APPLYING INFORMATION TECHNOLOGY TO COMMERCIAL OFFICE BUILDING OPERATIONS: NEW TOOLS AND TECHNIQUES

by

John Seckman

Submitted to the Center For Real Estate
in Partial Fulfillment of the Requirements for the Degree of
Master of Science in Real Estate Development
at the
Massachusetts Institute of Technology
July, 1992

Signature of Author____
Department of Architecture
July 31, 1992

Certified by _____
Dr. Gloria Schuck
Lecturer, Department of Urban Studies and Planning

Accepted by_____
Lawrence S. Bacow
Chairman, Interdepartment Degree Program in Real Estate Development

APPLYING INFORMATION TECHNOLOGY TO COMMERCIAL OFFICE BUILDING OPERATIONS: NEW TOOLS AND TECHNIQUES

by
John Seckman

Submitted to the Center For Real Estate on July 31, 1992
in partial fulfillment of the requirements for the degree
of Master of Science in Real Estate Development

ABSTRACT

Commercial office building owners today are demanding more efficient and effective management of their properties. Industry professionals agree that one of the weak points in property operations is information management systems. Although there has been substantial progress in applying computer technology to separate disciplines, like accounting and finance, very few applications integrate these functions. This lack of integration causes redundancies, mistakes and inefficiencies in the flow of information among the disciplines in the real estate value chain. The manufacturing industry, among others, has addressed this issue with the use of new computer tools and technology that can effectively link separate disciplines. The result has been a dramatic improvement in the value of products and services. Real estate operations can benefit from this technology as well.

A specific computer software system was adapted to the operating procedures of an asset management team for a major Boston office building. This system was then demonstrated to the team. Subsequent discussions and interviews with team members identified several important issues, including perceived benefits, implementation strategies, risks, justification and the possibility of gaining a competitive edge with the system. Eliminating redundancies, sharing information between functions and creating a building "history" on a central database are three advantages of the system.

The asset management team believes the type of computer technology presented in this research can improve the value of commercial office buildings through more effective and efficient property operations. With graphics, "point and shoot" commands and 3D modeling capabilities, some consider this technology a sophisticated "toy". With vision and leadership, this "toy" can be used to create a powerful competitive advantage for real estate operators and owners.

Thesis Supervisor: Dr. Gloria Schuck

Title: Lecturer, Department of Urban Studies and Planning

CONTENTS

INTRODUCTION

Not since the great depression has the real estate industry been in such disarray. Property values are falling, vacancy rates are rising, and real estate companies are struggling to adapt to a changing market. Office buildings, once the darling of the industry, are particularly hard hit. Massive overbuilding, coupled with softening demand for office space, has wreaked havoc on the office building market. Office building values have fallen by as much as 28 percent over the last three years, and it is likely they will fall even more in 1992 (Emerging Trends,1992). The average vacancy rate for these properties now hovers around 19 percent, compared to only 4.5 percent in 1979 (Wheaton,1992). All types of office buildings are affected, from "trophy quality" downtown properties to suburban office parks (Emerging Trends,1992). While the long term viability of the industry is still good, there is no quick fix for the current crisis. The existing supply overhang will take between five and ten years to absorb, depending on the location, if no new construction occurs (Birch,1991 and Wheaton,1992).

As a result of the decline in values and cash flow from their real estate investments, owners are increasingly concerned with the performance of their existing properties. The emphasis today is on creating value at the property level through new strategies and more effective asset management.

Donald Conover (1992) wrote recently that **"The key to success in real estate today is strategic asset management".** He defines asset management as "the protection and enhancement of creation of real estate value through the integration of all the real estate operating disciplines whose purpose is to drive the rental income stream" (p.16). Value in non-owner occupied office buildings is primarily created through leasing the space to tenants. The disciplines involved in "driving the rental income stream" include accounting, architecture, construction, engineering, finance, marketing and property management.

The pressure on performance at the property level means that owners are increasingly concerned with organizing the disciplines involved into more cohesive asset management teams (Herzberg,1991). Real estate operations are typically fraught with redundant and inefficient information systems, especially in terms of integrating the different disciplines. Information created and used during the process is often lost, misinterpreted or recreated because effective coordination and communication between disciplines is lacking. This slows down the process, increases mistakes and frustrates employees. This situation has not been fully addressed because until recently the focus was on building new buildings, not operating existing ones. Indeed, of the 5.5 billion square feet of primary office space in the United States today, 40 percent was built after 1981 (Birch,1991). In the 90's,

however, successful real estate operators will have to squeeze value out of their properties through more effective and efficient asset management (Leary,1991). Perhaps there are some lessons from other industries that can be applied to this challenge.

