in arrears, or seven years of useful life would have already been spent. The remaining three years would be averaged into that horizontal line. The horizontal line suggests that if funding was available for all arrears, that the amount needed each year, forever, is represented by the horizontal line. Also overlaid on the graph is an annual cash flow projection, represented by the bars. This is a representation of the summary of all items with remaining life equal to the year illustrated in Figure F. There are two graphs imposed, one on the other. This gives management a look at the annual cash flow or the arrears and ongoing costs to meet replacement needs. The information can be summarized and graphed by Physical Plant and represents all of the facilities that are assigned to the department. We can graph revenue areas on campus, who may have building responsibility, to show what their replacement needs are. We can graph a total campus and summarize all facilities on campus.

One item to notice in the graph is the cash flow spikes. Since each point on the graph is represented by detail, we can analyze the increased cost. Many times we are able to suggest retrofit or one-time-only projects that can increase useful life for a smaller amount of funds than replacements. Graphing gives us an idea as to what is coming and how much. It gives us the capability of taking other items such as floor coverings, mechanical systems, utility systems, and roofing, and allows us to make a determination regarding its future impact financially and see if there is a strategy that can be planned for better managing of replacements and extending useful life.

The building spreadsheets and the project funding graphs do assist in making better management decisions and focus on what the real capital needs of facilities are within the physical plant.

The Management

A capital needs program is a critical part of the total maintenance responsibility. It merges the information from a

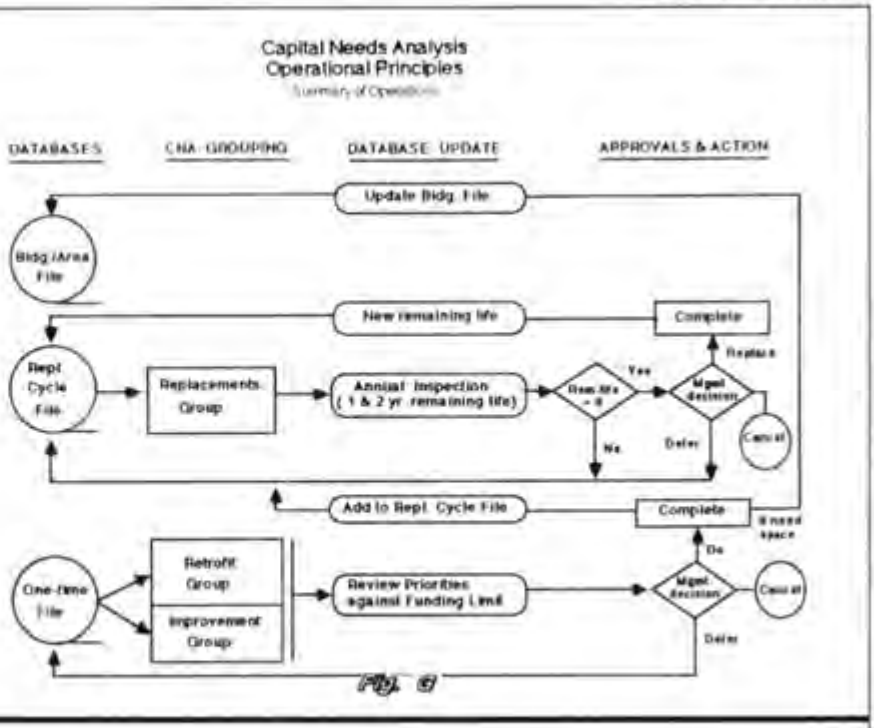

Fig. G

Fig. H

Fig. I

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capital needs study and integrates within a physical plant operation. One of the keys in managing a capital needs program is to have the flexibility to do what has to be done, when it has to be done. To allow for flexibility, three decisions are important:

1. *Fund*—flexibility to fund an item that is the highest priority where useful life has been maximized.
2. *Defer*—flexibility to defer projects with funding. The program needs flexibility so that the funding is coherent with expended useful life. The defer concept allows us to maximize useful life by deferring replacements if replacement is not needed, or to bring forward any items that may have been misjudged in terms of remaining life. The position of having to spend money causes poor management decisions.
3. *Cancel*—the decision; canceling an item helps keep the needs better in focus. Having the flexibility to fund, defer, or cancel any line item in the study data base gives management the flexibility to determine exactly what the real funding needs ought to be.

From the operational point of view, there are two files that need annual review and updating (see Figure G): 1) the replacement cycle file/replacements group items, and 2) the one-time-only/retrofit and improvement group items.

