

Section V

Operations and Maintenance

Some facility managers look at existing space as merely something to be tolerated until the next alteration. Some even shun operations and maintenance, perhaps because they think those functions tie them too closely to the boiler room. The fact is that in active companies, all space is in play at all times; it is being maintained, repaired, altered, or renovated constantly. Furniture is moved, exchanged, or replaced. New signage replaces old. Light fixtures are relamped.

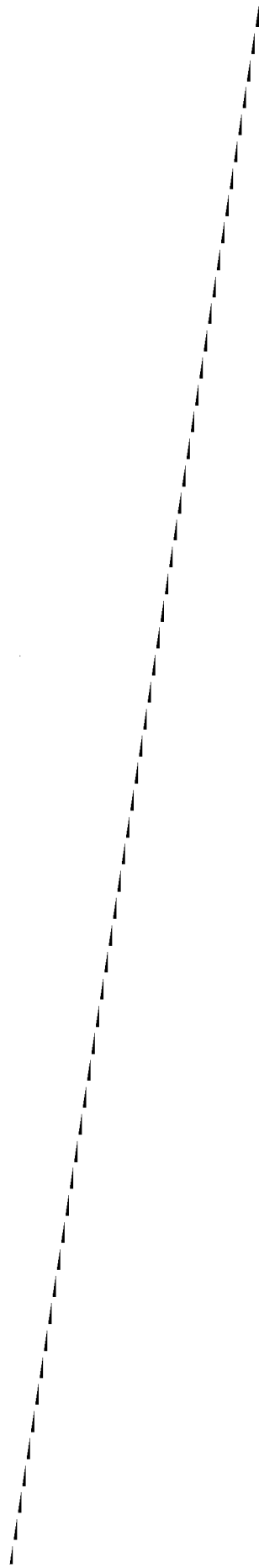
When I was an operations and maintenance manager, the facilities staff annually responded to over 50,000 service requests (30 to 35 daily just for moving) and corrected over 200,000 deficiencies under preventive maintenance.

This is a major effort that needs to be organized well and managed intensely. Operations and maintenance are big business and important business. There is no greater challenge than to provide quality services at minimal cost around the clock, which seems to be the standard against which operators and maintainers are judged.

Two issues have dominated operations and maintenance throughout my professional life. One is that maintenance and repair is consistently underfunded, often while companies are expanding their capital expenditures. A university facility manager supposedly said, "Everyone is anxious to endow a new building, but no one ever endowed a maintenance and repair contract." Studies that document the underfunding of maintenance and repair abound, particularly in the public sector, yet the situation seems just to worsen.

Second, because we have not consistently used life-cycle costing or solicited the advice of operators and maintainers during design and construction of facilities, we are faced with a bigger operations and maintenance challenge than need be.

As facility managers have downsized and outsourced in recent years, it appears to me that they have both outsourced and downsized operations and maintenance functions to a greater degree than the other functions of facility management.



13

Work Coordination

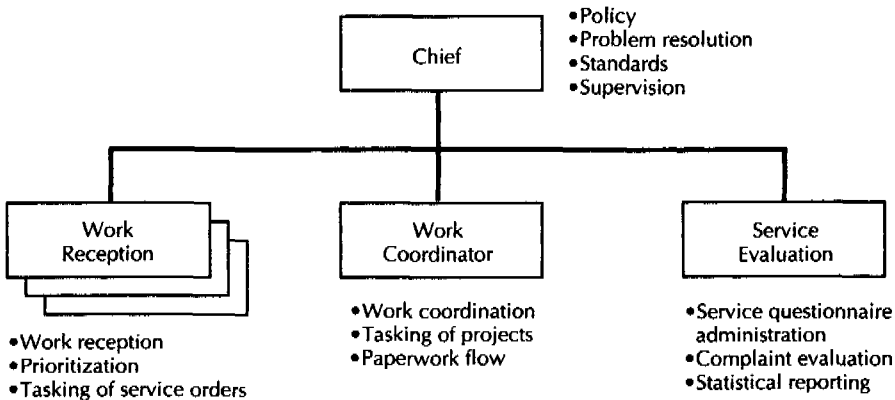
Pulse Points

- *The work reception center is the facility department's eyes and ears, receiving requests and prioritizing work.*
- *The work reception center can be the means to control and manage a charge-back system.*

As vice president of Facilities West, the late Art Hahn, one of my professional heroes, promoted good facility management through what he called pulse points, or critical operations. One of these pulse points is the *work reception and coordination center (WRC)*, the eyes and ears of the facility department. It is the single point where all, or nearly all, facility services are received, prioritized, tasked, coordinated, and evaluated.

No matter the size of the organization, the WRC can provide a full complement of services. In the smallest organizations, the WRC is often the assistant to the facility manager. In large organizations, the WRC may be a separate work unit (see Exhibit 13-1). Managing the WRC is a high-stress job requiring frequent breaks and probably rotation after a period of time. One way to relieve battle

Exhibit 13-1. Work reception and coordination center.



fatigue here is to hire service receptionists from a temporary agency and rotate them after about six months. Another approach is to rotate a mix of nonmanagerial technical staff through the WRC on three-to six-month details. The latter builds widespread mission appreciation within the entire organization.

Under one operating concept, employees trained in telephonic techniques operate within a rigid framework, normally a checklist. The stress here is on accurately gathering and passing on information to the appropriate service provider. The second approach is to employ service receptionists who understand completely the operations and nuances of the facility department. On the surface this would appear to be preferable, but it tends to reduce the volume of requests that can be handled and occasionally causes conflicts because the service receptionists start to make judgments beyond their knowledge.

Excellent WRCs can operate under both concepts; whichever is used, training and quality control are essential. If the work receptionists are not controlled, management decisions will be usurped, with the facility manager unaware.

Equipped with the proper automated system, the WRC can also be the center for the invoicing of all chargebacks. Some facility managers have made their WRC the chargeback enforcers. By its nature, it is at the core of the gathering of information for calculating unit costs and benchmarks. If the department is so equipped, the service orders for all preventive and cyclic maintenance can be both generated and closed at the WRC. Finally, it should be the hub of the department's service evaluation.

Work Prioritization and Flow

The premise of a WRC is that the receptionists have the authority to task the routine work of the department. Priorities vary from organization to organization and from time to time; however, most WRCs prioritize work by criticality, dollar value, and complexity.

Prioritization by criticality involves determining whether work requested is needed to protect life or property (priority 1), is detrimental to operations (priority 2), or is routine (priority 3). Typically, priority 1 requests are handled immediately by telephone. Priority 2 requests are tasked on a written service order and the work accomplished within one workday. Routine service orders (priority 3) are also tasked by a written request, with the work accomplished in three to five workdays.

Prioritization by dollar value is purely a policy matter, and recognizes that, above a certain level of funding (say, \$1,500 to \$2,000), management and/or the design team scrutinizes the assignment before it is tasked. Another somewhat more complicated alternative is to limit the effort (one to two workdays, typically) that can go into a service order.

Prioritization by complexity is also a matter of policy. Typically, any task that changes the form or function of the facilities is not immediately tasked for implementation, even though the dollar cost may be small. It is first sent to the planning and design division. For instance, frequently all electrical service orders are

passed through planning and design regardless of implementation cost, since out-let installation can have far-reaching effects.

An effective method of screening requirements before they reach the WRC is to appoint a mayor for each building or a facilities point of contact (POC) for each major element; some large organizations use a combination. For instance, the POC in each department screens requirements and passes them on to the mayor of the building. There are advantages to this system, but it can add an unnecessary level of bureaucracy if the POCs and mayors are not empowered to reject frivolous requests and are required to prioritize the requirements.

It is also extremely important that work flow be properly established. Proper work flow ensures that 90 to 97 percent (by volume) of the work of the facilities department is handled routinely. That allows the facility manager to concentrate on the 3 to 10 percent of the work requiring managerial intervention. One of the signs of a facility department in trouble is that staff members call the facility manager directly to resolve routine work requests. Another sign is more than one point of entry for work coming into the facilities department.

Exhibit 13-2 shows the entry and distribution of work within a typical facility department. Exhibit 13-3 is a detailed work flowchart for routine service orders.

Procedures

The WRC is the driving force behind all routine work in the facilities department. Since this work constitutes such a high percentage of the department's mission, it is important that it be done well. While each organization has its own unique requirements, there are common procedures. For example, the WRC should have

Exhibit 13-2. Work flow within a typical facility department.

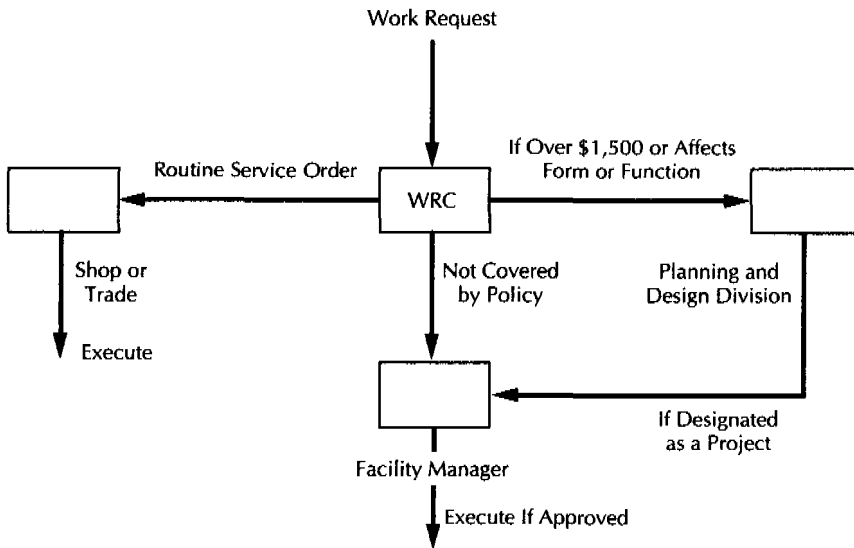
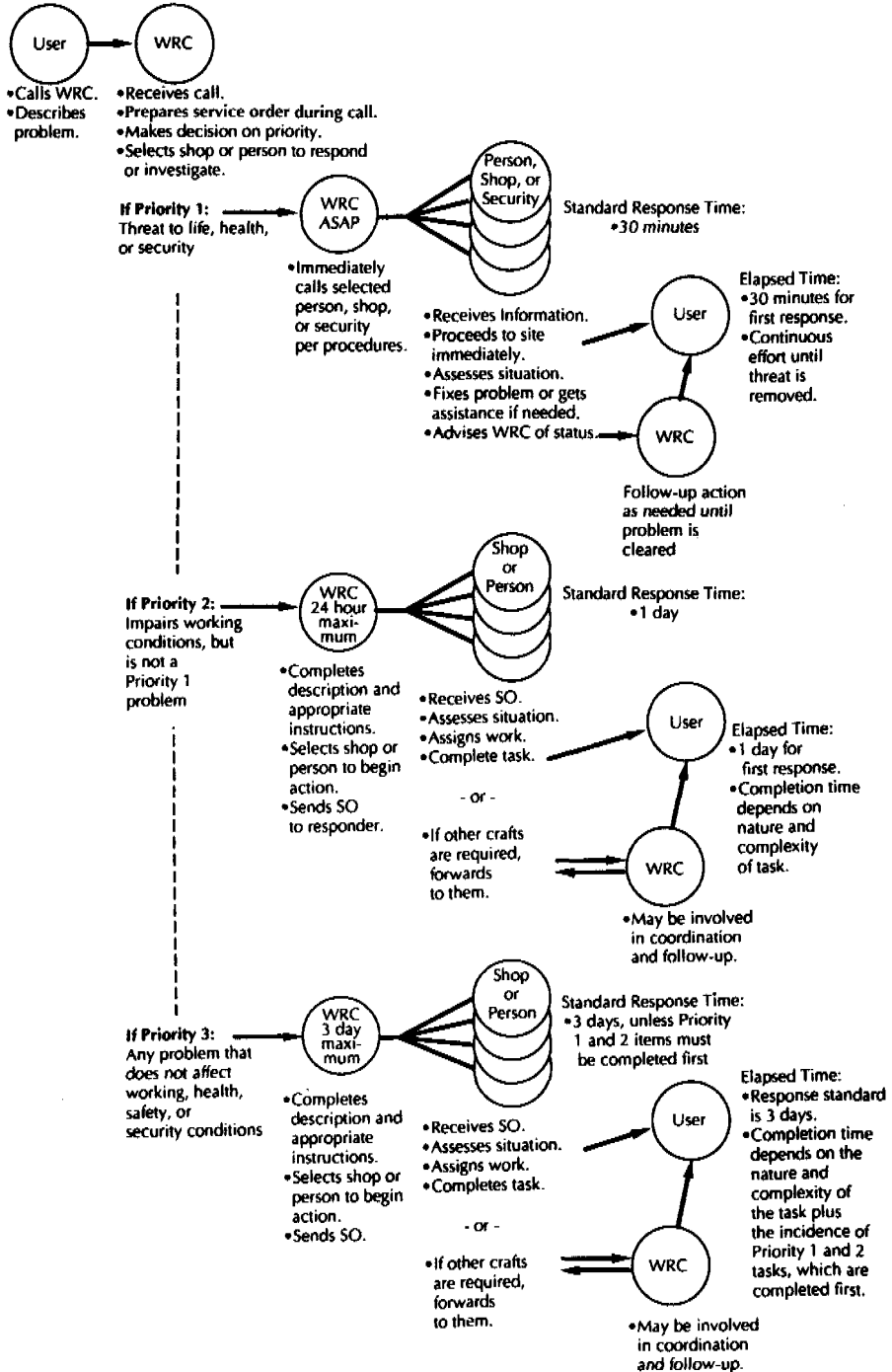


Exhibit 13-3. Simplified current work flow call to work reception center.



the capability of receiving work requests twenty-four hours daily and be staffed one half-hour before and after normal duty hours. Stagger the work hours of the receptionists or use other operational personnel in addition to the regular receptionists.

It is now very common for the WRC to receive facility requests through e-mail. A macro is provided on the company intranet to ensure that all information that is needed is collected systematically. One university is trying to use the Internet to network its widespread campuses to the WRC in the facility department.

Also, it is counterproductive to spend great effort confirming whether those requesting work are authorized to do so. At one time I required almost all requests be in writing and signed by an officer of the company; only a few services could be requested by phone. The service reception center had a book of authorized signatures against which to check. We were literally buried in paper. Faced with the prospect of either increasing WRC staffing or falling further behind in processing the requests, we eliminated the paperwork and converted to almost 100 percent phone requests. The only requests now requiring paperwork are signage, so that the name is spelled correctly, and furniture, because we cannot meet the requests for six to eight weeks and it is easier to file paper.

An answering machine is a must, because a good WRC frequently has a queue for service. The answering machine should be capable of tracking the following items:

- Total number of calls
- Number of calls answered within a specified number of rings
- Average waiting time
- Number of calls not completed (the caller hung up)

All incoming calls should be answered within two rings or get a recording informing the person that the call is on hold and offering an option to call back at a less busy time. If the WRC requires certain information, the caller should be so reminded at that time. Callers on hold should also be reminded every twenty to thirty seconds that the next available work receptionist will take the call. Some WRCs tape all incoming calls; check with the legal department before doing so to ensure compliance with company policy and local law.

Decisions concerning seemingly small matters can sometimes make a real difference in the quality of a WRC. For example, what is an appropriate background sound for callers on hold? Our preference is for easy listening music, but others have had success with all-news radio or company information bits. We have found it most efficient for work receptionists to use telephone headsets, freeing both hands. That becomes even more important with increasingly automated workstations.

Staffing the WRC is subject to many variables. Even if there is only one work receptionist, that person needs breaks—extended ones. Otherwise fatigue and stress make the job unappealing. The justification for additional staffing is often documented in the log of the telephone answering machine. If the average wait

time, the number of calls dropped, or the response time exceeds management's standard, more staffing is probably justified.

Work Coordination

The WRC must coordinate all work: preventive maintenance, cyclical maintenance, maintenance and repair projects, service orders, alteration projects, and capital projects. It is a facility manager's nightmare, for example, for a wall to be painted under cyclic maintenance two days before it is demolished as part of an alteration project. Not only is this wasteful, but it destroys the department's credibility. Work should be coordinated with other service organizations. The WRC should be aware of all conferences, parties, facility projects, and after-hours activities so that proper support and no conflicting activities will be scheduled. In a large organization, a particular individual should coordinate work, control the flow of paperwork through the facilities department, and task all nonroutine work. In a medium-size organization, this individual can also handle service evaluation. In a small organization, the amount of work can be small enough so that the facility manager or work receptionist can also function as work coordinator. (For additional guidance on aspects of work control, see David R. Howard, *Critical Issues in Facilities Management; Work Control*.)¹

Work reception and coordination is one of the facility management functions most often automated (56 percent) but its rate of automation seems to have slowed.² There are many excellent systems that allow the work receptionist to task the appropriate shop directly using an automated service order. Once the work is completed, the shop enters the time and materials expended, and the service order is closed. Preventive maintenance and project work can be similarly automated. The system can print out expenditures to date by shop, by service-order number, by budget code, by building, or by organization. In modern organizations, there is a separate printer and PC in each shop so that service orders can be processed there.