Information technology is a key ingredient in other industries that have successfully dealt with the problem that faces real estate owners. Many manufacturing firms, for example, have learned to coordinate separate functions like design, engineering, manufacturing and service into cohesive units with information technology systems as the central link. The result has often created teams that are able to produce more creative work in shorter time with higher morale than ever before (Morton,1991). In many ways, office building operations are similar to the manufacturing process. Most of the disciplines in the manufacturing process, shown in Figure 1, are also present in office building operations.

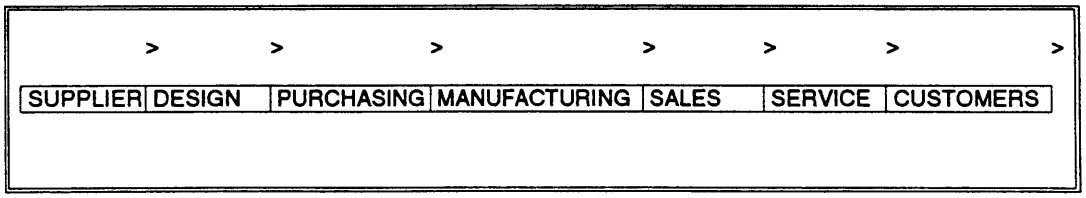


Figure 1. Manufacturing process.

A building could be viewed as a capital investment that produces a product (individual offices) that is sold (leased)

in customized units. These units must be produced at a competitive rate and serviced in order to gain customer satisfaction. In short, office building owners might be considered as manufacturers of space (Belmonte,1991).

This thesis explores the possibility of applying new information technology and tools to the process of operating office buildings. There is a new generation of computer tools and technology available that can capture the information created and used by most of the real estate disciplines on a single, comprehensive system. The research focusses on how such a system might be integrated into the asset management process. In theory, the technology can enhance individual productivity through automation, and improve the process by providing information and coordination between the disciplines. In simple terms, this paper asks whether or not the technology is practical to use and to what extent it can add value to the asset management function.

The research involves applying a specific computer software package to a major office building asset management team. After researching information technology trends and applications, each member of the asset management team was interviewed in order to build an accurate model of their current process. Based on this model, the computer software was customized to fit the process and demonstrated to the team. Subsequent meetings allowed issues related to utilizing the program to be identified and discussed.

Chapter one begins with an overview of the office building industry and value chain. Next, examples of how other industries have adapted to market pressures are presented, followed by an explanation of information technology. Current examples of the use of this technology in the real estate industry are then described. Chapter two describes the specific computer system and office building asset management team applied in this research. Chapter three details tools and procedures currently utilized in each step of the office building operation, followed by examples of how the computer system can be applied to these steps. The final chapter presents the reactions of the asset management team to the computer system demonstration, and conclusions reached during the course of this research. Although more research is necessary to address specific issues, this paper explores the possibilities for applying information technology to the office building asset management process.

CHAPTER ONE - BACKGROUND

The focus of this chapter is to establish background information on which the research is based. First, a brief description of the players involved in the office building industry is presented. Examples of how other industries have applied computer technology and a description of information technology is then provided. Finally, current computer software uses in the real estate industry are reviewed.

OFFICE BUILDING INDUSTRY OVERVIEW

Office building owners range from individual investors with one or two properties to institutional investors, such as pension funds, that often own real estate portfolios worth billions. While the individual owner may be directly involved in the day to day operations of the property, investors with major real estate holdings often depend on a variety of outside firms to handle this task.

Generally speaking, there are two levels of involvement in the operation of commercial real estate, asset management and property management. Many institutional investors rely on real estate asset management firms to "run" their real estate portfolio. These firms assume all responsibility for the real estate, acting as a surrogate for the owner (Glickman,1992). Many real estate developers operate on this level, controlling properties that they own or manage on behalf of a partnership

or equity investor. The asset manager may utilize outside property management firms, or perform these functions within their organization.

Within the property management function, a distinction between property management activities and marketing is usually made. Since the disciplines are distinctly separate, it is not unusual to have separate firms providing these services. Traditional property management involves the financial and physical aspects of the building. Financial management involves managing the expenses and income for the property. Collecting rent, paying expenses, and keeping detailed records of the cash flow are important aspects of this job. A large building may have dozens of tenants, each with different rental rates and expense charges, so that merely tracking revenues and expenses is a complicated task. Preparing financial reports to an outside party, such as the owner or a mortgage holder of the property has also become an increasingly important in the current market.

Property management also includes managing the physical building. The physical building includes both tenant offices and common areas, with equipment and infrastructure that serve the entire building. Maintaining the building infrastructure includes cleaning and repairing lobbies, landscaping, servicing mechanical equipment and monitoring the building mechanical, electrical and plumbing systems. Maintaining the tenant offices involves providing janitorial services,

servicing fixtures and making sure the occupants have a comfortable working environment. Coordinating the design and construction of new tenant suites or remodeling existing ones is also a function of the property management team.