Replacement Cycle File The replacement cycle file items are updated as part of an annual inspection program. Each year an inspection consists of those items with one- and two-year remaining life. An inspector looks at those line items and suggests the actual remaining life. If the remaining life is zero, then the items are sent to management with a recommendation to replace, cancel, or defer the item. If the remaining life is greater than zero, meaning we still have additional useful life, the item is updated and put back into the data base to be brought up for another inspection. Management always has the option, after receiving the information from the inspector, to defer the item again. If management chooses to complete the item, then the life cycle year is put in the new remaining life field within the replacement cycle file data base.

Employees from the maintenance shops are the inspectors and provide management with information based from a maintenance point of view. In some cases experts are needed to help determine remaining useful life, such as in electronics or major mechanical systems. The great advantage to shops doing the inspections is the tying together of all maintenance information. We have learned that as management and inspectors work together a standard for replacements can be agreed upon.

A simple example: the inspector suggests a replacement of carpet. Management and the inspector together can determine the level of repair or when to consider a replacement. This combined effort has helped immensely in identifying the repair replacement standard for capital items. This approach is a significant part of the team building that has happened as a result of the inspection process. As replacements take place, the actual life cycle is stored for reference and used to evaluate future life-cycle replacements. We have noted that in almost every case we clearly exceed the recommended life cycle if proper maintenance has taken place. Figure H is an example of the inspection form used. Special note should be taken to parts A, B, and C of the inspection form. The information needed to assist management in making a better decision is to know the total cost (labor and materials), the estimate of remaining life, and the cost-per-year given the repairs, replacements, or upgrade. This isn't to say that the final decision results are made because of parts A, B, and C; but it does give additional information in making better management decisions. In many cases, the major repair of an item rather than replacing it is the most economical thing to do. The remaining part of the inspection information also assists management in decision making.

One-Time-Only File You will note in Figure G that the one-time-only file/retrofits and improvement groups are reviewed by priority against funding limits. As capital funding becomes available, the management and administration make final decisions as to when the one-time-only projects should be completed, cancelled, or deferred. If the item is deferred, it remains in the one-time-only file for further review. If the item is funded and completed, then its effect is added to the replacement cycle file. If the one-time-only project is dealing with new space, then the building/area file is also updated with the additional information. The key is that *all* one-time-only projects are evaluated as to their effect on the building/area file and the replacement cycle file.

Figure I represents the management goals, which have been established for each of the files and overall program within the capital needs program. The real success of managing the capital needs program has been our ability to take *the study, the information,* and *the adjustments* in the data bases each year (inspections and priorities) and have the flexibility to manage in a meaningful and practical way.

Summary

There are many ways to approach a capital renewal and replacement program. In this article I have attempted to identify the procedures and program at Brigham Young University. Hopefully, this information will stimulate ideas and thinking about a total capital needs program. The major success at BYU is the great administrative and financial support, as well as the overall concern shown for facilities and maintenance.

We received a scope and mission of what we needed to accomplish. We organized a study that included an inventory and an evaluation of that inventory. It assisted us to better manage our replacement items. From the study we were able to share with management specific information about capital needs. We were then able to incorporate within the physical plant operation a capital review program using inspections to update replacements and priority review to update one-time-only requests. The management flexibility of the program helped us learn what information was needed to make good, solid management decisions and maximize the useful life of replacement items.

The integrity and credibility of the program has gone a long way in establishing a trust and support for the program. As complicated as this may seem, it is actually a simple process. The use of computers has made it easier because of the mountains of information that are needed to make decisions. Probably the one aspect of the program that is critical and needs to be emphasized is that it is a *people-governed* system. The inspection process, the management decision, the information process, and the flexibility of deferring decisions to maximize useful life are all *people* decisions. The computer is a tool and enables us to organize the information, but it is people who make the capital needs program work at Brigham Young University. ■

Data Base Update

Project Management: What Can It Do for You?

This, the third in our series of computer applications, discusses programs specifically designed to accelerate tracking and controlling project costs. But getting a project into the fast track takes more than just good software.

Howard Millman

Most managers deftly apply project management (PM) techniques instinctively on every job: it's a classic characteristic of a capable administrator. In most instances it simply consists of identifying and logically scheduling the steps leading to a job's completion. Although these steps are usually based on the availability of labor, material, or money, the foremost concern is always time. The implication: save time and you'll save money.