Service Evaluation

The WRC is in a unique position to evaluate service, both quantitatively and qualitatively. For service orders, I recommend the following quantitative evaluation each month:

1. By shop, evaluate
 - Service orders carried over
 - Service orders received
 - Service orders completed monthly and year-to-date
2. By shop, by priority category, evaluate
 - Number completed within time standard
 - Number not completed within time standard

To measure service-order performance qualitatively, send questionnaires to approximately 30 percent of the service recipients. Another approach is to target one to two buildings or organizations each month. The results of these questionnaires can be compiled and reviewed monthly, quarterly, and annually along with quantitative results.

Custodial services are measured qualitatively by questionnaire—similar to service orders.

Projects normally are evaluated using a postoccupancy evaluation or with a special questionnaire. Quantitatively, projects are evaluated on whether budget was met, schedule was adhered to, and the program was met. The WRC can administer project evaluation as a matter of administrative convenience, but it is probably best evaluated by the planning and design division or directly by the facility manager.

The importance of the WRC in customer relations cannot be overemphasized. Since 90 to 97 percent of the department's work flows through the WRC, its image is largely determined by how courteously, effectively, and efficiently work requests are treated. The work receptionists must be courteous and diplomatic, even when staff calling in work requests are not. They must be able both to give the status of requested work (automation helps immensely here) and understand the implications of even the most innocent request. Your local phone company (and some communications consultants) can provide in-house training to help work receptionists both maximize their use of time and improve their telephone etiquette. The training is well worth the cost.

Notes

1. David R. Howard, ed., *Critical Issues in Facilities Management*, vol. 2 (Alexandria, Va.: APPA, 1988).
2. "Facility Management Practices," *IFMA Report 16* (Houston: IFMA, 1996), p. 24.

14

Facility Operations

Pulse Points

- *Facilities operations is a multidimensional function, requiring solid management skills.*
- *Disaster recovery has major facility complications but should not be managed by the facility manager.*
- *Managing the company's environmental program can provide visibility to the facility manager.*
- *Indoor air quality may become a major environmental issue.*

Most facility management literature gives either of two impressions of facility operations: it does not exist, or it is a big machine that is turned on daily and operates smoothly with little or no funding, problems, or management attention. Neither could be further from the truth. Facility operations is a multidimensional function of facility management. It's often the forgotten function, but good management and organization ensure that 95 to 97 percent of problems are solved so that management can focus on the 3 to 5 percent of problems that truly need their attention. The truth is that facilities operations account for 50 to 75 percent of the facilities budget.

Facility operations includes these areas:

- Plant operations
- Energy management
- Hazardous waste management
- Recycling
- Inventory management
- Communications and wire management
- Alterations management
- Relocation and move management
- Furniture installation
- Disaster recovery
- Maintenance and repair

- Security
- Fire and life safety

Maintenance and repair are discussed in Chapter 15; fire and life safety are covered in Chapter 16.

Plant Operations

Of all facility operations, the one function most commonly relegated to the back burner is plant operations. That is unfortunate because there is nothing back burner about modern plant operations. A bright, highly proficient operating engineer bemoaned recently that plant equipment had evolved much more rapidly than had the education and licensing requirements for operating engineers. The skills he *really* needed were in electronics with some basic computer skills, whereas he had been trained in the traditional steam fitting, sheet metal, and plumbing skills.

There is no absolute definition of *plant*, but for the purpose of this book, consider the plant to be made up of the following systems:

1. Heating, ventilation, and air-conditioning (HVAC)
2. Mechanical and electrical vertical and horizontal transportation
3. Major electrical
4. Emergency power
5. Plumbing

In North America, the energy crisis of the early 1970s precipitated a revolution in building systems. Concurrently, computer-controlled building systems were just reaching the market. Together they made it possible, for a relatively modest capital cost, to provide individualized environments to a degree never before possible, at a substantial savings in both cost and size of the plant. Today it is not uncommon to see the HVAC system of large complexes controlled by a personal computer that also troubleshoots the system and provides a historical record of its operations. Such systems are commonly co-located with fully integrated fire and life-safety or security systems.

Historically, buildings have had their own engineer, be it a jack-of-all-trades. Some have even had a second maintenance mechanic. During the late 1970s and early 1980s, however, it became increasingly popular to gather all building operations staff under central control and dispatch them where and when needed. As a result, little preventive maintenance was done, the occupants felt deserted, maintenance was ignored to accomplish project work, and intimate knowledge of the building was lost.

Today, it is felt that some type of resident facility management technical staff is best for all occupied buildings over 250,000 square feet. For large complexes, there is controversy over how to organize the plant operations staff. Many departments have their own operating engineers, but increasingly this function is being

contracted out. One possible way to organize a plant operations unit is shown in Exhibit 14-1. Note that elevators are part of the operating plant. It is a good match since elevators are electromechanical equipment.

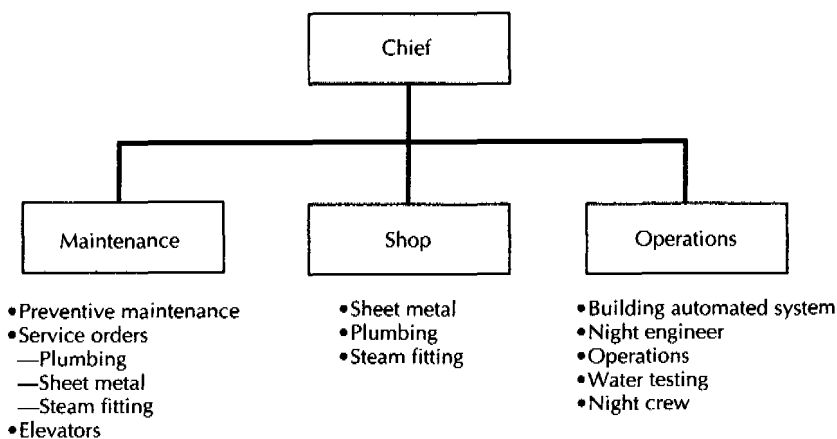
The plant operations function has perhaps the most routine tasks, but that does not mean they are not important, even critical, to facility operation. Unsatisfactory heating and cooling is the most common building complaint in office buildings. If the chief executive officer (CEO) is trapped in an elevator or Legionnaire's disease breaks out among the staff, the critical nature of plant operations immediately becomes evident.

The key to cost-effective plant operations is a solid, continuing energy management program and centralized building management. The former is discussed in the next section of this chapter. As for the latter, it is possible to operate an automated building maintenance system (BMS) under two different philosophies. The most cost-effective system has one individual (not necessarily even a knowledgeable one) monitoring all building systems from a central location manned twenty-four hours a day. That individual recognizes problems as displayed on a computer screen and notifies the appropriate operations personnel for corrective action.

The second approach has building functions monitored separately. In the most common arrangement, there are both a security operation center (also covering fire and life safety) and a building operation center, with these functions monitored by technical experts. This latter allows a higher degree of initial technical input but also is more costly.

Most new building designs incorporate an automated building maintenance system. It is also possible to retrofit these systems into existing buildings. Control points, detectors, and computer capacity can be increased incrementally as funding and installation capability become available. Several companies make total building systems, and each year more features are added, especially with the move to individually controlled environments.

Exhibit 14-1. Organizing for plan operations.



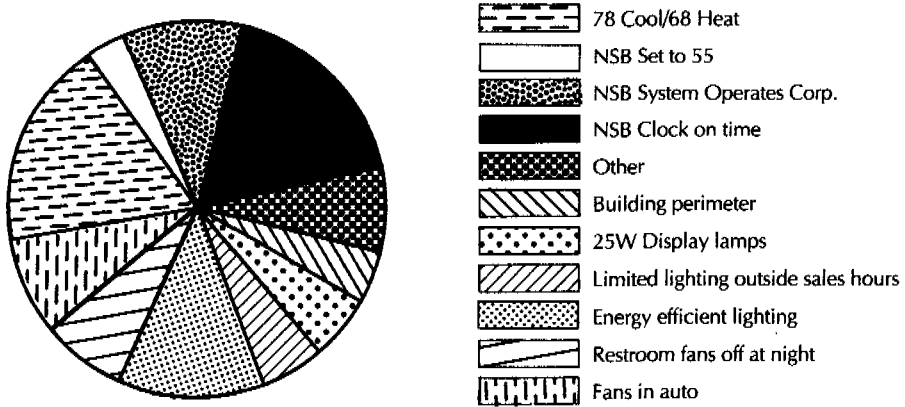
Energy Management

Energy management is not a separate function but rather an activity that spans every facility system. Modern energy management had its genesis in the oil crisis of the early 1970s. Two results came from that crisis: remarkably more efficient (and smaller) energy-consuming equipment and an understanding that energy is a major cost element and needs to be contained. The sudden appreciation for energy undoubtedly was a factor in the rise of facility management as a profession. The person who paid the light bill suddenly became an important corporate player.

Some of the impetus of the 1970s has been lost as oil prices dropped. Even some of the mandated public-sector measures are largely ignored. At most, traditional energy management now appears confined to measures that can be designed into new facilities, which have no effect on company employees, or are implemented by substituting energy-efficient equipment for older equipment. That is unfortunate because, from a baseline that represents no real effort at energy management, savings and cost avoidance of 30 to 33 percent are possible with a good energy management program. Some of the potential savings are displayed in Exhibit 14-2. One consultant I have heard speak feels savings and cost avoidances in excess of 90 percent over the status quo are possible.

There are many techniques and devices for energy management that have proved effective. The following are elements of a good energy management program:

1. The organization of the program is based on responsible committees to set policy and sell the program.
 - Appoint an energy manager responsible to the facility manager.
 - Have two levels of committees: a steering committee chaired by a senior manager with membership of the budget director, the facility manager, and two or three line managers, and a technical committee chaired by the facility manager.
 - Appoint the senior administrative person in each department responsible for user-dependent energy management matters (for example, turning off the lights) in that department.
2. All policy is developed by the technical committee, approved by the steering committee, and signed by the CEO. To be effective, energy management must be perceived as a management program, not a facilities program.
3. A detailed energy consumption baseline is established for each utility. Consumption against this baseline should be calculated at least annually to track progress. Utility companies will assist in these analyses.
4. A hierarchy of energy management measures is implemented:
 - Capital intensive (payback less than seven years suggested).
 - Moderate cost (can be budgeted in annual budgets with no significant effect).
 - Low cost or no cost.

Exhibit 14-2. Energy saving potential.

Item	1 MW = 1000 KW MWH/Year	Electricity = \$68/MW \$/Year	% of Total
1. Night setback (NSB) system			
• Operates correctly	1,556	105,800	8.6
• Clocks on time	3,377	229,600	18.6
• NSB thermostats set to 55	211	14,300	1.2
2. Temperatures: 68° heating, 78° cooling	2,847	193,600	15.7
3. Fans in "auto" and operate correctly	1,972.2	134,100	10.9
4. Restroom fans off at night	1,235.2	84,000	6.8
5. Energy-efficient lighting	3,250	221,000	17.9
6. Minimum lighting on prior to opening	1,086.2	73,900	6.0
7. Outside lighting off when unnecessary	696.4	47,400	3.8
8. Display lamps all using 25 watts	768.7	52,300	4.2
9. W/H restroom, cage room lights off	121.8	8,300	0.7
10. Tight-fitting weather stripping	122.4	8,300	0.7
11. Truck doors kept closed	352.6	24,000	1.9
12. Dock seals installed	30.9	2,100	.2
13. Compactor doors kept closed	26.4	1,800	.1
14. Hot water heater set to lowest temperature	45.4	3,100	.3
15. Pneumatic tube system off when not needed	39	2,700	.2
16. Conveyor off when not in use	136.8	9,300	.8
17. Small orders received through driver door	293.8	20,000	1.6
	18,168.6	1,235,500	100%

Source: Lloyd J. Vye, "Best Products Reduces Utility Budget by Millions," *IFMA Journal* (April 1989): 14.

5. Energy management is incorporated into all designs, and all new designs are reviewed from an energy management perspective.

Nearly 60 percent of facility managers continue to practice traditional energy management measures such as thermostat regulation and investing in energy-efficient capital equipment.¹ However, the electric power industry is currently in the midst of deregulation. Although it is unclear how this will play out, deregulation could offer large facility departments a real opportunity. Most observers believe that direct access to the electrical generation market (commonly referred to

as retail wheeling) will take place over a period of time, although it is well under way in some states.

Increasingly, companies will be developing an energy strategy with particular emphasis on leveraging whatever volume advantage a firm has to obtain more favorable terms from privatized suppliers. This development is not without drawbacks. *Caveat emptor* now becomes the cardinal rule when purchasing energy, just as it is with any other commodity in a free market. Although there may be a price advantage to large users, facility managers must now worry about the quality of electricity provided, guarantee of source, and price stability. There are other concerns that small users will get left behind and also that the price of inefficient plant will have to be absorbed by someone (hopefully not your company).

Depending on the sophistication of a company's current energy management and its ability to exercise some muscle in the market, facility managers and their companies stand to reap some real benefits. Already, utilities are downsizing and cutting costs so that they will be competitive in a deregulated market; industry consolidation, if controlled, should have the same effect.

Increased competition and marketing should work to facility managers' advantage. Cost savings may not be the only fallout of energy deregulation. In addition, value-added services (maybe the utility will actually own and maintain a company's chillers and boilers) may be intriguing to certain facility managers. Finally, a nearby co-generator may be willing to sell energy at below-market rates to absorb excess capacity. All of this can be confusing, if not outright scary. In order to manage this process, Wayne Robertson, director of energy consulting at Heery International, suggests the following actions.²

- Build a team; at first you may need to depend upon a consultant.
- Evaluate facility requirements using an energy audit.
- Actively seek out your utility to ensure that they notice you.
- Seek package discounts and rate incentives.
- Form or be involved in a users' group.
- Aggressively seek rate options.
- Perform a co-generation study and design.
- Evaluate peak shaving generation and gas cooling opportunities.
- Look for local co-generation projects.

By moving aggressively now, the facility manager may establish a structure to permanently reduce energy operating costs.

Energy services companies (ESCOs), most of which are former electric utilities repackaged to provide an array of energy services, offer the facility manager both new products and services. ESCOs now provide resource planning software, energy conservation products and services, on-site energy systems, and retail-wheeling advice. The extent to which ESCOs give truly independent advice is yet to be determined, but they certainly provide expertise to facility managers that was not generally available before deregulation.

Hazardous Waste Management

This topic includes a variety of management challenges, from abating asbestos to disposing of contaminated medical waste. The recommendations alone could fill a book.

Asbestos

By far the most common hazardous waste is asbestos. After much nervousness, even panic, facility departments have learned to cope with asbestos and approach its abatement in a commonsense manner. It is possible to abate asbestos and to continue operations in the same building. The following are trademarks of a good asbestos abatement program:

1. Appointment of an abatement operations and maintenance manager.
2. Training of an in-house abatement crew or hiring of a reputable contractor. (I strongly favor the latter.)
3. Securing the services of an environmental hygiene firm to do independent testing. This firm preferably does not work for the facility manager (suggest the health or human resources department), which ensures its independence.
4. Establishment of abatement files as follows:
 - Historical record of all abatement efforts
 - Air quality reports following each abatement effort provided by the hygienist hired by the contractor to do testing.
 - Record of procedures on each abatement site.
 - Disposal record from the disposal contractor.
5. Enactment of an internal relations program for staff that is both general and site specific. The independent environmental hygienist can be an excellent instructor.

The best arrangement has the contractor mobilize within a certain time to abate asbestos against previously approved rates. Some facility managers have one such contract (this ensures uniformity of abatement); others use two or three contractors so that one is always available when the need arises.

Some facility managers hire a contractor, often using the lowest bid, and then adopt a "see no evil, hear no evil" philosophy about the handling of asbestos waste. It is a managerially unsound approach and can place the company in legal jeopardy should improperly disposed asbestos be traced. Contrarily, there are both good contractors and good consultants. It is unnecessary to hire someone who tries to bully or frighten you with horror stories. Hire a contractor (or consultant) who will be responsive and will work both to protect the health of the staff and minimize disruption.

Do not fear asbestos; manage it!

Other Waste

Many facility managers are faced with handling either hazardous manufacturing or medical waste. Fortunately a company that handles medical waste normally also has the knowledge and experience for proper storage and disposal. Perhaps in no other area is the old saw, "If in doubt, do it right," so applicable. In the past some organizations have simply turned over their waste to a disposal contractor and washed their hands, without concern for proper disposal or interim storage. That is not only bad management but runs counter to public concerns and legal trends. Protestations that the contractor erred will not even be heard. To protect the company:

1. Have competent legal advice for dealing with hazardous waste issues.
2. Hire a waste management contractor with a proven track record.
3. Use an environmental hygienist, preferably hired by your medical department, to monitor your in-house and contractor's handling, storage, and disposal of hazardous materials.

For a discussion of the relatively new regulations facing so-called small (waste) quantity generators, see "Complying with Hazardous Waste Regulations," in the *AIPE's Guide to Better Facilities Management*.

Recycling

Recycling remains one of the functions most affecting facility management and is expected to have a high priority in the future.³ Based on anecdotal information, there still seems to be too much instability in markets and imprecision in laws to manage recycling effectively. However, several facility managers have made a name for themselves within their company by actively pursuing, normally with employee input, an aggressive recycling program.

Initially, you may need a half- to full-time person to establish a proper recycling program and oversee implementation. (The recovery of valuable by-products from industrial processes is not what is being discussed here. Normally their capture and reuse is under the purview of the vice president for manufacturing.)