The marketing function primarily consists of leasing activities, although advertising, public relations and other functions also fall under this category. The leasing staff is charged with finding and securing tenants for the property. They usually handle lease negotiations, and coordinate the activities that occur before a tenant moves into the building.

The real estate value chain is a collection of separate and distinct value activities that are performed in order to market, design, develop and service the product, which is office space (Porter, 1985). It involves activities performed by the asset team members as well as services purchased from outside vendors. Each firm's value chain is a reflection of its strategy for competing in the market. A typical real estate value chain is shown in Figure 2 (Macomber,1991).

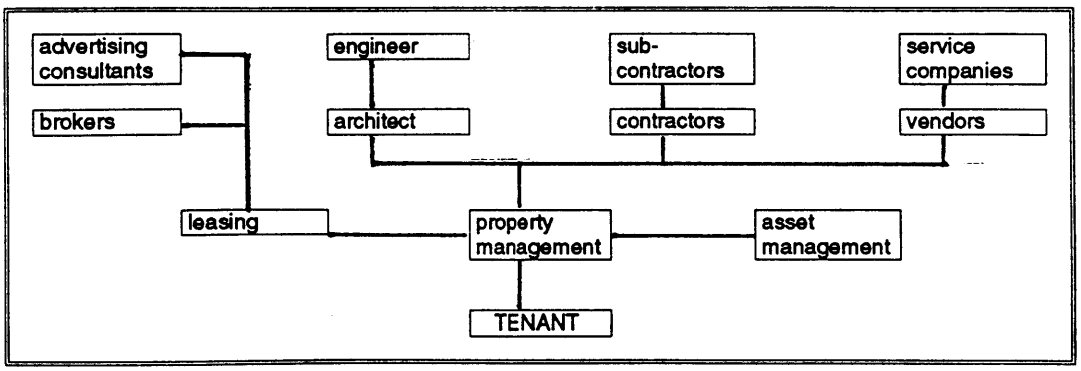


Figure 2. Real estate value chain.

While these functions are technically and strategically distinct, they are not independent activities but a series of interdependent activities. Each activity is linked within the entire value chain (Porter,1985). In office buildings, for example, a simple design decision to include special lighting in a tenant's suite impacts other areas as well. The engineer must check to verify that the electrical system will accommodate the new fixtures. The change must also be communicated to the contractor since it may affect the cost of building the suite. Any change in cost must be communicated to the leasing team since it may affect the deal. The contractor will need to contact the supplier to inquire about the availability of the fixtures since special order items can delay the completion date. Information flows up and down the value chain as the product is created.

Coordinating linkages can be a factor in developing a competitive advantage in an industry. Better coordination can reduce cost, improve efficiency and be a source of differentiation (Porter,1985). For example, an asset manager described how the management team had to retrieve information from the home office accounting report, and input it by hand into a customized report format for the project owner. This double handling requires extra time and can be a source of mistakes. If a system could be developed that would allow the home office report to be integrated electronically into a customized format, time and mistakes would be saved. The

flexibility and efficiency of such a system might also be a selling point in attracting new business (Krouch,1992).

For asset and property management firms, there is pressure for efficiency and effectiveness from several directions at once. One of the effects of the slowdown in new development activity is that many developers have turned to third party asset and property management as a means of survival. As a result, competition in the field has grown fierce. Property owners are simultaneously cutting the asset and property management fees they pay and demanding more professional service and better reporting procedures. Higher levels of competition for tenants, due to the oversupply of space, also demands more sophisticated leasing strategies and higher quality property management.

While total value chain strategy might involve internal and external linkages, this paper focusses on the linkages between internal asset team members. Office building operations generate an enormous amount of information that must be coordinated and communicated effectively and efficiently in order to create maximum value from the asset. Professionals from some of the best asset management firms in the industry have expressed the need for better information systems and procedures (Sears,1992 and Krouch,1992).

LESSONS FROM OTHER INDUSTRIES

John Rockart wrote recently that one factor pushing development of information technology (IT) is "the era of the customer" (1991). Companies are restructuring their processes in order to provide superior products and service to their customers. In many industries, this in response to increasing competition from the global market. Xerox, for instance, discovered in the early 1980's that their product delivery time was twice that of their Japanese competitor. Upon investigation, Xerox learned that the primary reason for the difference was that the Japanese had learned to coordinate their design, manufacturing, engineering and purchasing functions as a single unit. At Xerox, these disciplines acted as independent functions, so that new products were thrown "over the wall" from one function to the next. The lack of communication between functions caused new products to bounce back repeatedly between departments causing the product development cycle to increase. Xerox responded by developing product teams that were linked by a central computer system which allowed each function to share information and communicate with real time data (Rockart,1991). This is not unique among manufacturing companies. Firms like Lockheed, Black & Decker and Ford Motor Company have utilized computer assisted design (CAD) and computer assisted manufacturing (CAM) based information technology to integrate their product development functions resulting in faster product development

cycles. Ford claims it brought out the highly successful Taurus model twelve months ahead of schedule because of this integrated approach (Morton,1991).