Ordinarily, a project is laid out in a sequential chronological basis. First the wall is built, then it's painted. Often, projects aren't planned in their entirety. Enough work is scheduled for, say, a week. Then, near the end of that week, the next phase is planned. And so on. This kind of informal planning is okay for painting hallway corridors, but it's marginal for erecting a new building or coordinating a major renovation.

Traditionally, time tracking systems were usually progress charts. Often, that is still all that is required. But charts are oversimplified solutions to tough planning problems. For starters, progress charts are accurate only on the day they're made. They must be patched every time an activity slips or gains in time. And adding or deleting an activity further complicates matters. That continual updating is hair-graying drudgework in its purest form.

Yet another of the standard progress chart's limits is its inability to reflect competition for resources. Certainly, the availability of labor, material, or money plays a part in designing the original time frames. But as those resources are used, will their depletion significantly affect the job's progress?

That echoes the experience of Rich Loftin, supervisor of cost and schedules for Georgia Power Co. The enormous scope and complexity of designing and constructing nuclear power plants makes them ideal candidates for PM. In the days B.C. (before computers), Georgia Power's project management system was manual, as was all of ours. Now Loftin uses PM software to track the design, construction, resource depletion, and costs of the plants. "We achieve the same accuracy as we did with our manual system," says Loftin, "but now we do it in one quarter the time."

Computers are unequalled at updating repetitive data. In the Age of Antiquity B.C., schedule changes in major projects usually resulted in a 2" pile of eraser dust. Thus, applying the Critical Path Method (CPM), the bedrock of project management, was impractical until computers could choreograph the data juggling.

In its infancy 30+ years ago, the CPM was the exclusive domain of a mystic brotherhood. Back then only a select few understood the intricacies of programming. Now, while still popular for minis and mainframes, CPM also runs on ram-crammed micros.

Okay, so you suspect progress charts may not have the firepower you need for your job. At what point, then, do you start investing your time to design a CPM network?

Stan Pinska of Pinska Associates in Hastings, New York is determining that threshold for his architectural practice. Pinska, determined to harness the computer's timesaving speed, is creating design

CPM or PERT? What's the Difference?

Basically the *Project Evaluation and Review Technique* is a variant of the *Critical Path Method*. The major difference is that CPM expects you to reasonably predict and control an activity's duration. PERT provides far more flexibility in scheduling duration via a best, worts, and most likely time estimating technique. CPM is somewhat of a standard in the construction industry; PERT is better suited for more exotic missions.

My advice? Use CPM for building a structure on your campus. Use PERT for launching it into space.

and construction schedules for his major projects. But, with a hint of both irony and satisfaction in his voice, he notes, "Right now I'm so busy that finding the time to save time is a problem."

Harnessing the Computer's Speed: Qwiknet

How do you determine if your job calls for PM software? One way is by getting a fix on the project's complexity. As a starting point consider any project having ten or more trades and a cost exceeding $100,000 per candidate. Remember, this is an *approximate* guide. Yet another more accurate yardstick uses as its nucleus the number of separate events or activities in a project.

Qwiknet uses the Critical Path Method of scheduling. This simply means it analyzes the relationship between events based on logic and time. Truthfully, we all use CPM every day, usually for relatively simple tasks involving activities that are neither critical nor complex. But once the job's complexity expands past casual scheduling we need more firepower.

Christine Eyre, product marketing manager for PSDI, Qwiknets' distributor, feels that "it's the number of activities in a project that determines its complexity, not so much its dollar size." Qwiknet is offered in 125, 250, and 500 activity versions.

Large jobs are especially dynamic; problems and changes develop daily, which translates into juggling an armload of details. But don't sweat the details. Just remember that a computer with suitable software is unequalled at managing repetitious data. And Qwiknet's design measurably speeds and simplifies data manipulation. For example, Qwiknet includes a three button optical mouse to speed cursor movement and command execution.

The mouse's buttons are preprogrammed: the left selects menus and windows as well as executes Commands (Return), the middle summons a context sensitive Help message, and the right cancels the last command entered and redisplays the prior screen (Escape). Although the buttons usually evoke the same response in all applications, occasionally they are reassigned. As a reminder, a menu at the screen's bottom (the main menu is always at the top) displays the current function of the mouse's three buttons.

Using the keyboard in combination with the mouse allows you to create a Network. This is a two-step process: first you list the activities, next you define their logical relationship to each other. In other words, the material is ordered, the wall is built, then it's painted (and maybe repainted if you neglected to ask for a color choice first). Activities and logic can be added, changed, or deleted at any time.