Most recycling consists of segregation and either resale or disposal of the segregated products. Commonly, waste is segregated as follows:

1. Paper (newspaper, white paper, all other)
2. Aluminum cans
3. Glass bottles and jars (clear, green, brown)
4. Scrap metal
5. Styrofoam
6. All other

Most current programs segregate only three to five of these products at the facility level, with all other waste going in the "all other" category for disposal.

Recycling is not cheap (\$5 to \$20 per employee for initial containers). Often in urban areas, interim storage space or extra segregated dumpster space simply is not available. Personnel to segregate waste is an additional expense. But some companies have worked with local agencies to employ the disabled for this chore.

Unfortunately, many facility managers who have tried to be out front on recycling have experienced frustration. For example, some who funded the additional costs of recycling from the sale of paper have seen the bottom drop out of the paper market as more and more companies turned to recycling. Large organizations should consider cogeneration of waste materials if it can be cost justified and if the facility is in an area where the stack effluent will meet Environmental Protection Agency (EPA) standards.

Some degree of segregation is needed at the workbench, production line, and desk level. Generally the facility manager is expected to provide the three Ps: policy, the proper container, and pickup. However, the program will be suboptimized if viewed as solely a facility department's program and responsibility. Company management must support the recycling effort for it to be successful.

Despite the cost, the often confusing nature of the legislation, the lack of markets for many recycled products, and the additional space requirements, most companies realize the need for recycling and are making an honest attempt to implement a program.

Indoor Air Quality

Indoor air quality could be the Achilles' heel of facility managers. Many buildings have been constructed so that air quality cannot be adequately controlled. In the traditional office building, for example, temperature can often be controlled only by zone. In order to reduce operating costs, the amount of fresh air (and humidity) brought into the building with each change of air has been severely limited. Often ducts are filled with fungi, dirt, and dust (which is stirred up each time the ductwork is modified), and filters are often ineffective for the type of dust and pollen to which employees are allergic.

A new announcement of federal indoor air quality standards has seemed imminent for the past several years but appears to be hung up politically at the EPA. Nevertheless, indoor air quality problems will only increase, regardless of more stringent regulation. Facility managers need to adopt a program that emphasizes good operational practices (better space layout, for example), improved maintenance practices (better custodial cleaning, for example), as well as capital investment to correct past problems.

Employees will continue to insist on more control over their indoor environment and better air quality. In the long run, providing better air quality can lead to better employee efficiency. This is an area where facility management can contribute to the bottom line.

Inventory Management

An accurate inventory of facility property has two purposes. First, managers like to have an accurate count of what they manage. Second, for tax purposes it is necessary to know what furnishings and equipment of what vintage are on the books so that they can be depreciated properly.

In general, the rules for inventory management are not made in the facility department. Inventory management is much like purchasing or procurement—vitaly important but dependent on policies and procedures most often set by others. By far the facility manager's greatest involvement is with furniture inventory (74 percent), with 62 percent responsible for furniture disposal and 35 percent responsible for the disposal of other property.⁴ The inventories to manage these functions can be maintained through a number of methods, the most promising of which is bar coding.

Bar coding is a technique to affix a number to a piece of property in order to track its physical location and create a file on that piece of property. A handheld scanner can download information into a computer and track individual pieces of furniture, certain types or components of furniture, furniture from a certain manufacturer, or even standard furniture sets. Bar coding the locations also makes it possible to maintain inventories easily; some manufacturers even offer their products bar coded.

While bar coding is moderately expensive, it is efficient and effective for inventory management in mid- and large-size organizations. Implementing a bar code system requires a well-thought-out inventory schema and a good bar coding system.

The principal considerations for implementing a bar coded inventory system are as follows:

1. What is the degree of detailing desired in tracking? Units? Assemblies? Parts? Once the numbering system is set, stick to it.
2. Will color, fabric, or condition be described? That may dictate the system.
3. How will locations be defined? Are those locations understandable to designers? To users? Others may want to tap in to the inventory for their needs.
4. Will the inventory be differentiated regarding depreciated value, owned versus leased, and other factors? If so, a smart code may be needed in the bar code.
5. How will the initial tagging objectives and strategy be done? Some staff object to having their furniture tagged unless they are present, yet waiting for their presence slows the process. Placement of the bar code on any single piece of furniture must be consistent and accessible yet aesthetically acceptable.
6. How will the information be updated? Establish an update procedure.

Properly managed bar coding can allow management of property from acquisition through disposal.

Of course technology may be changing this. The high costs of manual inventory procedures will eventually make way for laser bar-code reading and direct input into a computer database. This will allow an up-to-date inventory of furniture in use and available for distribution. Then reliable inventory printouts will be more important. Also, fallout from unfriendly takeovers will force company financial officers to change the way furniture is accounted and inventoried (from a depreciation schedule inventory to an assets listing inventory). In this way, a current, accurate valuation of total assets is possible.

Communications and Wire Management

Slightly more than half of most facility managers manage telecommunications.⁵ That may present a problem because no other function in this information age has such a profound influence on facilities as data and telecommunications work.

For years the communications function consisted of paying the telephone bill to the local phone company. Suddenly this function has become one of the most dynamic, largely owing to deregulation of the phone system, increasing computerization of business functions, and interconnections of computers through hardwiring or the telephone system.

Communications is where the information systems department and the facility department come together. The communications function is as likely managed in the information systems department or as a separate division than in the facility department. This is because, to the information services department, the communications system is the electronic highway over which information flows. To the facility department, the communications system is a major user of space (antennas, risers, file servers, modems, closets, and wire trays), requiring additional trades on projects, and a set of wires and outlets that must be accommodated and that restricts layout flexibility. But no matter where the communications function is placed, there must be close and continuous coordination, starting with planning and design. Generally communications engineers, particularly those with a voice communications background, have not been trained to design and document their wire installations to the degree other building elements are planned and designed.

There is a legitimate debate within facility management concerning the degree to which communications should be documented. Should communications wiring and devices be drawn, or should they be documented by alphanumeric schedules? Should all communication runs be depicted, or should only termini be shown? Or is the best system some combination or permutation of the above?

My preference is for documentation in the form of drawings of the following:

1. All communications risers
2. The type and location of outlets unless standardized
3. The location of all equipment (muxes, net commanders, file servers, etc.)
4. The location of any communications element for which space planning is necessary

5. The location of all frame rooms, closets, and cabinets
6. All fiber-optic runs
7. The entry point of outside services
8. All antennas
9. All communication ducts
10. All cable trays

This is the minimum for effective wire management. Room-type information should be recorded on a communications overlay; information on the cable plant and risers should have separate sheets, just as mechanical and electrical systems do. Although it is not specifically a part of wire management, I like to record on key plans the basic power requirements and heat output data for each piece of office technology equipment in place. This information can be maintained on the overlay of room information, as an equipment schedule, or in a separate alphanumeric database. It should be capable of being manipulated so as to assess the effect of moving office technology on the HVAC and electrical systems.

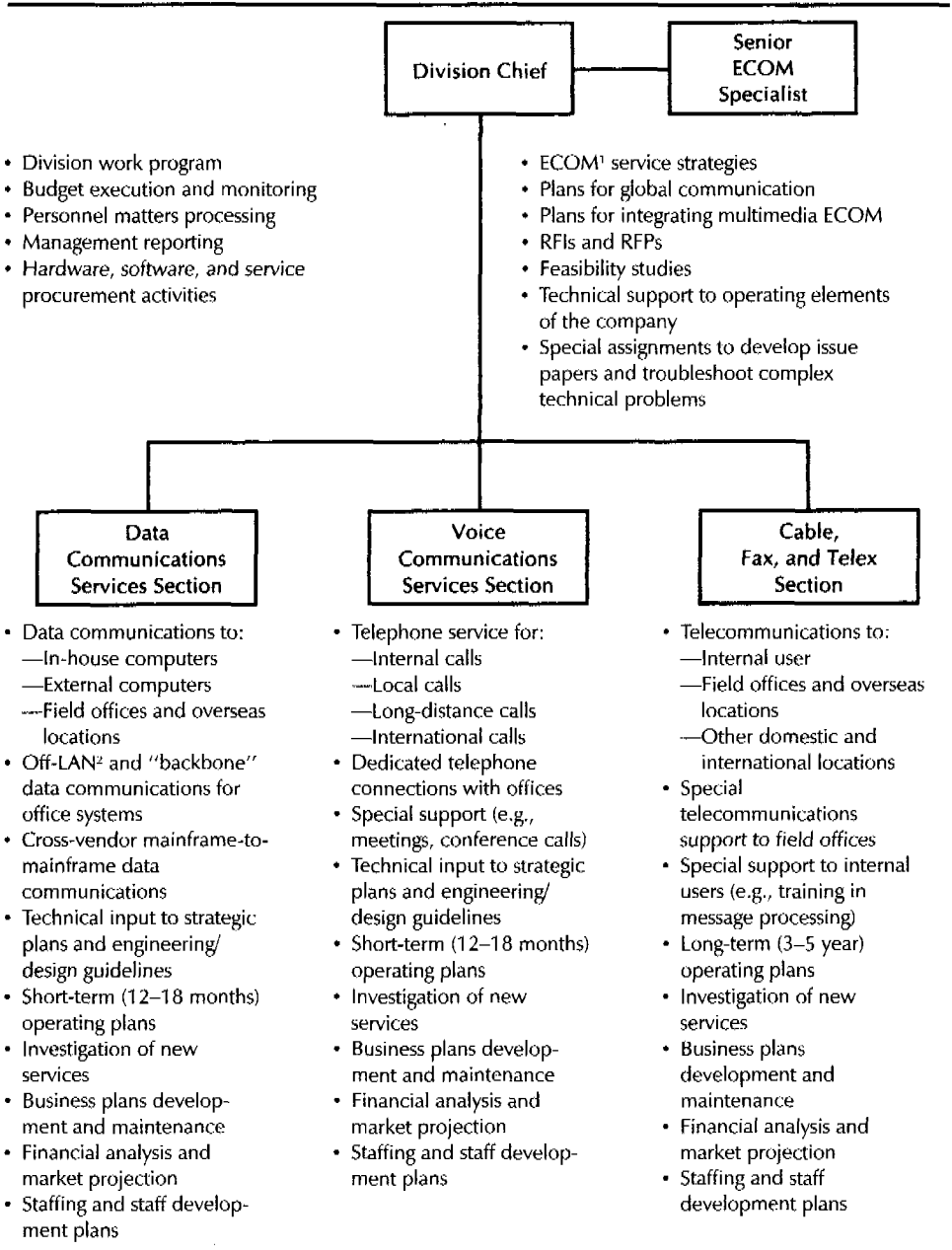
It is my experience that the average (even the better-than-average) architectural-engineering (A-E) firm does an inadequate job of planning and designing telecommunications and data communication systems. Perhaps the reason is that they did not have to do so when Ma Bell existed. Consequently, design services must often be obtained from a specialized communications consultant. When the facility is large enough to justify such a firm, a design-build company can design, build, and maintain all low-voltage systems, not just data and telecommunications.

Communications management is a function of the nature of the company or business. It is quite a different task to rely on the local telephone company than to run one's own telephone switch. Exhibit 14-3 is one possible organization for a communications division in a facility department of a large corporation with a broad range of communications needs. Note especially the need for the electronic communications specialist. Using this model, applicable organizations can be scoped up or down. One rule of thumb for communications organizations is that there be one professional for each \$750,000 in annual communications expense.⁶

With the arrival of data communications, premises-based switching, private satellite communications, local area networks, and facsimile transmission, the communications function suddenly is a full plate. Several principles are in order:

1. Various technologies must be understood because functionability increasingly is user driven.
2. A wide variety of solutions from multiple vendors exists for every communications problem. Don't be the first to buy in; try to protect against obsolescence.
3. Communications is a business function. Conduct an economic analysis before choosing among options.
4. Look for opportunities to maximize technology by expanding existing systems. For example, voice, data, mail, fax, e-mail, and messenger service probably would benefit from single management.

Exhibit 14-3. Possible organization for communications division of a facility department.



1. ECOM = electronic communications.

2. LAN = local area network.

5. Multiple options and vendors should increase the leverage of the facility manager.

John Richardson describes the communications revolution this way:

Some day when you leave your office for the day, a sensor in your building will note your departure. Automatically the lights will be turned off and the heat turned down. You will ride home content in the knowledge that your organization has put new ideas to work to control spiraling communications cost and improve worker efficiency. You will, in effect, have taken advantage of the revolution in semiconductor technology.⁷

As Richardson's description shows, communications is becoming more entwined with facilities. Even now the telephone can be used to control both individual HVAC and lighting. Therefore, companies and facility managers need to reexamine who should manage communications. Companies continue to put the two disciplines under separate management, at their ever increasing risk. Whether communications is managed independently or in the information services department, the facility manager must ensure that planning, design, installation, and even maintenance are coordinated, since no single other function has such a pervasive and encompassing effect on facilities.

Alterations Management

There is probably no other function so popular as altering space; 55 percent of facility managers say that they do it continually.⁸ Everyone enjoys a renovated cafeteria, or an upgraded workplace, or a facelift on the assembly line. Since alterations are so popular, they must be carefully controlled or they will hemorrhage the facility budget. This is a particular problem where funds for alterations are mingled with funds for maintenance. Unless alterations are well managed, maintenance funds will be diverted into alterations, to the detriment of the department. This has grown to such a problem that the U.S. Army, for example, restricts the amount of maintenance and repair funding that could be diverted to alterations.

In corporate North America, where churn rates of 20 to 30 percent are the norm, alterations are a way of life. In fact, downsizing often accelerated the necessity to alter space. Alterations can become the preponderant function of the facilities department—the yardstick by which the facility manager is measured. This creates a project mentality in the department, whereas the proper approach views alterations as one function, albeit an important one, in a facility's life cycle.

There are a number of standards that allow alterations to be managed well and to the advantage of the organization:

1. Space, so you don't move walls six inches to suit someone's ego.
2. Materials, so you don't use mahogany paneling where drywall will do.
3. Construction practice, so that you don't build in bookshelves where a free-standing bookshelf will suffice.
4. Layout, so you're not reconfiguring an office because someone wants his back to the door.
5. Engineering, so that you are not providing eight electrical outlets in a room but are providing proper access to electrical and data outlets.

If adhered to, these standards allow minimal guidelines for construction, particularly if the workforce is stable. That leads to a 30 to 40 percent savings in design costs.

A second major means of control is proper document flow between the design division and the alterations division, within the alterations division, and through the work reception center to ensure that alterations work is coordinated with maintenance work.

Someone should be tracking the flow of a project from inception through closeout. In large organizations (those handling more than one hundred projects annually), both the design division and the alterations division need to establish single points of contact through which all projects enter and leave the division, and formalized routing documents and an automated system for tracking project progress through the system. In large organizations, this tracking is often done for the department by a work coordinator in the work reception center. The issuance and pass-off between divisions should be formally noted, probably as critical events in the project management system.

Computer-assisted design and drawing systems make the upkeep of accurate drawings relatively simple, provided later alteration drawings use official construction drawings as a base and later changes in the field are incorporated. Too often, partial drawings or schematics (cut sheets) are used to do small alterations or renovations. That practically guarantees that the information will not be updated in the database. Given that 30 percent of all space is renovated annually in the average corporation, costly as-builts will be completely out of date within four years. Actually, drawings that are 10 to 20 percent out of date tend to be viewed as obsolete, so less than a year's failure to update can ruin a good set of facility drawings. The facility drawings listed in Exhibit 14-4 should be on hand for alterations.

As important as they are, few alteration programs have good estimating support. Proper estimates of alteration costs require specialized skills. The estimator must be familiar with construction costs in general and, more important, with the costs of altering space at that site. He must be capable of both gross (for working and conceptual estimates) and detailed estimating and must work on many small estimates but have a database unique to the site. Above all, the estimator must work rapidly and accurately. (There is an excellent discussion of a PC-based support system in Sanford Gerstel's *Critical Issues in Facilities Management; Computer Applications*.) Since the estimator needs site-specific knowledge to work properly,

Exhibit 14-4. Facility drawings required for alterations.

<i>Essential</i>	<i>Optional Layers²</i>	<i>Schedules</i>	<i>Others</i>
Base building	Reflected ceiling	Electrical panels	Typical
Key plans ¹	Electrical	Floor design loads	perspectives
Site survey	Mechanical	Security devices	Renderings
	Fire	Communications	
	Life and safety	conductivity	
	Plumbing	Historical	
	Mechanical room	information (e.g.,	
	layout	architect, when	
	Parking	constructed)	
	Communications	Finishes	
	Data	Masonry	
	Communications	Space by floor (e.g.,	
	Security	gross, core,	
		circulation,	
		occupiable)	
		Ceiling heights	

1. Key plans are base building drawings with single-line room drawings. For each room and room occupant, some information is provided (e.g., phone number, name, organization, grade, and applicable standards).
2. Some of these layers may have sublayers. For example, the plumbing overlay could be divided into water supply and sewage.

an outside estimator is of little value. Therefore, the facility manager should employ a staff estimator or use someone hired as part of the A-E package. There is no effective cost control without proper estimating.

I have found it helpful to categorize work by size. Except for projects that require design, I allow the work reception center to assign work under \$2,000 (best estimate) directly. For larger projects, I feel specific authority is needed. Here are some helpful rules for assigning large projects:

1. Placement in the work plan is authority for the design division to begin conceptual design and obtain a working cost estimate.
2. Projects under \$100,000 can proceed for design and execution if the working estimate is within allocated funds (unless the facility manager desires to allocate funds quarterly or semiannually).
3. Projects over \$100,000 can proceed beyond concept only after specific approval by the facility manager.
4. Projects whose conceptual estimates exceed the funds allotted may proceed only if authorized by the facility manager.

This system is workable, and though seemingly bureaucratic, dampens the tendency to overspend on the alterations budget or to expend all alterations funds in the first quarter of the fiscal year.

If too many projects are chasing too few funds, there should possibly be an alterations prioritization committee. This committee is most effective if it is a user group, with the facility manager as secretary. The committee establishes priorities for the alterations budget and reviews progress and reprioritizes at midyear. If the committee members are chosen properly, consensus is not difficult; however, it must be certain that committee policy allows some deviation to meet health, safety, and operational emergencies.

The manager of alterations must insist that workers are doers, not thinkers or designers. All changes other than small field changes need to be referred back to the design division for redesign, approval, and additional funding. If this rule is not strictly enforced, expect leakage of 15 to 25 percent of the alterations budget.

The alterations program is implemented in many ways. Increasingly, the work is contracted out, often to a term service contractor responsible for operations, maintenance, and alterations or minor construction. Some large companies even provide design services to ensure that all aspects of the facilities mission are integrated at the contractor level (i.e., they see the big picture). A very successful variant is to have a body-shop contract whereby skills are ordered by number of tradespeople to meet the peaks and valleys in a work program. Often in such a program tradespeople stay in the facilities even though the contractor changes upon rebidding; they are *de facto* in-house crew.

I prefer to use the designer as project manager during alterations. That fixes responsibility, allows for rapid decisions on changes, and means a single contact from concept through project completion. Some large design firms have separate project managers oriented toward client organizations who coordinate both the design and execution phase of all alterations.

Most project management systems are too sophisticated for alterations. For the vast majority of such projects, data entry efforts exceed the benefits since projects are simple, relatively low cost, and of short duration. A weekly report is often of more value. There are successful automated systems that track annual alterations work rather than individual projects.

Relocation and Move Management

With 20 to 30 percent churn rates, corporate America must accept relocation as a fact of life. Even manufacturing facilities are subject to relocation.

Actually there are two levels of relocating. The first is strategic and involves a major acquisition or disposal of space; this is increasingly cost-driven.⁹ That is not the type of relocation I discuss here.

Relocation management in facility operations is management of departmental staff relocations caused by adding or losing staff, loss or gain of leases, or movement to a more suitable space. In many organizations, these moves are funded from the same budget as building maintenance.

I prefer to separate alterations from relocations for two reasons:

1. Management frequently likes to focus on the annual or unit costs of relocations. Alteration projects tend to have higher unit costs than relocations, which distorts record keeping when the functions are combined.
2. Often relocations are mandatory; there is some degree of choice in whether alteration projects will be done.

The controls and procedures for alteration management equally apply to relocation management. Two interesting phenomena have arisen:

1. Relocations have become so prevalent that large international developers and real estate companies have developed relocation networks. Those networks promise to handle all aspects of personal and corporate relocations.
2. Moving companies in major metropolitan areas now often have specialty units to relocate libraries, computing facilities, medical facilities, etc.

Organization

Almost all companies employ a moving company (some have staff movers) to move furniture, equipment, and supplies within their facilities. Often this function is managed by the facility manager; if not, it still has a major impact upon the facilities and their operation.

Move management entails the following:

1. Major inter- and intrabuilding moves
2. Moves to support the alterations program
3. Moves to relocate facilities stock
4. Service-order moves
5. Delivery of supplies within the institution
6. Fixed moving commitments (e.g., two movers to the loading dock, one mover delivering copy paper)

The first four of these functions are directly controlled by the facilities staff; the last two tend to be managed by others, and they work relatively unsupervised. Consequently it is often necessary to send the most dependable movers on fixed commitments and supply delivery. Though these movers are not always working for the facilities department, they are viewed by staff as facilities people, so they must be at their best.

Service-order moves are handled through the work reception center. There also should be close coordination with the food service staff, the conference services staff, and the security staff to ensure that setups and takedowns for major events are systematically provided. Keeping lobbies, cafeterias, and conference rooms set up properly at all times is a major challenge.

For construction or alteration projects, movers are just another trade that needs to be scheduled—this time to clear for construction, install or reinstall furniture, and deliver personal goods. The project manager is responsible for seeing that moving crews are scheduled.

Often, when a division's staff evacuates an area prior to construction, they leave behind files, office supplies, even obsolete office technology. The custodial staff normally is trained not to touch such items, yet they must be cleared out before construction can begin. The move manager or a responsible mover can go through the space, then contact the office supply room, the administrative officer of the evacuating staff department, and the appropriate file room to set a suspense date for removal. All items left after that date are treated as trash.

All move coordinators need both short- and long-term storage. Long-term storage can be at a location off-site. As a rule of thumb, the long-term storage site should be able to service the facility within two workdays. The short-term facility requires immediate access to the loading dock, should be sized to meet all demands with lead times less than two workdays, and should contain items that experience has shown need to be available on a short response time. A portion of short-term storage facility should be secure storage.

Once construction is complete, the offices need to be set up and the staff's personal belongings moved in. That is the normal sequence of events, but be alert for special conditions. It is embarrassing to have to remove a newly installed and stained mahogany door frame because a senior executive's sofa will not go through the door. Move supervisors and lead movers should be expert in the organization's entitlement and layout standards. Once the staff occupies an office, and it is discovered that it was laid out incorrectly, it is difficult to change. To avoid this, have the move coordinator review the final punch list from the staff's perspective. They are on-site at the appropriate time and all other crafts should be essentially complete, so it should be crystal clear to them exactly what needs to be done to complete the project and turn it over to the users in A-1 condition. One creative facility manager photographs each desk prior to a move and tries to recreate that setup after the move.

Procedures

My preference for providing moving support is a term contract with a local firm for movers and equipment. I normally include provision for local storage. If possible, a core crew with at least one supervisor stays in the facility, supplemented by additional movers as needs demand. For large evening or weekend moves, the moving contractor can hire off-duty military personnel complete with first-line supervision (a sergeant or petty officer), if possible, to work with the company's crew.

Moving requests are handled just like other facility work requests: through the work reception center. However, provide a separate dispatcher for all move-related work, because the number of inquiries and amount of required handholding is very high.

Prior to a move, distribute packing boxes. It should be department policy (1) what is user packed, (2) what is mover packed, and (3) what is not to be moved. Everyone should be in agreement, and items should be clearly labeled, normally with a color code. Also, company policy should clearly state to what degree items are to be designated on a manifest. There is a trade-off between the cost of docu-

mentation and the chance of an item's being lost. (For example, I do not manifest interoffice moves.) I have found it helpful to provide premove instructions. Even with such instructions there is a certain amount of customer interface to ease the trauma and increase the efficiency of the move. Give special thought to items requiring special moving (e.g., a safe or artwork).

The movers must control the freight or service elevators, either through dedication or an elevator key system. Also, there should be staging areas for temporary storage of goods. Access to loading docks at both origin and destination must be arranged. If traffic will be disrupted, make special arrangements with local police. Ordinarily, the moving company makes these arrangements.

Some degree of tender loving care is required for customers in the two or three days after a move. Assign a crew of movers, working with the move coordinator, to make post-move adjustments. On day 2, the handymen, again coordinated by the move coordinator, can assist in hanging pictures, replacing doors, and the like. On day 3, the handymen can go systematically through the area, correcting nicks and dings and spot painting. On all three days, day porters make a midday trash pickup, and movers remove packing boxes and excess furniture. Each of the first three nights after a move, there should be heavy cleaning, with carpet spot cleaning on the third night.

Move management must always be mindful of three principles:

1. Security is at its weakest during the chaos of a move. Take extra security precautions.
2. People are under stress during a move. Try to plan and execute the move calmly and efficiently.
3. Always have an alternative plan for critical parts of the move, like another freight elevator, or a single moving truck, or a security system requiring special access.

Experienced movers, a well-informed staff, and plenty of supervision can ensure a smooth move.

Furniture Installation

My experience has been that furniture attic, or back-up, stock should be 4 to 10 percent of total inventory, with a minimum of at least one backup item for each component or set and two for all common components. Bookcases and lateral files seem to disappear because they are easily defended as exceptions or special cases, so additional attic stock may be required.

With gradual conversion from case goods to systems furniture, the skills necessary to install furniture are not necessarily best provided by movers. In fact, in some areas union work rules preclude this. I prefer initial installation by the company providing the furniture, but the best installation crew is a matter of economics and personal preference. Some in-house capability is desirable to satisfy any urgent needs to reconfigure, install, or remove furniture. In large organizations

frequently there are specialized installation needs—specialized shelving comes to mind. It is best to have these special items installed initially by the manufacturer but reconfigured or reinstalled by the department's alterations crews or maintenance personnel.

Once furniture is installed, treat it like all other building elements. Inspect and repair it under a preventive maintenance program. Respond to service orders and conduct cyclic maintenance, particularly refinishing and upholstery cleaning. Finally, plan for replacement. It is best to have a minimal repair capability for jobs like spot cleaning and caster replacement during work hours, with heavy repair (reupholstery, refinishing, major cleaning) done on a scheduled or off-hours basis.

Disaster Recovery

Catastrophe can strike even the most prepared organization. Flooding, fire, earthquake, or other natural disasters occur at any time, as can sabotage or serious vandalism. Certain companies are particularly vulnerable to strikes. Proper planning, however, can ensure that the company's business is disrupted as little as possible and that loyal employees will not have to wait long before resuming their work.

Disaster recovery planning and implementation certainly have a large facilities component. To be most effective, they should be managed by a company business manager because the recovery planning must support the business plan of the company. I participated in a disaster recovery planning effort that originated within the administrative structure of an institution. It was never accepted because it was never viewed as relevant by line managers, and administrative managers were not knowledgeable enough of business functions to make proper disaster recovery decisions. Because the outward manifestation of disaster planning is often framed in terms of facilities, there is a tendency to view disaster recovery as strictly a facilities function. That is fallacious and should be resisted.

A substantial part of disaster recovery planning should be already in place to meet the common problems of an effective facilities department. For example, there should be:

1. Adequate routine physical coverage of the premises to ensure that 99 percent of all problems can be solved when they occur and that help can arrive quickly to solve the other 1 percent.
2. Good engineering drawings of all buildings and an up-to-date assessment of major equipment and structures.
3. A notification chain (and an estimate of travel time) for staff and contractor personnel.
4. A twenty-four-hour contact point at all major utilities, the police department, and the fire department.
5. The provision of an alternative site for critical functions.

There is no commonly accepted format for a disaster recovery plan, but a possible format is shown in Exhibit 14-5. In addition, the following steps should be taken to prepare the facility department for a disaster:

Exhibit 14-5. Disaster recovery plan format.

- I. Introduction
 - A. Assumptions
 - B. Considerations
 - C. Definitions
 - D. Objectives
 - II. Requirements (normally by organization)
 - III. Strategies and Discussion (includes selected strategy)
 - IV. Detailed Procedures
 - V. Appendixes
 - Notification and assembly plan
 - Command center plan and manning
 - Staffing and team composition
 - Administration and logistics
 - Communications
 - Facilities
 - Data processing
 - Vendor/contractor
 - Legal
 - Labor (if applicable)
 - Public relations
 - Budget and finance
-
1. Designate an alternate facility command center and rendezvous point. The center should be capable of twenty-four-hour-a-day operation.
 2. Designate an emergency response team.
 3. Prestock a complete facility database of drawings, schedules, and instruction books, as well as equipment for the emergency response team.

The goal of disaster planning is to restore the operations of the company. That goal must be kept in mind or effort might be diverted into counterproductive activities. For example, it may be best to emphasize an alternative site rather than reconstruct the principal site. Larger organizations should perform a vulnerability assessment.

Disaster recovery always needs to focus on both the short and long term. The short-term plan stresses continuity of operations, quick reaction, and quick damage assessment (e.g., retain, salvage but clean, or throw away), with a horizon of less than six months. The long-term plan stresses a return to predistaster conditions with code and operational improvements implemented. The long-term plan may have a three- to five-year horizon and should be fed by the short-term plan.

Since most facility managers never experience a disaster, and almost none

experiences more than one, it is easy to overlook the more costly and difficult problems:

- Heat damage to structural steel not readily inspectable
- Soot damage
- Dampness and corrosion, particularly in communications equipment, office technology and building systems
- Art restoration
- Hazardous materials cleanup
- Mold formation
- Condensation in drains and lines during cold weather
- Too much or too little water in high-pressure boilers

Each of these problems should be assessed and planned for in addition to the usual fire, water, and structural damage expected.

Because not even the largest organization can have all the necessary skills in-house, disaster recovery planning is perhaps most effectively done by a disaster recovery consultant. Additionally, disaster recovery planning requires input from both operations and planning and design. Often the senior planning and design person leads the planning effort; then, if the plan has to be executed, the facility manager or senior facilities operations person is in charge.

While not principally responsible for disaster recovery planning, the facility manager in most companies is a major player. Recent floods, the California earthquake, and the Oklahoma City bombing have magnified the importance of good disaster recovery planning. The IFMA periodical, *Facility Management Journal*, provides helpful information in an annual issue devoted to disaster recovery. See also the Disaster and Recovery Planning subsection listed under Books in Appendix A.

Notes

1. *1996 Corporate Facilities Monitor* (Houston: IFMA, 1996).
2. "Power Buying," *Facilities Manager* (January–February 1997): 24–25.
3. "Facility Management Practices," *IFMA Report 16* (Houston: IFMA, 1996), p. 28.
4. "Demographics and Trends," *IFMA Report 2* (Houston: IFMA, 1986), p. 34.
5. "Facility Management Practices," *IFMA Report 2* p. 14.
6. John R. Richardson, "Telecommunications; Changes in Management, Regulation and Technology," in *Facility Planning Technology*, McKinley Conway and Linday L. Liston, eds. (Norcross, Ga.: Conway Data, 1987), p. 919.
7. *Ibid.*
8. "1989 Modernization Survey," *Buildings* (June 1989): 120.
9. Eileen Carstairs, "The Corporate Relocation Game," *Corporate Design and Realty* (January–February 1987): 35.

15

Maintenance and Repair

Pulse Points

- *The facility manager needs to educate management in the cost of ownership.*
- *A company should budget 2 to 4 percent of the replacement value of its facilities for annual maintenance and repair.*

In 1989–1990, I participated in a National Research Council study of the maintenance of public buildings in North America. The resulting report, which emphasized our failure to maintain and repair properly our inventory of public buildings, made these recommendations:

1. Agencies should make qualified staff and managers specifically responsible for maintenance and repair (M&R) and should ensure that they are trained and recognized. M&R funds should not be diverted to minor alterations and improvements.
2. M&R programs should be built on formal condition assessments.
3. The annual M&R budget should be 2 to 4 percent of the current replacement value of the facilities, excluding land. This amount is over and above the amount to overcome a backlog of maintenance and repair.¹

Although the explanation does not appear anywhere in the published study, the brevity of those recommendations was driven by our desire to recommend some simple rules that could be understood and sold to the legislators who appropriate the money for maintenance and repair of public buildings.

This report was enthusiastically accepted and is often quoted, but, I must admit, it was a failure. A new report by the Association of Higher Education Facilities Officers and the National Association of College and University Business Officers indicates that for institutions of higher learning, deferred maintenance levels have risen \$5.5 billion since 1988, and the gap between institutional capacity to fund capital needs and the funds available continues to increase.² Observation and anecdotal information from other parts of the public sector confirm that the situation continues to deteriorate.

In 1997 the National Research Council reconvened a new committee to go back over the same ground because some agencies that tried to use the yardstick of 2 to 4 percent were told by their legislative overseers that it was "too simplistic." The fact of the matter is that our companies historically do not want to provide adequate funds to maintain and repair public buildings. We continue to add to our inventory but don't maintain what we have. We have probably built more than we can afford, but most assuredly we have built more than we are willing to maintain.

M&R in the private sector has been equally ignored. The reasons range from a concentration on short-term goals, to a lack of penalty for underfunding M&R in any specific year, to the tenuous and ill-perceived connection between building maintenance and the corporate bottom line. During this period of emphasis on cost cutting, facility managers were lucky to maintain level funding of M&R, to say nothing of reducing backlog.

Public authorities face the dilemma of shrinking budgets and control tax rates, while responding to increased calls for services. Decisions to underfund the M&R of public buildings are often made because the officials do not understand the implications of underfunding, nor, in many cases, do they even have the criteria to alert them that they are underfunding.

It is often difficult to discern the consequences of a reduction in M&R. The physical evidence is usually not immediately visible; several years may pass before the effects can be observed. And facility managers do not themselves usually have evidence that they can use to defend their requests, nor can they describe in specific terms the consequences of underfunding. Yet the costs to correct the effects of long-term underfunding often exceed the cost of the M&R that would have precluded those deficiencies. No single M&R program model can fill every need at every corporate level, yet there are principles and concepts that ensure a cohesive approach to M&R. Before discussing the elements of such an M&R model, let's agree on some basic terms.

Key Terms

- *Maintenance*—the work necessary to maintain the original anticipated useful life of a fixed asset. It is the upkeep of property and equipment. Maintenance includes periodic or occasional inspection, adjustment, lubrication, cleaning (non-janitorial), painting, replacement of parts, minor repairs, and other actions to prolong service and prevent unscheduled breakdown, but it does not prolong the life of the property or equipment or add to its value.