The program, through a forward pass analysis, automatically determines the early start and finish dates for every activity in the project. Subsequently, a backward pass analysis then determines the late start and finish dates. It also computes float, in effect a cushion of time, for every event. *The events with zero float plus the longest duration is the critical path.*

After your activities and logic are in place your Network is complete. Now, as an option, you can include estimated, budgeted, or actual cost data. For example, say the project involves a per diem backhoe rental. If you run the backhoe three extra days, the project's cost naturally increases. If you keep the backhoe three days but you eliminate ten days of hand digging, you achieve a net cost savings. Now let's say these changes eliminate two weeks' warehouse charges for longer before they go on strike over a contract issue. . . .

Complicated relationship, isn't it? So let the computer do the work. You just tell it what to do, and let the program tell it how.

After your network is designed you'll need hardcopy printouts for distribution. Qwiknet prints out twenty different types of reports, each emphasizing one or more specific facets. You can, for instance, print the current schedule, target schedule, eight different bar charts, resource assignment, and even the entire network logic diagram. It all depends on to whom you're presenting your data and the level of information they need or warrant.

Additionally, Qwiknet offers histograms for resource graphing. Because histograms are glitzy bar charts, you will need a printer capable of handling graphics (most dot matrix can).

So far we talked about using Qwiknet primarily for keeping your project on the fast track. That's important, but what are some other advantages? Qwiknet also does the following:

- Allows "What if" forecasts based not only on dollars as a limited resource (spreadsheets do that equally as well), but also with labor, material, and time.
- Encourages anticipating instead of reacting to delays.
- Simplifies designing a schematic layout of the project.
- Enables visualizing intangible concepts as physical activities.
- Avoids the tedious updates required with manual tracking systems.

Qwiknet is convenient and comprehensive; sometimes it's also complex. To reap its advantages some training time at the keyboard is essential. However, backed by a thorough intelligent manual, an excellent tutorial, plus PSDI's helpful customer support, you can master its features at your own pace. ■

Availability:
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Management Resources

Diana L. Tringali

Design Competition

Recently, the University of Miami was looking ahead to future site planning and decided that a design competition would provide a good cornerstone for the campus master plan. They received fifty-two entries from eight countries, which covered a wide range of alternatives. They charged a $100 registration fee and received 200 registrations. The cost to the university was $35,000 for prizes, plus honoraria and travel expenses for the jurors. The university is also planning to sell a compendium of the entries to help recoup some of the costs. A panel of five judges reviewed the projects and helped select the entry that was most responsive to the university's needs.

Boiler Technology

Hampshire College has found a gas-fired space/hot water heating system that provides comfort year-round while saving energy and dollars. They converted three of the largest buildings to a multiple boiler system at a cost of $390,000. Forty percent of the campus energy needs will be served by the boiler network. In smaller, individually converted buildings, reductions of 72 percent in overall electrical energy use and 60 percent reduction in operating costs were realized for January 1986.

Pest Control Possibilities

Paramount Pest Control in Washington, D.C. is waging a new war on termites. They are using Ben, a termite-sniffing beagle. Beagles' sense of smell and hearing are so keen that they have been known to find as few as twenty-five live termites. A visual termite inspection costs $40 with no guarantee. But an inspection with the dog costs $150 and comes with a one-year guarantee. TADD Services, the California-based company that trains the dogs, says that there are thirty-five dogs working across the country with approximately one addition per month.

Telephone Techniques

A telephone at the Hilton at Walt Disney Village in Lake Buena Vista, Florida is not just a telephone. This is one of the first applications of a digital private branch exchange (PBX) telecommunications system in the lodging industry. Guests can control room temperature—heat, air conditioning, and fan speed—with the push of a button on the telephone. It also acts as a remote control for the television and as a security reminder should a guest fail to bolt the door. The system was developed by United Technologies Building Systems Company of Farmington, Connecticut.

The PBX system also has smoke detectors connected through it, which in the event of fire immediately notify the security station and can be used to broadcast to guests. The system also provides the hotel with control over energy consumption. When a guest leaves the room the temperature range automatically adjusts to reduce energy use and upon the guest's return restores the room to occupied status. The hotel uses it as a management tool as well. For example, cleaning personnel enter the room, key in to indicate the job is in progress, and when finished punch in another code to indicate the room is ready.