- *Repair*—work to restore damaged or worn-out property to a normal operating condition. As a basic distinction, repairs are curative, and maintenance is preventive. Repair can be classified as minor or major. Minor repairs are those associated with maintenance activities that do not exceed one to two workdays per task. Minor repairs do not appreciably prolong the life of the property or equipment or add to its value. Major repairs are those that exceed two workdays per tasks, or are beyond the capability of existing maintenance personnel. Major repairs often are defined as those that can prolong the life of property or equip-

ment, but should not increase its value. They usually require contracting for repair service.

- *Replacement* of building-related components or systems—the act of replacing an item of permanent investment or plant equipment. It is the exchange or substitution of one fixed asset for another having the capacity to perform the same function. The replacement may arise from obsolescence, wear and tear, or destruction. In general, as distinguished from repair, replacement involves a complete identifiable item.

The Cost of Ownership

When a corporation or public authority decides to acquire a new building, it commits itself to a stream of costs that will be realized throughout the life of the building. (See Exhibit 15-1.) The total cost may be identified as the cost of ownership of the building. This cost of ownership concept is useful in developing budgets for M&R. If authorities recognize that the costs of M&R are informally committed at the time of acquisition, then understanding the annual M&R budget is easier.

The stream of costs includes the cost of the acquisition itself—that is, the cost of acquiring the site, the costs of design and construction, or the cost of purchasing an existing building. These costs are visible and, unfortunately, are frequently considered to be the only costs worthy of immediate attention during acquisition. But several other costs accompany the acquisition decision. Operations costs must be accounted for throughout the useful life of the building. The building's functional costs, such as the cost of personnel to maintain, repair, and replace major building elements, are also part. Included are the costs of utilities and of cleaning

Exhibit 15-1. Typical costs of ownership.

Acquisition

- Site costs
- Design
- Construction or purchase

Operations

- Utilities
- Custodial

Maintenance and repair

Replacement of components

Alterations and improvements

Rehabilitation and replacement

Disposal

the building. In addition, routine and recurring maintenance of the building is realized as a stream of costs, as are costs of repair and replacement of major building components such as boilers and air-conditioning systems.

The stream of costs also includes the ultimate replacement of the building or its rehabilitation, assuming the function continues longer than the economic life of the structure. Ultimately, the stream of costs includes the cost of disposal. This may be demolition or the cost of sale to another party. The authority planning to acquire a new building should acknowledge these costs and view them as inherent in the ownership of the building.

Another cost component should also be recognized: alterations and improvements. If alterations and improvements permit a change in the use of the facility, then the accompanying costs are associated with the cost of ownership relative to the new function. If alterations and improvements are incurred without a change in function, then they must be justified in terms of increased efficiency or effectiveness. Too often alterations and improvements are funded from the operations and maintenance (O&M) budget, where they often eat up the funds that should go to M&R.

Organizations typically fund maintenance using procedures that inhibit effective M&R. Budgets are prepared and funds for building operations and maintenance are combined, usually resulting in a relatively large outlay. Inevitably, the operations component of O&M is significantly larger than the maintenance component. When management must reduce a budget, they then look at O&M as a whole. However, those responsible for managing the buildings can exercise very little control over the operations component. As a result, operations is typically fully funded and maintenance is reduced. There are specific effects associated with underfunding M&R (see Exhibit 15-2). Unfortunately it is possible to under-

Exhibit 15-2. Effects of underfunding.

Code failures	Service failures
Structural failures	<ul style="list-style-type: none"> • Power • Heating, ventilation, and air-conditioning (HVAC) • Leakage and intrusion
Safety failures	
Health failures	Premature loss
Excessive costs	Loss of contents
<ul style="list-style-type: none"> • Excessive replacement • Minor failures lead to major failures • Treating symptoms, not the cause • Increased consumption of utilities 	Social costs
	<ul style="list-style-type: none"> • Poor aesthetics • Poor morale • Inability to attract best employees • Increased pollution • Loss of readiness
Lower productivity	Absenteeism and turnover

fund routine and recurring M&R for a period of time without immediately visible results.

Corporations should recognize the cost-of-ownership concept. All elements in the stream of costs should be funded at an appropriate level. Although the M&R component varies from building to building, it is possible to develop a relationship between this and an inventory of buildings. For instance, different relationships have been developed to express average levels of M&R. Cost per square foot is frequently the yardstick for determining an appropriate level of M&R budgeting.

A simple method of stating M&R needs is in the annual percentage of replacement value of the building. In order to understand this relationship, consider the elements of an M&R budget: routine and recurring maintenance plus the cost of annual repairs (including the costs of the replacement of major components, such as boilers and air-conditioning units). The long-term, average relationship between the replacement value of an inventory of buildings and annual M&R requirements is in the range of 2 to 4 percent. The specific percentage for any inventory depends on several factors, including the age of the buildings, the type of construction (permanent vs. temporary), the loading of the buildings, and the climate. My observations and discussions with facility management experts indicate that M&R funding at 2 percent of replacement value is minimum; any lesser amount results in a degradation of inventory over time. Of course, this recommended range may not be as relevant to a small inventory of buildings in a local community as it is to a large inventory at a state or federal agency level. However, even with small inventories, the 2 to 4 percent range of M&R funding is valid over time.

Repair or replacement of major deficiencies in building components that have evolved as a result of long-term M&R underfunding is an implicit part of the stream of costs. When funding is not available for all repair projects in a given year, a backlog of repair projects is created, and the condition of the property and the significance of that condition must be assessed in order to reduce this repair backlog. Cost of ownership implicitly recognizes the need to correct high-priority deficiencies with a structured program to reduce repair backlog, but such corrections are outside the 2 to 4 percent funding range for any one year.

On the other hand, fully funded M&R results in an equilibrium point of funding that maintains the inventory and backlog of repairs. At this point, routine maintenance is fully funded, as are routine repairs. In an era of fluctuating budgets, good management dictates that maintenance be funded first, with repairs variable. Alas, repairs continually postponed also escalate into disasters. At the minimum, authorities should strive to reach this funding equilibrium; otherwise, the buildings are consumed through lack of maintenance and repair.

An organization can determine replacement value in several ways. The controller, in fact, will probably dictate how it is to be done. The simplest approach estimates what it would cost in any given year to replace a building to perform the same function as the original. Another approach applies escalation factors to the acquisition cost of the building. Some companies have developed computer programs to perform this calculation and to provide a replacement value or cur-

rent plan value for the total inventory each year. A number of indexes are available, including those published by the U.S. Office of Management and Budget for the U.S. federal government and those published by *Engineering News Record*. There is the potential for inaccuracy in any of these estimates, particularly since some public buildings are over a hundred years old. It is necessary for each company to evaluate its inventory and develop the best approach for determining its replacement value.

The company is bound by the procedures established by its reviewing authorities for the formulation and presentation of its budgets. I am not recommending a single approach appropriate for all levels of detail and budget formats. The cost-of-ownership concept, however, does provide a framework for indicating the funding level for M&R. Management can then take a long-term look at funding levels and develop a strategic plan for appropriate M&R funding.

Maintenance and Repair Management System

To be effective, an M&R program must operate in the context of a complete facility management system. Maintenance, like all other functions, needs to be goal oriented. Exhibit 15-3 shows one approach to establishing goals and objectives for an M&R program.

It is difficult to present one M&R management system equally applicable to all organizations; no two building maintenance organizations are organized identically. However, the model in Appendix F-5 is as comprehensive and applicable as possible. It starts as a classic management model: planning, organizing, staffing, directing, controlling, and evaluating. However, the next level of detail is a checklist for good M&R management. Automated facility management (such as computer-assisted facility management, or CAFM) is often a possibility. While priority should be on systematizing maintenance management, whether automated or manual, the database for facility holdings in excess of 100,000 square feet should be automated for efficient management.

The elements in the M&R model are closely interrelated. There are, however, a number of feedback loops:

- Planning-programming-budget-execution-evaluation
- Budget-accounting-work plan-management information system (MIS)
- Capital budget-maintenance and repair budget
- Condition assessment-level of annual funding
- Work management-staffing-work standards-output

Managers should establish policies and procedures to monitor each of these periodically and regularly.

The following are the elements of an effective M&R management program, roughly corresponding to the model; where an item is contained under several management functions, it appears where first noted.

Exhibit 15-3. Universal maintenance objectives.

Overall maintenance goal: Provide economical maintenance and housekeeping services to allow the facility to be used for its intended purpose.

Specific maintenance objectives:

- Perform daily housekeeping and cleaning to maintain a properly presentable facility.
- Promptly respond and repair minor discrepancies in the facility.
- Develop and execute a system of regularly scheduled maintenance actions to prevent premature failure of the facility and its systems and components.
- Complete major repairs based upon lowest life-cycle cost.
- Identify design and complete improvement projects to reduce and minimize total operating and maintenance costs.
- Operate the facility utilities in the most economical manner while providing necessary reliability.
- Provide for easy and complete reporting and identification of necessary repair and maintenance work.
- Perform accurate cost estimating to ensure lowest-cost solutions to maintenance problems.
- Maintain a proper level of material and spare parts to support timely repairs.
- Accurately track the costs of all maintenance work.
- Schedule all planned work in advance, and allocate and anticipate staff requirements to meet planned and unplanned events.
- Monitor the progress of all maintenance work.
- Maintain complete historical data concerning the facility in general and equipment and components in particular.
- Continually seek workable engineering solutions to maintenance problems.

Source: Gregory H. Magee, *Facilities Maintenance Management* (Kingston, Mass.: R. S. Means Co., 1988), p. 14.

Planning and Programming

A good M&R management system starts with the basic data, plans, policies, procedures, and standards to set proper priorities, describe the facilities and their condition, define the work, establish standards, and organize the work into a plan that is both responsive and doable. (In many cases, however, because of years of underfunding, the database has deteriorated.) The inventory of facilities describes the category of facility, states its condition (whether by ongoing inspection or a condition assessment), then assesses the critical nature of any deficiency. New elements, whether capital additions or correction of errors, are entered at least annually.

Exact categories, priorities, and definitions of work are developed. Preventive maintenance, for example, is differentiated from repair. Facility managers select definitions and categories of work that fit their needs and then stay within those definitions to determine the elements of their work plan. Other common ways to

categorize work are by priority for accomplishment (e.g., emergency vs. routine) or by approval level required to implement (e.g., \$1,500 or less, \$1,500–\$20,000, \$20,000–\$100,000, or over \$100,000).

The annual departmental M&R work plan contains major M&R projects in priority order, a lump sum to fund preventive maintenance, and a lump sum to fund routine service-order M&R work. A prioritized list of underfunded requirements, in priority order, is also attached.

Generally M&R is planned and funded annually; however, it should operate with a midterm plan that sets priorities on major and cyclical M&R and that provides three- to five-year guidance on the thrust of the M&R program.

Budgeting

Of all the functions of a good M&R program, budgeting usually requires the most management attention; it is, after all, the lifeblood of M&R, an annually controlled function with multiple review points. Each company identifies its requirements in its own unique way (e.g., bubble up or top down), but often all sources of requirements are not considered (What impact will more carry-out fast food in the cafeteria have on carpet maintenance?). There needs to be a comprehensive scheme to collect requirements.

In the model, requirements are examined and prioritized before being submitted in the budget. If funds are likely to be available beyond the critical requirements, they are rank-ordered by priorities established in the midyear plan. Alteration and minor construction funds are not mingled with M&R funds. There are strict rules governing the leakage of M&R dollars into alterations funds.

When the budget is assembled, the manager conducts several analyses, including historical comparisons, unit cost comparisons, comparison to a target percentage of current replacement value, comparisons to the current year's budget, and trend analyses. Variances then become a principal part of the narrative of the budget along with new issues. If the funding guidance is lower than the accumulated requirements, statements of the impact of the funding constraint, by category, are submitted.

The cost accounting and MIS are responsive to proper M&R management requirements. A proper system is able to produce current cost data to assess requirements for preventive maintenance, minor maintenance and repair (service orders), cyclic maintenance projects (by project), and repair projects (by project). It is capable of doing so by time period and by facility. If cost comparators are used, the MIS is able to calculate them.

Each large company decides whether to track expense or commitment data, or a hybrid of both, during budget execution; smaller companies, particularly those with an inventory principally of buildings, track the unit cost (recommended dollar per square foot) of preventive maintenance and service orders. (Some larger organizations prefer to track total M&R dollars by activity code, with special emphasis on critical trends.)

The effect of the capital budget on the M&R budget is worth mentioning for at least three reasons: (1) additions to the capital inventory add to the base for

M&R, (2) decisions based on life-cycle costing, rather than more capital costs, have positive, major downstream effects on future M&R budgets, and (3) designing to maintain is a principal concept in all design policies.

Organizing

Organizing an M&R management program at the national or international level (usually a staff function) or at the local level (usually both a staff and a line management function) can be very different. However, certain common features should be in place.

1. A manager is clearly in charge of M&R, from policy through evaluation.
2. The M&R program is placed where it is not subjected to competition for new construction funds.
3. A clearly defined channel for gathering, categorizing, and executing M&R is in place to ensure coordination with operations, alterations, and capital construction.

The M&R manager has an analysis capability and a good information system. In medium and small companies, buildings are metered (data collection systems put in place) to collect comparative data by individual building or within a facility category. Finally, well-developed material management and purchasing functions—knowledgeable of and responsive to the M&R manager—are essential for a well-run program.

Staffing

Staffing for good M&R management varies significantly according to the size of the company, yet a number of principles are common:

1. The M&R program staff is as technically competent as the capital program staff. The M&R staff is involved in reviewing all capital projects.
2. Only when necessary (because of the small size of the building inventory, for example) is M&R a part-time staff function.
3. The M&R program is staffed to inspect for deficiencies, as well as to inspect the M&R work done.
4. Training is available to improve management and technical skills.
5. Leadership qualities in a manager are emphasized, so the M&R program is proactive.

The correct mix of contract and in-house staff is an important item for consideration, particularly during the program execution phase. I do not have specific guidance, but the best situation is what the manager is comfortable with and can afford in terms of salaries and staff positions. Tasks related to policy, standards, budgeting, work plan development, and quality control and evaluation should be retained in-house.

Directing

The function of directing is almost synonymous with implementing. The common threads at any level are:

1. An appropriate level of design and documentation
2. The ability to respond rapidly to a crisis
3. A recognition that a substantial portion of the workload is reactive

Over time, experienced managers can predict the last two items reasonably accurately despite their apparent unpredictable nature.

The quality of direction in an M&R program normally reflects the information available to the manager. For example, how can limited funds be properly prioritized unless the manager has determined the most critical needs? Proper direction is based on a number of factors, including established priorities, condition assessment, criticality of need, and the work plan.

In many large companies, a major function is allocating M&R funds among executing activities. This allocation often dictates how the activities will execute their work plan. Factors to be considered include the following:

1. Budget guidance
2. Priorities
3. The ability to execute the work plan
4. Criticality of facilities
5. Quality of the submitted requirements
6. Past performance history
7. Condition assessment

Particularly at medium to small facilities, a strong work management and coordination center, automated diagnostics, and commissioning procedures for new buildings can be directed and have strong influences on a good M&R program.

Controlling

The principles of M&R control are consistent for all types and sizes of companies. Control devices include policy, procedures, standards, work plan, budget, approval levels, management information systems, and documentation. The manager, given whatever level of resources, balances and manipulates the following:

1. Control of the budget
2. Control of expenditures
3. New crises
4. New priorities
5. Possible windfalls

To do so, it is absolutely essential that a real-time management information system be available. Above all, someone should be accountable for all aspects of the M&R program.

Evaluating

With the emphasis on benchmarking, M&R evaluation has taken on an entirely different character from early in the 1990s. Traditionally, facility managers evaluated their M&R program according to factors such as these:

- Comparison of the year completed with the prior year or an average year
- Whether priorities were met
- What critical facilities were accommodated
- Trends such as total backlog or against a target percentage of the replacement value
- Leakage of M&R dollars
- Comparison by activities; category or building, leakage, and percentage of work plan executed
- Whether the right skills were employed

Benchmarking of M&R has become prevalent. That has been driven by the quality management movement and is largely concerned with matters of efficiency. The benchmarking process involves identifying specific areas for study, measuring performance in these areas, identifying other companies against which to benchmark, comparing the department's performance against its benchmarking partners, and then figuring out who has the best practices and how to implement those best practices into the department. The professional associations have assisted in this regard. The Building Owners and Managers Association (BOMA) publishes the *Experience Report* annually. The International Facility Management Association (IFMA) publishes *Benchmark Report* triannually. APPA has developed and published a benchmarking model called the Strategic Assessment Model, which, among other things, assesses M&R. The model includes fifteen benchmarks by which colleges and universities can assess their maintenance program against others and a recommended standard. Some possible M&R benchmarks are contained in Exhibit 15-4.

If the benchmarks generated by the professional associations are inadequate, the facility manager can hire a benchmarking consultant to help gather the data and find data against which to compare. Once the benchmarks have been established and implementation procedures are in place and functioning (my experience is that it takes two to three cycles to get the bugs out), then the manager should set goals and objectives to improve M&R. This process involves allocating resources. However, once the facility manager has decided to emphasize a certain area—improved customer satisfaction, for example—and has implemented procedures to do so, the benchmarking process should be able to track progress so that responsibility can be fixed, success can be reinforced, and failure can be recognized early.

Exhibit 15-4. Typical benchmarks for maintenance and repair.

<i>Efficiency Benchmarks</i>	<i>Effectiveness Benchmarks</i>
Total and work time per work order	Percentage of customer services for which customer satisfaction is measured
Cost per work order—total and by category	Percentage of positive comments received—total and by category
Total maintenance and repair costs—total and by category	Backlog of deferred maintenance
Costs as a percentage of replacement costs	Hours available vs. hours worked
Number of work orders completed on time for preventive and routine work	Ratio of preventive maintenance hours to routine maintenance hours
Funding of maintenance and repair as a percentage of the total facilities and capital budget by time period	Equipment failures
	Number of work orders by time period by category
	Number of positive comments received per time period

Putting Maintenance and Repair in Context

I have already mentioned the serious problems of underfunding of M&R in North America. Since this condition has existed throughout my professional life, I doubt that top management and legislative bodies will suddenly change and adequately fund M&R. Therefore, it is essential for facility managers to ensure that they are using allocated funds wisely. Often they are simply spending money without making any rational decision as to where they get the biggest payoff from our limited funds. Central to good decision making in this area is *condition assessment* (CA).

In its simplest terms, CA is a total audit of the facilities with a detailed list of discrepancies, including code violations. Most contain a funding profile for the next five to ten years for M&R and a projected replacement date for building elements and equipment. A benefit that I discovered during a CA is that I learned which design firms truly designed for maintainability and durability and which manufacturers produce equipment with the longest service lives. Another spin-off is to observe outside experts and their technology and techniques to assess the condition of the company's facilities. Some of those same technologies are applicable to the department's M&R program.

Almost all large architectural-engineering (A-E) firms have CA capability. In most cases, they can do their work with minimal destructive testing. I strongly advise against trying to do CA with in-house staff. They can guide and oversee the operation, but they don't have the amount of time available for the in-depth analysis required by a good CA, and they may unconsciously bias the results. Although the cost is admittedly high, the CA can be the heart of a reasonable M&R plan and program. Another benefit of using an outside consultant is that management will listen (where they may not listen to their internal experts). Al-

though it was costly, the CA I did at the World Bank formed the basis of strategic facility decisions for at least ten years, the absolute maximum time that large facility departments should allow between CAs. Another approach for very large organizations is to conduct a CA of a sampling of facilities—10 to 20 percent—each year so that all facilities are audited within a time frame of five to ten years.

The Maintenance Plan

I have found that public-sector agencies are far ahead of their private brethren in organizing comprehensive maintenance programs. However, in implementation there is less variation because everyone invariably underfunds M&R. Every building element should be covered by an appropriate level of maintenance, determined by management and considering (1) the cost-effectiveness of maintenance through increased serviceability and extension of service life and (2) the desired appearance of the facility elements.

There are almost an infinite number of approaches to maintenance and repair, but they tend to fall into one of six categories:

1. Inspect and repair only as necessary (IROAN).
2. Cyclical repair—repair performed on a specific cycle (e.g., replace roofs every seventeen years).
3. Preventive maintenance—maintain equipment according to a preestablished checklist and cycle (e.g., change generator oil every 100 hours or semiannually, whichever occurs first).
4. Predictive maintenance (the use of sophisticated nondestructive testing to avert the breakdown of critical equipment).
5. Breakdown maintenance most of which can be repaired on a service order (e.g., a burned-out light bulb)
6. Repair projects (e.g., replace all window assemblies in a factory).

A comprehensive maintenance program uses each of these techniques to ensure that every facility component is maintained and repaired in a cost-effective manner consistent with facility standards.

From my observation, plant systems have the most thorough and sophisticated maintenance plans, particularly for preventive maintenance.

Historically, custodial service (janitorial service, carpet and floor cleaning, window washing, and insect and rodent control) has not been considered part of maintenance, but that is incorrect thinking. These services are an integral part of comprehensive maintenance. For example, carpet repairs are minimized if carpet cleaning is done effectively. The guru of custodial services is Edwin B. Feldman of Atlanta, Georgia. He has written a number of books on custodial service, the best of which deals with designing for maintainability, which should be top priority for every architect, engineer, interior designer, and facility manager.³

The maintenance plan should include user input. Users can play both active and passive roles. For example, they can:

- Use trash receptacles.
- Report spills quickly.
- Use equipment, particularly elevators, properly.
- Report deficiencies.
- Place signs only on authorized bulletin boards.
- Refrain from using water fountains as slop sinks.
- Turn off lights when not in use.
- Turn off water faucets.
- Use walkoff mats to clean feet.
- Report unsafe conditions.

It is estimated that this level of staff involvement can reduce building maintenance costs by 10 percent. The actions can occur through a number of stimuli, such as managerial emphasis, pride in the organization and its facilities, and an education or internal relations program.

Preventive Maintenance

I have been most successful operating a preventive maintenance (PM) program with three teams:

1. Plant
2. Exteriors, interiors, furniture, security, fire and life safety systems and furnishings
3. Electrical switchboards, floor panels, and devices

Preventive maintenance of specialty items (elevators, building controls) is best contracted through the manufacturer. All told, these teams report all items beyond their capability to the work reception center so that a service order can be processed.

All three PM teams, particularly the second, need to understand the limits of their maintenance work and when a service order must be written. Painting is always an issue. The PM team should paint, but only spot painting; the PM foreman must be sensitive to when excessive spot painting will produce a leopard look and when the painters should be called in.

The PM team cycle is largely determined by each manufacturer's recommended maintenance frequencies. I try to have all public and executive areas inspected weekly. I inspect thoroughly the building exteriors annually and examine the garages and back hallways at least semiannually. The second PM team effort is concerned primarily with occupied areas of the building. It should try to visit these areas quarterly. Each building occupant, particularly the administrative staff, should know the particular handyman on the PM team. For this reason, the team members must be capable of interaction with the staff. If this program is managed well, it is the best public relations program for the facilities department as well as its eyes and ears.

Increasingly facility departments, but particularly their vendors, are using

sophisticated, nondestructive methods to predict equipment failure before it happens, among them, thermography, wear-particle analysis, ultrasound, oil analysis, and vibrations analysis. Often these technologies are used in tandem or as a second opinion before a critical piece of equipment is pulled off-line. These technologies can also often be used to identify sources of energy inefficiencies. Some of these technologies require expensive equipment and extensive training; others can be brought in-house at a reasonable cost if the demand for predictive maintenance exists. Predictive maintenance, not surprisingly, is most often used in maintaining industrial facilities because the technology and expertise already exist to maintain the production equipment.

Cyclical Maintenance

This topic does not appear in most books on maintenance management because it is not a pure category of work. Rather, it is a concept—a convenient way of thinking about maintenance. Experience shows that certain items need to be maintained on a certain basis. For instance, battery-powered clocks need new batteries semiannually. The team can use the weekends to set the clocks forward and back for daylight savings time and also change the batteries. If not done sooner, all interiors should be repainted every three years. Though carpeting will often last ten to twelve years, for a number of reasons, I replace it every six years. Cyclical maintenance is actually replacement, but of a nature that expedites planning and budgeting. Ensure that cyclical maintenance practices are in agreement with the life expectancy of the products. For instance, you may have convinced your boss to switch from broadloom to carpet tile because the latter's greater life expectancy justified the higher initial cost.

The Work Reception Center

I have already discussed the role and operation of the work reception center (WRC) in Chapter 13. The WRC is key to a successful M&R program. It is the one place where anyone can report a facilities problem and get action, without fuss or long bureaucratic review. A typical history of problem solving in the M&R program is as follows.

	<i>By Number of Problems</i>	<i>By Cost</i>
Preventive maintenance	75%	50%
Service orders	24	30
Projects	1	20

Several conclusions can be drawn from these data, but one that is inescapable is that M&R projects can often be solved through a good PM program and a work reception center. If the WRC functions properly, the facility manager and the maintenance manager (if there is one) can spend their time managing major repair projects.

For the WRC to function properly, the staff must:

1. Be given authority to task shops directly to accomplish all but exceptional work.
2. Have clear guidance on what work is an exception.
3. Be equipped with a maintenance management system that allows them to develop, track, and close work orders and to develop work and cost history by shop, user, and facility.*

Realistically, all but exceptional service orders should be completed within seventy-two hours. Whenever this cannot be achieved, the WRC should notify the individual with a brief explanation and a probable completion date.

Repair Projects

Despite all best efforts, some repair projects will arise each year. In addition, the value and complexity of some work may make it necessary to develop and control it as a project (a major roof repair is a good example). Some companies allow certain major repairs to be capitalized, but normally that is not possible. Because these projects tend to be large and often require design, they need to be planned and programmed. They also need to be spread over a number of years so that they do not have too severe an impact on any one single annual budget.

Migration of Funds

Most organizations fund all their alteration and renovation projects from the same account as maintenance and repair. That is an invitation to long-term neglect of the latter. There are nearly always alteration and renovation requirements far in excess of the funds available. Unless controls are established, it is almost inevitable that alterations will consume a greater and greater portion of the annual O&M budget. Two controls have been used effectively.

1. Setting a dollar amount or percentage ceiling on the annual amount of alterations work
2. Allocating the funds, using a user's priority board chaired by the facility manager

I predicted in 1995 that there would be a greater appreciation for the need for better maintenance and repair. That has not happened, and facilities continue

*For an excellent discussion of the benefits of a computerized maintenance management system, see Kalman Feinberg's presentation, "Computerized Maintenance Management Systems as a Financial Tool for the Facility Professional," in *Proceedings of World Workplace '95*, pp. 91-100. Proceedings are available from the International Facility Management Association.

to degrade. The emphasis on downsizing and cost reduction and the need for relatively fewer facilities have masked the coming crisis. As we all know, you can “pay me now or pay me later.” For facility managers who want to be on the cutting edge, I offer the following techniques:

- Wider use of building diagnostics and condition assessment, particularly technology-based, continuous-read systems.
- Increased application of preventive maintenance to all aspects of facilities and their furnishings, not just the plant.
- Formulaic funding for normal maintenance and repair—for example, 2 to 4 percent of replacement value.
- Better use of M&R funds through CA and the use of computerized maintenance management.

There are two outstanding books on maintenance management that should be part of every facility department library: John E. Heintzelman’s *The Complete Handbook of Maintenance Management* and Gregory Magee’s *Facilities Maintenance Management*. These books provide both solid maintenance philosophy and cost-effective techniques for implementing and maintaining a quality maintenance program.

Notes

1. *Committing to the Cost of Ownership* (Washington, D.C.: Building Research Board, 1990), pp. xi–xii.
2. Harvey Kaiser and Jeremy S. Davis, *A Foundation to Uphold* (Washington, D.C.: APPA, NACUBO, Sallie Mae, 1997), p. 2.
3. Edwin B. Feldman, *Building Design for Maintainability* (Atlanta: Service Engineering Associates, 1982).

16

Facility Services

Pulse Points

- *Most administrative services should be considered for contracting out. They require expertise that is not likely to be on staff.*
- *Facility managers should anticipate the expanded or new services that their customers will demand.*
- *When faced with managing a new administrative service, benchmark with and learn from the best-in-class.*

In this chapter we discuss the general administrative services that facility managers have traditionally managed, as well as some emerging services. As middle management has been reduced in companies and agencies, facility managers have taken on a broader spectrum of managed services, to the point that many are questioning again whether *facility manager* is really a descriptive term for the position.

According to a recent survey, the general administrative services managed by facility managers were as follows:¹

Service	Percentage	Change in Past Eight Years
Security	71	+ 13%
Mail services	54	+ 10%
Communications	53	+ 10%
Copying services	44	+ 2%
Records management	50	+ 10%
Moving and shipping	50	+ 11%

Clearly there has been an increase in the role of facility managers as organizations have flattened.

Certain facility managers, of course, manage functions not even surveyed. Each service mentioned here is a major management function. However, I discuss

only some managerial considerations plus how each of these services affects and is influenced by traditional facility services. I refer to the manager of each specific service by that job title (for example, security manager). Large organizations may have a technical manager to handle these specialties for the facility manager, but often that individual is the facility manager in smaller organizations.

Traditional Services

Food Service

Food and facility services are inextricably intertwined. Capital costs for food service facilities are high. Food products soil carpets and furniture. Food preparation areas have high maintenance costs. Because of the fear of spoilage, food service equipment must be kept functioning continually.

Food service is often performed at five levels:

1. Coffee service
2. Carry-out and fast food
3. Full-service cafeteria
4. Private dining rooms with table service
5. Banquet and party service

Increasingly, companies are placing coffee services in the workplace. First, it reduces the time away from the desk. Second, it provides a meeting place for employees to mingle informally. It is interesting to observe these coffee bars. Some are austere and communicate the message, "Get your coffee and don't dawdle." Others are more elaborate, with tables and chairs encouraging communication. Neither approach is right or wrong; each simply reflects the company's approach to work.

These coffee bars require day-porter service to keep them operating and clean. Some companies hire the replenishment of the coffee bars; some use in-house personnel; in others, volunteers make the coffee. Cleanup of the equipment and the immediate area, however, is best done by a day porter. Also, decentralized coffee bars cause an increase in carpet staining, probably because staff often get their coffee in open cups rather than in the covered cups normally sold in a cafeteria. Recycling is changing the face of coffee service (ceramic cups are making a comeback), but it is not making it less complicated.

Whether the company should subsidize food service is an often-debated issue. The consensus is that there is an advantage to have staff eat on the premises so a subsidy is justified. This subsidy most likely consists of paying the rent, utility costs, and repair and maintenance costs rather than defraying the actual costs of food and service.

When food service is provided, the issue is whether to contract out or provide in-house service. During this era of staff reductions, most companies are using food service contractors. There are numerous competent contractors available,

with some specializing in cafeteria, fast food, or coffee. Others provide the full spectrum (table service dining and banquets as well), but at a higher cost owing to increased overhead.

Another concern is whether to hire a national contractor or a local one. A national company centers on the resources available, allowing the client a wide range of talent to support the food service operation. But local companies involve their management or ownership in the operation. The parameters of profit for a regional company are less than for a national contractor.²

The company needs to set the tone for the quality of its food service. It is difficult to make the banquet and private dining rooms profitable at a price competitive with local restaurants unless some of that overhead is borne by a high-volume cafeteria. That is particularly true if the food service operation is required to "eat" a large amount of official entertainment costs. The company needs to decide whether food service is to be a profit center, a break-even operation, or a subsidized service. The contractor can then recommend options to meet the company's objectives.

Maintenance of the food service equipment is always somewhat vexing. One approach is to hire a maintenance package from the food service contractor; another treats food service equipment the same as other installed equipment. The amount of equipment often is the determinant. When justifiable, my preference is to have the maintenance mechanics assigned to the facility department but under the operational control of the food service manager, who also determines their working hours. The security force, all engineers, and all electricians must be extremely sensitive to the specialized needs of the food service facilities, particularly for uninterrupted gas, electricity, and refrigeration. Many facility managers tell sad tales of failing to reactivate power to a food service walk-in refrigerator following weekend maintenance and finding spoiled food on Monday morning. Remember that food storage and preparation occurs at other than "normal" hours.

Reprographics

One of the catch terms of the early 1980s was the "paperless office." Anyone who has ever managed the reproduction function for a large organization knows the term is a myth. Paper enters a facility and has images imprinted in volumes unthought of even ten years ago. It is not unusual for a large company to produce hundreds of thousands of copies annually.

It used to be necessary to hire outside art and design people and a commercial printer, or to establish an internal print plant, if the company needed high-volume, high-quality printing. But with the advent of high-speed copiers, volume no longer was an issue. Then desktop publishing began providing sophisticated graphics and layout. With PC-based desktop publishing and color laser printing, highly sophisticated color reprographics will be almost completely decentralized to the work units. My department can now produce documents at desks that only five years ago we would have sent to art and design and then to a printer.

Because the technology (and also the philosophy) of reprographics is chang-

ing so rapidly, it is difficult to assess the impact of reprographics on facilities. Generally, the cost and ease of installation and maintenance of desktop copiers permit wide dissemination of equipment down to the lowest work units. It is reasonable to require users to "eat" the space to support a desktop copier, but most companies place high-speed, high-volume copiers at designated central locations. Quite often they are stacked vertically so that an employee always knows what location to go to on a floor to find the copy machine.

The location of these copy machines should be chosen carefully. They require large volumes of paper. That paper needs to be moved to the copier in bulk and replenished often. Moving paper in bulk can be extremely damaging. Storage and movement of completed products can be a similar problem. In some exceptional cases, the storage of paper or documents actually can exceed normal floor-load criteria. Also, these machines require a dedicated electrical circuit, substantial space, and special ventilation, particularly if they are used full-time.

Most companies prefer to lease their equipment, although various options are available for buy-lease, maintenance, and copy paper supply. Another decision is whether to have permanent attendants man the high-volume copy centers or to allow staff to operate them. The choice depends on the complexity of the equipment and the expected volume of use. In addition, there is a trend toward decentralizing the support and leasing of desktop copiers directly to work units.

Digital technology is playing an increasing role as the technology is simplified and as consumers become more familiar with applications. Digitization allows different pieces of office equipment to communicate with one another, thus enabling workers to accomplish many tasks while seated at their desks. For example, a letter can be scanned into a computer, printed, copied, and faxed with just a few keystrokes. In addition, the full-color copier is coming into its own. PC-based color copies are now available to everyone at a relatively low cost.

In some cases, the volume and complexity of printed material still require a printing facility. The first option, particularly in urban areas where pricing is competitive, is to contract out. Normally at least two rates are established: one for normal printing and one for immediate turnaround. Ensure that requirements for expedited printing are spelled out in all contracts with printers.