The Bookshelf

Improving Campus Telcom Service

Campus Telephone Systems: Managing Change, by the National Association of College and University Business Officers. Washington, DC.: NACUBO, 1985. 120 pp. $22 ($15/NACUBO members), softcover.

NACUBO has published a reference book on telephone systems that will be helpful to any university administrator. Campus administrators and consultants in telecommunications authored the seven chapters and provided a useful background for the changing telecommunications environment in the nation and on campuses.

"The Changing Telecommunications Environment" provides a most interesting summary of the history of AT&T. After Alexander Graham Bell invented the telephone in 1876 his two partners, Hubbard and Sanders, devised the philosophy of the Bell system: "Equipment could only be leased, not bought." Western Union viewed the telephone as a fleeting fad and turned down an opportunity to purchase the Bell Company in 1877 for $100,000! The general reaction to the "break-up" of the Bell System has been negative. The question asked is, Why break up the best telephone system in the world? The history of the company is described in an excellent summary of the divestiture agreement with the Justice Department in 1982, and one can see some wisdom in the action by the Justice Department.

Subsequent chapters are clearly written and provide guidance on managing change, selecting a consultant, financing a new system, and telephone system technology. As a followup there are case studies of a large institution (University of Tennessee/Knoxville) and a small institution (McPherson College). An eleven-page glossary of terms completes this excellent reference.

The publication certainly attains its goal of providing a book that "would give administrators (of higher education) an overview of a rapidly changing field."

One sentence in the chapter "Managing Change" puts the subject in focus: "Telecommunications management in the information age involves more than just telephones—it involves development of a particular attitude about information management, which is destined to become one of the most important industries for the remainder of the twentieth century."

Orders for *Campus Telephone Systems: Managing Change* must be prepaid and mailed to NACUBO, P.O. Box 35024, Washington, DC 20013. Purchase orders are accepted from NACUBO members only and should be sent to Order Desk, NACUBO, One Dupont Circle, Suite 500, Washington, DC 20036.

—Lawrence F. O'Neill, P.E.
Administrator of Physical Facilities
Washington University
St. Louis, Missouri

Text to Managing Maintenance

The Complete Handbook of Maintenance Management, by John E. Heintzelman. Englewood Cliffs, New Jersey: Prentice-Hall, Inc., 1976. 355 pp. $49.95, hardcover.

Maintenance management is certainly a prime responsibility of the head physical plant or facilities administrator. *The Complete Handbook of Maintenance Management* is a good general text that covers a broad subject area in this field. Even though it is not aimed solely at a university or college plant system, the majority of information contained within it is part of the daily routine of every plant's chief administrator. John E. Heintzelman brings to his book more than twenty years of experience in industrial maintenance management, and he has worked extensively as a consultant for both government and private companies. The text is well illustrated with more than eighty helpful forms, tables, and graphs. The book is broken down into five major management functions: planning, organizing, staffing, controlling, and directing.

Planning allows a manager to act rather than react as he or she uses foresight when making decisions. Planning must be given proper attention for it is one area that can greatly reduce the cost of a maintenance operation. Budgetary controls are a necessity for proper planning. Techniques are given for controlling cost to help quantify plans. To obtain the greatest efficiency, steps are outlined to plan a plant's level of maintenance effort.

Maintenance work must be properly identified and scheduled for a program to be truly effective. Various methods are given to identify work, including complaints, manufacturer and safety standards, periodic or preventive maintenance, work identification numbering, emergency service calls, foreman's inspections, formalized planning on minor and major jobs, and inspections by craftsmen and inspection groups. The most popular and successfully used job planning and estimating styles are detailed. Techniques are drawn from proven systems to help a manager devise a complete periodic maintenance program that goes beyond the preventive maintenance program that deals only with preventing equipment malfunction. Finally, the author looks at designing maintenance help features into new buildings to cut operating costs.

The next essential maintenance management function discussed is organizing. Activities needed to achieve the goals of the maintenance department must be consolidated together and delegated to the appropriate supervisor. Methods are given to help a manager save dollars and obtain the desired physical results through contracting. Areas of contracting discussed are for construction projects, janitorial, and groundskeeping services. Many helpful pointers for reducing costs of contracted janitorial services are given. The two basic contracts for janitorial services, cost-per-square-foot and purchased-labor, are shown. Most of the chapter on contracting groundskeeping maintenance stresses the importance of properly contracting landscape maintenance.