The second option, housing a print plant in the facility, presents unique challenges. Newsprint comes into a facility on large rolls, which are difficult to handle without damaging the facility. Both newsprint and the completed product require some degree of humidity control and storage space. Also, a print plant places a major demand on freight elevators.

Mail and Messenger Services

One of the legends of the corporate world is the chief executive officer (CEO) who began his career in the mailroom. Surprisingly, there are many examples of people who have risen through the ranks from the mailroom. One theory is that if you understand how mail is distributed, you understand how the organization works.

Managing the mailroom requires concentrating on essentials and details. Since mail is one means of communication, there is merit in common management for all communications means in the company. The five factors critical for success are personnel, facilities and equipment, technology, adherence to postal regulations, and emphasis on users.

Staffing is the most challenging area for the mailroom manager. There is a diversity of personnel and of products, particularly when the staff is a mix of in-house and contractors or vendors. Products may include first-, second-, third-, and fourth-class mail; parcels; overnight express mail; registered and certified mail; facsimile and telex; and messenger services. During a recent consulting contract, I was observing the mailroom in the late morning. At the same time, the company's mail clerk was trying to service a U.S. Postal Service mailman, three parcel service delivery men, and two messengers.

Good human resources management in the mailroom does not differ from management in other areas of the company. People must be challenged. Everyone must understand the mission of the mailroom and must realize that they contribute to that mission. Motivation is essential, as is participation in establishing goals and decentralization of responsibility.

Many mailrooms resemble a sweatshop. To avoid this, the facility manager should seize every opportunity to (1) use industrial design to make working conditions more efficient and more pleasant and (2) improve production and reduce boredom. The location of the mailroom (access to the loading dock, controlled access of outside vendors, central location) is critical for effective operation and security. The following points should be considered in design:

1. Work flow should be from left to right, owing to traditional mail equipment design.
2. The layout should be flexible.
3. L- or V-shaped mail-sorting areas are best.
4. Since many tasks are repetitive, study the ergonomics of all workstations.
5. Minimize interruptions through proper layout.
6. In midsize and large companies, use a mail conveyor system.
7. Involve security in determining the mailroom's location.

The availability of entry-level personnel, a traditional source for the mailroom, is becoming tenuous. This means the mailroom manager may have to resort to nontraditional approaches or replace people or functions with technology. Part-time employees such as retired employees or high school students may be hired to supplement the full-time staff. Mailroom jobs can also be enhanced through cross-training.

Ultimately, users will determine the success or failure of the mailroom. Constantly evaluate and seek user feedback.

- How do users feel about the mailroom's performance in general?
- How do users measure the mailroom's operation?
- What can the mailroom do to serve users better?

Never underestimate the value of public relations. Consider an open house in the mailroom. Participate in the company briefing for new secretaries. Consider promoting a mailroom user group.

A real challenge is staying current with postal service and other vendor rules and incentive programs. To do so, keep a library, obtain vendor briefings, and join the local Postal Customer Council.

Smooth work flow, minimum interruptions, and intelligent selection of carriers cut mailroom costs.

Lee Yeaton, vice president of Pitney Bowes Management Services, recognizes the challenges of managing a cost-effective mail center. Mailrooms traditionally are low on the priority list of corporate concerns even though, according to a Pitney Bowes study, mail accounts for over 9 percent of operating costs at Fortune 500 companies. He recommends examining the entire process, not just the mail center:

- Focus on the areas that will affect the business the most.
- Ensure that you are communicating by the most economical method. It often costs less to send a fax than a first-class piece of mail. And 17 percent of third-class mail is never opened, much less read.
- Are duplicates eliminated from the mail stream?
- Is all mail properly classed?
- Does mail conform to postal automation standards?
- Is your business mail reaching the right customers? Should the recipient be paying postage instead of you?
- Do you stay in touch with postal and technology changes that can reduce costs while increasing customer service?³

The proper application of technology is yet one more area for cost-cutting—for example:

- An integrated system connecting scales, meters, a security system, and a PC
- An electronic scale with a memory capable of accounting against a budget, of calculating chargebacks, and that is adjustable for postal rate changes
- Postal meters

The mail must go through, so ensure all equipment has responsive maintenance and repair backup.

More than \$10 billion was spent in 1989 on overnight delivery service.⁴ The accounts payable manager can determine how much the company spent on this service. The reality is that 30 percent of these costs probably can be cut. Express mail and overnight delivery have become almost routine in modern business. To manage express mail costs, focus on three major areas: use, rates, and bills. Consider the following as mailroom procedure:

1. Select the proper mode such as same-day service via air, ground or fax; overnight service via air or ground; two-day service and three- to five-day service. Many services do "best way" calculations if asked.

2. Express delivery is a highly competitive industry. Vendors readily offer discounts to their large customers, but discounts are inconsistently applied.
3. Specify when the material is needed. Sometimes express has become a habit, not a necessity. Log and publish the use of express if there is an appearance of abuse.
4. Get the U.S. Postal Service booklet, *Priority vs. Price*. Certified mail-return receipt can be a less costly alternative to express when urgency is not an issue.
5. Check for errors. Billing errors and overcharges are frequent. Often discounts are not given.
6. Consolidate packages going to the same destination, which is less expensive than sending multiple packages.
7. Obtain a one-time external audit targeted on cost-effectiveness.

Finally, if priority or express mail has become a major expense, which it has in most companies, appoint an express mail manager to lower the costs.

Increasingly, companies are seeking more rapid ways than mail to communicate. However, I believe that the mail and mailroom will be with us for the foreseeable future. Trends in mail are as follows:

- More user-oriented postal services and interconnection of public and private technologies or systems for the advantage of each and discounts for participants
- More work-share programs between the postal service and private companies
- More electronic postage transfer
- Bar-coded addressing and sorting
- PC-based addressing systems
- Robotics in high-volume user mailrooms

Just how rapidly this field is changing is exemplified by the facsimile machine. The fax greatly reduces the workload on central mail services. Companies that grew to operate worldwide providing priority mail service suddenly found their existence threatened. The use of e-mail should have a great effect on both "snail mail" and fax, but most companies find that the expected trade-off does not occur. The volume of all three seems to increase. Conventional mail and priority mail are likely to remain necessary for heavy freight and printed matter like books and brochures. But the mail service manager will have an even greater array of price and technological options in the future. The department's success will depend on how quickly new cost-effective methods are instituted for receiving, processing, distributing, collecting, and disseminating information (not mail).

Transportation and Fleet Management

Normally the facility manager is not the fleet manager in a company with a primary role in transportation (e.g., a newspaper, retail, or wholesale marketing

company). Often, however, the facility manager finds himself the manager of a small fleet of executive sedans, service vehicles for facilities staff, and shuttle buses.

Executive sedans present special problems not only because they have high visibility and sensitivity but because of security concerns. Often the drivers perform a security function also. Chauffeur service, of course, can be maintained in-house, but it can also be contracted as part of a security contract or with a chauffeur service. The provision of sedan service for the company is similar to that of chauffeur service. Sedans can be owned, provided as an unique package, or be part of a fleet package.

Whether to own or lease vehicles is very much a function of the facility manager's willingness and resources to operate and maintain a fleet. The primary reason for maintaining in-house fleet management is control. Leasing arrangements now largely negate that reason. A leased fleet can be responsive and well controlled, so the trend is to lease; I suspect that is prompted by resource, legal, and liability considerations as much as anything else.

Regardless of how the fleet is managed, certain principles should be observed:

1. Vehicles should be centrally dispatched and controlled.
2. Parking, whether on-site or off-site, should be provided for all vehicles. I hold that vehicles should not be garaged at an individual's home or be allowed to be taken home except as an infrequent exception. It becomes viewed as a perk and can create unnecessary morale problems, as well as serious liability exposure.
3. Maintenance can normally be provided best through outside sources (the lessor or the dealer). Extended warranties available on most vehicles actually make maintenance relatively economic. Fleet rates for maintenance services can be negotiated.
4. If you provide gas and oil (or use a credit card), someone should check consumption per vehicle monthly. Another easy-to-implement control is to insist that the normal provider of gas and oil dispense only into an authorized vehicle (license number clearly indicated on the credit card invoice), not a separate container, without a separate approval document.
5. Assign licensed drivers or operators to each vehicle and allow operation by someone other than the driver or operator only as a management exception.

In medium to large facilities, other vehicles can often improve the efficiency of the facilities department:

- A self-propelled or towed extendable personnel lift
- Golf carts
- Small pickups
- A self-propelled material lift

- Street or sidewalk sweepers
- A four-wheel drive vehicle (with a bull-blade for snow, where appropriate)

Many large companies find that a shuttle bus system is necessary in large urban areas. The shuttle can improve normal distribution of mail as well as move people, but it must run on a consistent schedule. Early or late operating hours are some of the most important times for shuttle service; whether employees can use the shuttle as a primary commuting means is a policy issue.

It is important that shuttle pickup points be easily accessible (sometimes special security arrangements must be established). Drop-off locations should be out of traffic so that riders can be discharged or taken on in safety. Pickup points should also be selected and illuminated so that persons waiting for the shuttle feel safe and are not exposed to accumulated exhaust. If possible, panic phones should be available at all pickup points.

Shuttle drivers can be one of the most valuable tools for internal public relations for the department (or one of its most serious PR problems). The drivers should know not only their routes but the location of common facilities (cafeterias, lobbies, etc.), the schedule of daily and special events, and the identity of principal company officers and their office locations.

Records Management

Unless a company's core business is closely tied to records management (an insurance company, a library), properly managing records has been underemphasized. This is likely to change in the near future as companies are increasingly dependent on accessing more information faster yet buried by the increased volume of information. Typically records were maintained at two or three locations (office, central file, historical file) with no uniform policy on records retention or archiving. But the inability to share information, shrinking facilities, and increased computer-generated paper have brought records management to the forefront. It is now estimated that 95 percent of business records are still stored on paper.⁵

Records management at the work-unit level is important to both the records manager and the facility manager, but it is difficult to control. Companies try to control pack rats by limiting the number of files issued, but there are so many exceptions granted that the approach is ineffective. The most effective controls are well-developed records management policies and standards for review, retention, disposal, retention, and archiving. If the pack rats are ever to turn in their files to a central location, they must be assured that their information needs will be met responsively (most seem to require twenty-four-hour response) and without effort. Central files and archives must be located, equipped, and managed to provide that level of service.

Some of the more common media to store files are tape, disk, microfiche, optical disks, and CD-ROM. These new media, while they store information in much smaller volume, still offer substantial file management challenges. Some of the popular file management techniques are:

- Numbering systems
- Color coding
- Automated indexes to paper-based filing systems for active records
- Automated file change-out and control system
- Automated records center for inactive records
- Computer-assisted microfilm retrieval systems
- Automated vital records or disaster recovery plans on databases
- Development and application of networking or communication technology to provide multiuser configurations

One of my mentors told me long ago that when faced with a problem for the first time, I should go to the expert in that area and adopt that person's solution to the problem (little did I know that he was stating the essence of benchmarking). Applying that philosophy to records management, look to the companies for which records are their lifeblood and have either major government oversight or fiduciary responsibility (insurance and mortgage companies come to mind) for best practices in record management. USAA, for example, is recognized for its records management procedures.

Security

In the wake of the bombing of the Murrah Federal Building in Oklahoma City, the Justice Department reviewed security at federal facilities around the country. The review resulted in 8,500 recommended countermeasures. Threat analysis is a vital first step to physical security, and federal efforts in this area can be helpful to all security managers. Federal buildings are rated in five security levels, from minimum security (level 1) to facilities that are densely occupied and critical to national security (level 5). A similar rating could be applied to commercial buildings.

The General Services Administration (GSA) has established fifty-two security standards for federal buildings with occupants. These address traffic patterns, parking, lighting, physical barriers, closed circuit TV, entrance and exit controls, employee and visitor identification, intrusion-detection systems and other aspects. These standards can be used directly or be modified for commercial use.

Improved security is not cheap. The GSA, for example, estimates the minimum security features for a level 4 building to add about 3.3 percent to construction costs.⁶

Today security often is managed by a separate department in large organizations, but whether or not the facility manager has direct responsibility for security, the service has tremendous impact on physical facilities—their design, their operation, and their policies.

It is the administrative service most often outsourced, according to a recent study. Of facility managers having security responsibility (71 percent), 61 percent outsource the function.⁷

Basically, there are three parts to a good security system:

1. *Personnel* who enforce rules and procedures, respond to alarms, assist tenants or visitors, locate and report possible problems, investigate and report incidents and accidents, and provide information to staff concerning security in their areas

2. *Physical devices* that extend the ability of the security officer by providing a delay to an intrusion, alerting the security officer to a problem, and allowing response time

3. *Policy and procedures* that control access to the facility, regulate movement within the facility, monitor for problems, provide a response to hazardous conditions and a method of reporting such conditions, and teach the staff good security and safety

If one has not been done, a security and safety assessment should be conducted by competent in-house staff, a security contractor, or a consultant. The local fire and police department might assist. This assessment should examine the following as a minimum:

External Factors	Own Facilities	
1. Neighborhood	1. Perimeter	4. Elevator control
2. Outside emergency services	2. Interior of the building	5. Fire stairways
	3. Lobby control	

Security and safety systems should be designed to meet the specific needs documented in the assessment. Systems available range from simple to highly sophisticated—and expensive. The system that is chosen should (1) meet necessary codes, (2) fit long-term growth plans, (3) be supportable for at least five years, (4) can be supported seven days a week, twenty-four hours daily, and (5) is compatible with existing systems and power supplies.

The best systems, however, are only as good as the company's security and safety policies and procedures. For example, deliveries should be restricted to loading docks, service entries, and service elevators. Similarly, all employees should be encouraged to report unsafe conditions and suspicious persons and to safeguard both personal and company property. Those steps alone greatly reduce security and safety problems.

Key control can be a major irritant because good security procedures run counter to operational effectiveness. Key control, except in rare cases, must be implemented at the building level and varies with the resources and skill levels available. A master key system should be used only where absolutely necessary. Possession of a master key should be determined by need or status. If keys must be issued to tenants, it is good practice to change locks and issue new keys periodically. Never issue keys on a long-term basis; require that they be turned in periodically and revalidate the need.

Cleaning personnel should be admitted to secured areas by security officers, not given keys. Keys should be under the control of security personnel during nonworking hours, and they should check them at the beginning of each shift.

Each key should be stamped "Do not duplicate" and numbered. There should be a record of the names of the persons and date when keys are issued. When a key is lost or stolen, conduct an investigation. If it is a sensitive area, change the key cylinders. When a person leaves the company, make every effort to obtain all keys by withholding final compensation.

Lighting is perhaps the most important security and safety aid while also being functional and decorative. Effective lighting depends on a reliable power source. Generally, the source is primary power, usually supplied by either a local power company or an on-premises generator; an auxiliary generator, with an automatic switchover; or battery-operated lights with automatic switches and trickle chargers. Only the most critical lights function off the batteries. Lighting can be controlled by a number of devices. Control is normally a compromise among operational efficiency, energy management, and security or safety. Common light control devices are switches, monitors or light level sensors, or timed light sweeps.

Alarms permit the most economical use of security forces. Basically, an alarm is a method of alerting either a specific response group or the community at large that there is a danger, intrusion, or malfunction. Exhibit 16-1 lists some common types of alarms. Generally the alarms do not initiate any action.

Basic components of an alarm system are a triggering device (contact points, metallic tape, ultrasonic, laser), a means of transmitting a signal, a monitoring device or station, and a power source. The same considerations mentioned for selecting a security system in general also apply to alarm systems. In addition, insist that they are UL-approved.

Among the most sophisticated security devices are access control systems. These systems control entrances and special security areas. They are also used for monitoring parking areas and elevators and for controlling lighting and other energy-dependent equipment. But besides monitoring people and electronic equipment, access control systems can track the location of parts, critical files, or other objects.

Some common access control systems are retinal scanners, fingerprint or handprint scanners, access control cards, magnetic strip cards, magnetic dot cards, embedded wire cards, and proximity cards. Combined with a photograph, these cards become identification cards. Some companies incorporate a watermark or stamp to make counterfeiting difficult. When interfaced with a computer, these access control systems can identify who enters a specific location and when. The system can also be set to sound an alarm if someone uses the card after hours or uses an unauthorized card.

Visitor control is another area where efficiency, security, and politics clash. To avoid problems, visitors should be greeted by a receptionist or guard who confirms the appointment and asks the individual to sign in and out. In some instances, guests should be escorted to the person they are visiting, and in secure areas, even escorted to and from the lavatory. Messengers too should be confined to outside the security perimeter. Some companies have created bullpens for them. Service personnel are often allowed to enter areas where even trusted employees can't go. Organizations shouldn't allow someone to service a machine

Exhibit 16-1. Types of alarms.

Alarms by Type

- A. Fire alarm
 1. Detect heat, smoke, etc.
 2. Transmit a signal and/or activate a sprinkler.
- B. Intrusion alarms
 1. Detect an intruder.
 2. Transmit a signal.
- C. Warning/special-purpose alarms
 1. Detect a problem in a machine, etc.