Heintzelman provides many useful techniques to help a manager establish control so that his or her plans can be carried out as intended. Various automated information systems are viewed, and the author gives step-by-step procedures that any maintenance manager can use to successfully design an automated maintenance information system. These steps include operations analysis, requirements analysis, design concept and specifications, program development and test, implementation, and evaluation. The author states that by following these steps a manager can avoid costly systems rework at a later date, which could cost 50 to 100 percent more than the initial investment.

The final section deals with the management function of directing. Directing helps tie all other necessary functions together through motivating, communicating, leading, teaching delegation, delegating, coordinating, orienting, supervising directly, and directing with unity of command.

The Complete Handbook of Maintenance Management is a readable book and is set up to lead the reader through a sequential development of a maintenance management program from beginning to completion. It is an ideal book for someone starting from scratch, or for someone revamping an entire or part of an existing maintenance program. A newly appointed plant director, his or her assistant, or even one in charge of the plant's building maintenance operation could very well find this a helpful text. The more seasoned administrator may find it a good review and may even find a few new and useful ideas for his or her own program.

The Complete Handbook of Maintenance Management is available from Prentice-Hall, Inc., Book Distribution Center, Route 59 at Brookhill Drive, West Nyack, NY 10995.

—Rick J. Beal
Chief Architectural Draftsman
Western Illinois University
Macomb, Illinois

Complying with Right-to-Know

Hazard Communication Federal/State Right-to-Know Laws. Chicago: Commerce Clearing House, Inc., 660 pp. $30, softcover.

This is a quick reference book of federal and state right-to-know laws with explanations. The book contains OSHA's hazard communication standard (29 CFR 1910.1200) in reproduced full text. Commerce Clearing House also provides full analysis both from their point of view and OSHA's explanations, enforcement plans and appellate court decisions on the standards validity.

The book also reviews the state hazard communication laws on regulations for each state and if the state law differs from the federal law the different provisions are analyzed. For states that have enacted the federal law with amendments, only the provisions that differ substantially from the federal regulations are reproduced.

The provisions of the federal hazard communication standard is to evaluate hazardous chemicals in the work place. The resulting information is to be transmitted by manufacturers, importers, and distributors by means of container labels and material safety data sheets. The employers currently affected by the standard are those in industrial codes 20 through 39. The decision by OSHA to limit the enforcement of the Standard to certain manufacturing sectors has been criticized and challenged in the courts by unions and public interest groups. The standard is now before the court of appeals for justification of limitation or further expansion of coverage.

Many states already have provisions through state and local community right-to-know laws enacted to protect employees from hazardous chemicals in the work place that are not limited to the manufacturing sector. This book helps to look at the problem of overlapping federal and state hazard communication requirements. The book provides for an analysis of federal standards with OSHA's guidelines for compliance officers. The analyses of court decisions apply to the laws as they stood October 1, 1985.

The book is useful in understanding the current maze of laws and regulations in an area of hazard communication and right-to-know that is getting more and more attention every day. The analysis is understandable and gives the reader necessary information to implement the OSHA 1910.1200 standard or applicable state laws and compare the difference in state and federal laws. The book also provides information as to the compliance officers' interpretation of the OSHA law.

The negative side of the book is that there is already available on the subject a lot of free or inexpensive government publications from your local OSHA office. Also, the state labor departments can help with state interpretations of community right-to-know laws. Most state labor and OSHA personnel are willing to discuss interpretations with employees or employers through telephone consultations.

For the person who does not have access to consultations on the laws and regulations or who has responsibilities in several states, this is an excellent reference book. It enables the reader to cross reference different state laws as they relate to the federal regulation. Hazard communication is here to stay and the person responsible for implementation of a hazard communication program would benefit from this information available in one easily understood publication.

Hazard Communication Federal/State Right-to-Know Laws is available from Commerce Clearing House, Inc., P.O. Box 5490, Chicago, IL 60680-9882.

—Linda D. Lee, M.S.
Safety Director
University of Arkansas for Medical Sciences
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Institute for Facilities Management (including special program on medical college facilities), January 4-9, 1987, Denver, Colorado. $675 ($575/APPA member institutions). To register or to receive a program brochure, contact APPA, 1446 Duke Street, Alexandria, VA 22314-3492; 703/684-1446.

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Proceedings of the 73rd Annual Meeting of APPA (Improving Management Through New Technologies). $21 ($15/APPA members) + $5 shipping/handling. Order from APPA, 1446 Duke Street, Alexandria, VA 22314.

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