Alarms by Control Type

- A. Local alarms system
 1. Detects and transmits a signal to an alarm on or near your premises.
 2. A bell, horn, etc.
 3. Depends on scaring the intruder or someone calling for help.
 4. The least effective.
- B. Proprietary system
 1. Owned and operated by the company or individual.
 2. Detects and sends a signal to a monitor to the premises where action can be taken (to a guard on a console).
 3. Good if there is a procedure for response and employees to perform the function.
- C. Central station
 1. Detects and transmits a signal to a central location where some action is taken (police or fire department notified or a contract security officer sent or both).
- D. Automatic dialer
 1. A detecting device connected to a telephone which, when activated, will automatically dial the police and play a recorded message.
 2. Some communities have outlawed dialers, due to high false alarm rate.

Circuits

- A. Independent circuit. The best is a direct line from the company to the central station, using protected telephone lines.
 - B. Loop circuit. Several companies are on the same circuit to the central station. It is cheaper, but less secure.
-

until they confirm that a repair has been requested, and the service person should be escorted at all times. Finally, vendors must also be watched. They should not have unlimited freedom.

The average commercial or industrial business has ten to fifteen visitors per year per employee, and up to 40 percent never return their temporary badges.⁸ To deter unauthorized use, some badges now automatically turn a different color when a visitor goes outdoors. For guests who should be in a building for only a limited time, there is a badge that voids itself after several hours, with the word

expired. Also available are badges that automatically expire after one day, a week, or a month.

Security procedures are highly site specific. However, all security personnel should be trained to handle openings and closings, visitors, confrontations with staff, unauthorized personnel, and after-hours emergencies. In large organizations, contracting out security services is often considered. The perceived advantages of in-house guards are as follows:

- Known personnel
- Lower turnover
- Loyalty
- Sense of ownership
- Better control
- More familiar with the facility
- Training and performance can be judged more readily
- Security force is to company's own specifications.

For an excellent discussion of creating a security program in two widely different sites, see "How GSA Is Strengthening Security After Oklahoma City" and "Behind the Scenes of a Safe Urban Campus" in the July–August 1997 edition of *Facility Management Journal*. A facility manager should be able to design an excellent security management program using the information in these two articles.

The perceived advantages of a contract force are as follows:

- Lower expense
 - In-house guards generally earn more than contract guards
 - Few fringe benefits are paid
 - Liability insurance, payroll taxes, uniforms, and equipment are paid by agency
- Disinterest
 - Personnel are not part of the company
 - Personnel hold loyalty to the company, not to other employees

In a large, stable workforce, a proprietary system may be better; where flexibility is required, a good contractor may be better. A survey conducted by the American Society for Industrial Security (ASIS) showed that approximately 40 percent of those companies responding used contract services for 50 percent or more of their guard needs. Over 50 percent said they did so for economy or to avoid administrative problems of labor and personnel, and their experiences were rated from fair to good.⁹

Security managers increasingly are being asked to provide services such as identification document issuance and control, parking control and security, loss prevention, crime prevention, criminal investigation, safety program, executive security, and physical aspects of computer security. Whether to hire a national company or a local company for any of these services is a question along the same lines as for other services. With a national corporation come all the resources

like training, emergency manpower, new services, new equipment, and liability exposure. But a local company may be a known quantity, and it may know its employees better.

Security has become a more important function primarily because of potential terrorism, revenge cases, and increased crime, particularly drug-related crime. Its importance through the next decade is unlikely to diminish, as increasingly companies look to ensure a safe working environment.

Communications

Automation of the workplace has placed unprecedented demands on a company's communications network. In the 1980s, there was no bigger headache for facility managers than cable management. At the same time, deregulation of the telephone industry meant that a company could own its own telephone system, and unparalleled options of equipment and services were suddenly available. Not surprisingly, many communications managers found themselves ill prepared to handle the technical, policy, and operational issues that surfaced. The facility impacts alone were monumental and, in buildings thirty to fifty years old, at times seemed overwhelming—thus, the rise of the communications manager and the consultant for smaller companies.

Communications needs are truly unique to each company, often to departments within the company. Nevertheless, some extremely sophisticated assessment techniques are available. When assessing communication needs, look for the following as a minimum:

- Number of incoming and outgoing calls
- How many people use the lines
- Growth: location, personnel, businesses, profit

For a number of years following telephone deregulation, many companies chose to own their own, premises-based phone system. Some of that ardor seems to have subsided. Leasing again seems to be the financing option of choice. Still, there is increased sensitivity to communications and greater expectations for these in-house systems. I recently observed a FM supervisor at a retreat. He was equipped with a mobile phone, a beeper, and a radio. For service providing instant communications has become a necessity. So, don't forget the following:

- Customers want choices.
- Poor systems give a poor impression of the company.
- Systems are expected to save time, energy, and money.
- Systems are often used as input and switching devices for other building systems.

Common features of modern systems include automatic call-back, message waiting, speed dialing, call waiting, call forwarding, teleconferencing, "Do Not Disturb" memos, intercom, toll restrictions, least-cost routing, station message detail

recording, voice and data switching, and interface with voice mail. When buying a communications system, consider the following:

- What is included in the contract price
- Costs avoided by using new features
- Operating costs
- Maintenance costs
- Flexibility, particularly the ability and cost to expand
- Ability to switch equipment among company locations

It is increasingly evident that the telephone and telephone infrastructure will be used for a broad range of fax, videotext, and data transfer or retrieval services. These capabilities will be enhanced as fiber optics becomes more prevalent. A study of telecommunications, based on telephone interviews and mail surveys of 167 companies, found the following:

- *Corporate telecom networks.* The typical company surveyed had 808 domestic and 27 international network nodes. Typically, more than 20 large computers and 5,000 terminals and PCs were linked into these corporate networks on either a dedicated or dial-up basis, users noted.
- *Key issues facing telecom management.* Almost all of the communications executives interviewed named two or three "key" issues that they planned to address during the next twenty-four to thirty-six months. Named in order of importance, the issues included central site network management; LAN/WAN connectivity and LAN integration; consolidation/network integration; and integrated services (ISDN).
- *Telecom operations.* More than \$20 million was the typical budget for voice and data communications among the respondents. Nearly \$6 million was being allocated for data communications equipment and service alone. These executives reported an average of 38 people assigned to their telecom groups.
- *Other key issues.* Also mentioned as central issues were cost-effectiveness, network availability, international expansion, and network capacity/band width.¹⁰

Electronic and Information Security

Electronic and information security is a corollary to records management, communications, and security. It applies to information security for electronic tools, particularly software, and for the company's informational data bank. Partly, information security is a victim of the information explosion. Administrative personnel, archivists, and librarians are overwhelmed by the volume of information to be managed and sometimes fail to protect it to the degree they should.

The mobility of employees among companies, some of whom are competitors, makes information security even more difficult. Also, systems themselves tend to aggregate data. They are designed to meet operational needs, and security

is often an afterthought. In addition, security of reports is threatened by each new wave of equipment, such as color copiers and printers, that makes counterfeiting easier, along with unauthorized copies. To counteract this, distribute updated reports only if prior ones are handed back for shredding.

Shredders too are taking on additional importance. Some machines are so advanced that they can shred entire cartons of data, still in the carton. As another tactic, security specialists are using encryption to transmit reports. Encryption, however, has operational problems, and its lack of acceptance limits its use. In sum, our best hope for better information security may be better employee training and a campaign that emphasizes the importance of information and intellectual property.

Emerging Services

In this chapter we have discussed general administrative services commonly managed by facility managers. There are also some emerging services that will have an impact on the traditional functions when introduced.

Art Program

It has become fairly common for some capital costs to be set aside for purchase and installation of works of art; 0.5 percent of a major project is a common figure. Quite often those funds are used to buy a few major pieces for the entrance or lobby plus a large number of relatively inexpensive pieces to adorn corridors and office walls.

I prefer to consider all but major pieces of art as furnishings and include them in the planning and design of space. Limited funds are best used for prints rather than originals because it allows a broader distribution of art with limited funds, and it decreases inventory and security concerns. One successful program has been to box-frame 15-by-18-inch photographs of company operations and hang them in appropriate areas. This can be a valuable supplement to the art program and improve the quality of the workplace.

The degree to which art should be appraised, curated, accounted for, and secured can be a problem. Major pieces obviously should be secured. Large sculpture requires few security precautions beyond protection from weather and graffiti. Smaller pieces may require a pedestal, enclosure, and alarms. How extensive the inventory is must be carefully assessed for cost-effectiveness. I suggest any inventory be kept at two levels:

1. A PC-based management-level list that allows callup of a piece by property number, title, artist, location, assigned unit, value range, and place of purchase.
2. A card-based list that contains the following: photograph, property number, title, artist, gallery, and initial purchase price, medium, appraised value, and date of appraisal. (With a CAD/CAM, this file, too, can be PC-based.)

What degree of inventory to maintain is also extremely complex. For example, it probably costs up to \$50 per entry to prepare either of the inventories. Obviously it is not cost-effective to inventory \$25 to \$75 prints. However, if ten of those prints are lost in a year, which is a good possibility, documentation is necessary to make an insurance claim. If the insurance deductible is relatively low (\$500 per incident, for example), an inventory helps recovery of part of the loss. The collection should be reappraised every three to five years.

Large organizations should consider having an in-house frame shop, preferably contractor operated. Besides supporting the art program, a frame shop can be a superior service provider by:

- Supporting in-house exhibitions and photo or art displays
- Framing items like official maps, photos, and certificates
- Maintaining and relocating the company's art, when necessary, for alterations or painting
- Updating the location portion of the art inventory
- Maintaining the art locker—the storage room for all pieces not currently exhibited

Art selection, when there is a capital expenditure, is best handled by a volunteer employee committee, possibly chaired by the design manager. The committee should understand its budget, how much space it is expected to furnish, whether it be permitted to select a major piece and where it will be sited, any procurement rules, and the time schedule. While volunteer committees are sometimes difficult to deal with, art affects employee morale, so employee input is desired from the beginning.

Even with a professional design staff and a dedicated art advisory committee, it is probable that at least a part-time art consultant will be necessary. That consultant will probably be hired on a hourly basis and can assist with appraisal, maintenance, security, and purchasing advice. However, the consultant should not be allowed to sell art to the company. Whether the consultant is allowed to sell art to individuals in the organization is a policy decision.

Shared Services

Shared services are not really a "service," but a way of delivering services; it is ordinarily associated with property management rather than facility management. The landlord of a building with multiple tenants establishes service centers for services such as fax, high-speed copying, parcel mailing, cables, conferences, and exercise facilities, and charges the tenants for usage. This relieves any one tenant of high initial costs to establish the service. Much of the early publicity for smart buildings promoted this concept.

However, these shared services generally were not well accepted. Perhaps tenants wanted more flexibility than the service centers could provide. Perhaps billing was a problem. Perhaps developers had difficulty recovering their capital costs in a reasonable time while charging a bearable rate. Perhaps demand

for services was too erratic and fluctuated too widely to permit effective and efficient management.

Increasingly, however, corporations are using one type of shared service: temporary workstations. Because of the ability now to plug in and plug out telephones and data communications, workstations are being set aside for use by transients, consultants, and excess staff. A variant is to use small conference facilities with easily relocatable partitions as hot-body offices, although the viability of this latter concept is not yet established. While local area networks and flexible telecommunications permit adequate communication among geographically separate members of the same work unit, employees still want turf with recognizable boundaries and social interaction with fellow workers.

Child Care

Of all benefits possible in the workplace, none has captured management's support so quickly as child care. While the human resources chief ordinarily has staff responsibility for child care, the facility manager has major responsibility for space, construction, maintenance, and repair of in-house day care facilities. The importance of a safe, clean facility cannot be overemphasized. Just let any trace of asbestos be found or the water in the drinking fountain be out of tolerance for lead, and concerns will be loudly voiced.

Child care developed from a single-parent, low-income issue into a major domestic policy issue. Corporate decision makers raise child care as a boardroom agenda as they face recruitment competition for a shrinking labor pool. Real estate developers view child care as a valuable marketing tool in an age of empty office buildings. A brief glance at corporate demographics reveals a 45 percent increase in the number of working mothers since 1950. By 1990, 60 percent of new entrants into the workforce were women. Eighty percent of women in the workplace will have a child at some point during their careers.¹¹ Child care is rapidly being recognized as a means to broaden recruitment, reduce absenteeism, lower turnover rates, improve public image, and increase morale. Some employers are even using the availability of day care as a determinant between relocation sites.

Some employers are exploring on-site child care options, but many find the realities daunting. Operating a child care center can incur significant risk—and just opening one can easily cost \$250,000. Although the corporate staff can help with zoning and permits, offering a child care center requires hiring people with necessary skills. Consequently, the company must make sure that the apparent need is both broad-based and continuing before consent is given.

The most common form of day care management is contracted out, with policy set by a board of employee-parents. If the facility manager supports a day care center, he must ensure that service is nearly instantaneous and extensive. Any problem in the day care center must be given a high priority.

Health and Fitness Facilities

Many facility managers who offer health and fitness centers exhibit frustration over their inability to control costs, particularly capital costs. Often that signifies

that the facilities are driving the health and fitness program. The facility manager never gets ahead; this year the employees need an aerobics room, and next year there'll be a demand for a track. When the weight room is still in construction, someone will lobby for a swimming pool.

The health and fitness facilities offered to employees should reflect the program the company has established. Once management decides on a program, the facilities for that program can be planned and constructed.

I feel that the best fitness programs are designed by a professional, guided by an in-house board of directors. Whether the consultant simply helps establish the program, policies, and procedures, or also operates the facility with his own attendants, instructors, and safety personnel, is a corporate decision based largely on the risk manager's willingness to allow employees to use facilities without supervision. I have seen extremely successful programs run without supervision and without legal or insurance problems, while other companies insist on a full-time, CPR-rated professional staff.

Some of the facilities in common use are:

- Urban walking and running courses
- Par courses (suburban areas)
- Aerobics rooms
- Weight rooms
- Exercise equipment rooms
- Saunas
- Handball, squash, and/or racquetball courts
- Multipurpose courts
- Massage rooms
- Tennis facilities
- Running tracks
- Swimming pool

The last three require large space and considerable capital outlay. In general, they are prohibitively costly in an urban environment. A swimming pool brings with it a whole set of engineering, construction, operations, and safety problems beyond what most companies want to tackle.

Whether the company has an institutional health and fitness program or not, changing lifestyles almost dictate that employees have access to showers and locker space. There is a particular demand for lockers and showers at the end or beginning of the workday, as well as at noon.

Company fitness programs tend to draw the most competitive employees. In turn, employees become advocates for their personal preference in equipment and operating hours. For this reason, an employee board of directors should develop and promulgate policy for the fitness center; the facility manager alone cannot and should not try to sort through each proposed addition or change.

Fitness centers have a major impact on facility management. They tend to have high capital costs, particularly if retrofitted into existing space. Athletic facilities are not by their nature more costly to operate and maintain, but because they

often reuse existing space, their design may be suboptimized and therefore more costly to operate than a new facility designed specifically for fitness. Finally, fitness buffs are often zealots; as such, they expect superior services, and their expectations can bring pressures that result in increased operating costs.

Concierge Services

Another emerging service is a concierge in buildings to handle a variety of tasks like obtaining gifts for a spouse, giving out and receiving dry cleaning, and the like—tasks best done during normal working hours.

This concept has worked well in fine hotels for years. With married couples both employed, the need for a concierge at work to handle the mundane but necessary, and sometimes extraordinary, chores becomes more and more viable.

The concierge service is run by an independent contractor who normally offers a menu of services. Some offer to take on almost any task. Most concierges perform for cost plus tips by getting a fee from the vendors to whom they take their business. Others charge a fixed, advertised fee per service. They are normally provided a lobby location, and often are provided heat, light, and electricity gratis. Frequently, there is no need for special provisions, since those services already exist in the lobby.

To the extent that it can be provided with little cost or disruption, concierge service can be of real value to employees. It represents the type of employee-oriented services that companies will use to attract and hold quality employees.

Some Final Words on Outsourcing

I am a strong proponent of outsourcing these administrative services because the result is a more technically competent level of service. The facility manager retains control and ensures customer service. There may be some temporary initial savings if the company has substandard personnel or high company benefits, but the long-term savings are in operational efficiency, ease of human resources management, and the ability to stay up-to-date technologically.

Outsourcing is with us (\$23 billion in services will be outsourced by the year 2001).¹² Facility managers need to develop their skills as outsourcing managers as much as they need to develop any technical skill. As my favorite consultant, Stormy Friday says, "We need to view outsourcing as a tool, not a weapon."¹³

Notes

1. *Facility Management Practices* (Houston, IFMA, 1996), p. 14.
2. John Soat, "The Ins and Outs of Contract Services," *Administrative Management* (February 1986): 59.
3. Lee Yeaton, "It's Past Time," *Today's Facility Manager* (March 1995).
4. Philip Binkow, "Control Delivery Service Charges and You'll Save," *Office* (December 1989): 56.

5. David O. Stephens, "What's Ahead for Records Management in the 90's?" *Office* (January 1990): 135-136.
6. Robert Hager, "Building Security: Are You Overlooking Something?" *The Military Engineer* (December 1996): 25-27. By permission of The Society of American Military Engineers (SAME).
7. *Facility Management Practices*, p. 14.
8. Robert Linn, unpublished class notes for a course on facility management, New York University.
9. Soat, "The Ins and Outs," pp. 59-60.
10. "Telecom Management: The Key Issues," *Office* (February 1990): 17.
11. Cheri L. Sheridan, "Child Care: The Issue of the 80's," *Business Properties Magazine* (November 1988): 39.
12. Paul Tarricone, "Outsourcing Turns to Smart Sourcing," *Facilities Design & Management* (February 1997): 40-43.
13. *Ibid.*