At the other end of the value chain, customer service, firms like Xerox, Digital, and Otis Elevator have utilized information technology to integrate product, customer and service history information, providing higher levels of service. Otis's well publicized OTISLINE project linked service technicians, dispatchers, product information and service history into a central system that revolutionized their service concept. Under their new system redundant tasks, like preparing summary reports to the home office from the field office logbooks were eliminated. Because all service calls in the United States are now on a central database, products with unacceptable service records could be detected. This data is passed to the design and production teams for correction.

The evolution of IT within the manufacturing industry is relevant to the situation in real estate. The first applications began with automating single functions, like accounting and payroll. Simple networks were then added, linking one or two departments. Shared access databases were introduced next. Eventually the networks were expanded to allow all types of users to connect to the central database, whether they were using sophisticated CAD workstations or simple word processors. At this point, the basic elements of

an IT system are in place (Rockart,1991). Real estate functions have become increasingly automated, from accounting and financial applications to architectural CAD systems. Are networks and databases around the corner?

In the banking industry, Merrill Lynch scored big with their Cash Management Account, which relied on IT to interrelate several separate functions to provide an "integrated product" (Morton,1991.p.135). Other banks such as Citicorp, Chemical and Banker's Trust are investing in their trading operations by providing computers for their traders with enhanced user interface and more sophisticated decision support tools. At the same time, they are upgrading the back office functions and building electronic links between the traders and the back office to provide seamless electronic trading (Morton,1991). One of the most powerful applications of IT is visible in the ubiquitous grocery scanner check out system. This electronic tool not only simplified the check out operation but yielded substantial benefits to the grocery industry by tracking store inventory and providing information on consumer purchasing patterns.

INFORMATION TECHNOLOGY OVERVIEW

In 1985 Michael Porter wrote, "The information technology revolution is sweeping through our economy", and that "No company can escape its effect" (p.149). Morton (1991) states: "Information technology as an information engine can do for

business what the steam engine did in the days of the industrial revolution" (p.8). What is the revolution all about? The IT revolution is a product of two factors, the demands of an increasingly turbulent and competitive business environment and the growing power and affordability of computer technology (Morton,1991).

Global competition, the push for quality products and service, environmental concerns and political change are all part of the modern business climate. To keep up, businesses are finding it necessary to be increasingly coordinated to provide maximum impact. Companies are seeking higher levels of productivity and increased responsiveness to market trends and the requirements of customers (Morton,1991). As was previously noted, the real estate industry has a particularly challenging market environment in the years ahead.

At the same time, computer technology applications are spreading throughout society due to advanced capabilities and reduced costs. Computer applications today go well beyond numerical data processing to include qualitative information, images and drawings. Information can be processed and formatted to fit the user's needs and, through networks, can connect to any point on the globe (Morton,1991). This increasing power is often available at a reduced cost. Consider the change in price of the architectural CAD system in the last decade. In 1981, a typical system cost $250,000 or more, had 1 megabyte in memory, 80-640 megabytes in disk

capacity and measured roughly 30"x 120". In 1990, a comparable system costs about $15,000, has 16-48 megabytes in memory, over 200 megabytes in disk capacity and measures 20"x 20" (Novitski,1992).

The power of IT comes from the fact that it affects both production and coordination. As a production tool, IT can be used in producing physical objects, like cars or buildings, but it is also capable of producing intellectual products such as loans and budgets. IT is especially applicable to work where the employee depends on knowledge or information in order to perform their task. These "knowledge workers" can comprise up to 80 percent of a service organization and are categorized as workers that add value to original information (Morton,1991,p.10). This includes designers, engineers, brokers, and anyone that produces budgets, market research analyses, legal briefs, etc.

The ability to use IT for coordination as well as production functions creates an elegant synergy. An example of this is American Airlines' computerized Sabre reservation system. In addition to automating reservation and ticketing functions, it is also used by American for route scheduling and other functions (Porter,1985). Utilizing IT also yields benefits in its ability to create an "organizational memory" (Morton,1991,p.11). For example, large corporations utilizing computer assisted facilities management (CAFM) systems to track their offices and equipment can calculate occupancy

costs, average space requirements and furniture lists automatically. These capabilities can be a significant aid in strategic planning. The business database also establishes a record that allows the information to be sorted in order to detect patterns.

IT strategy goes beyond information to include the technology for processing, communicating and storing all of the information that firms create and use (Porter,1985). The concept includes hardware, software, networks, workstations, and is increasingly concerned with how different computer systems can be interconnected to share information (Morton,1991). The basic IT components are depicted in Figure 3.

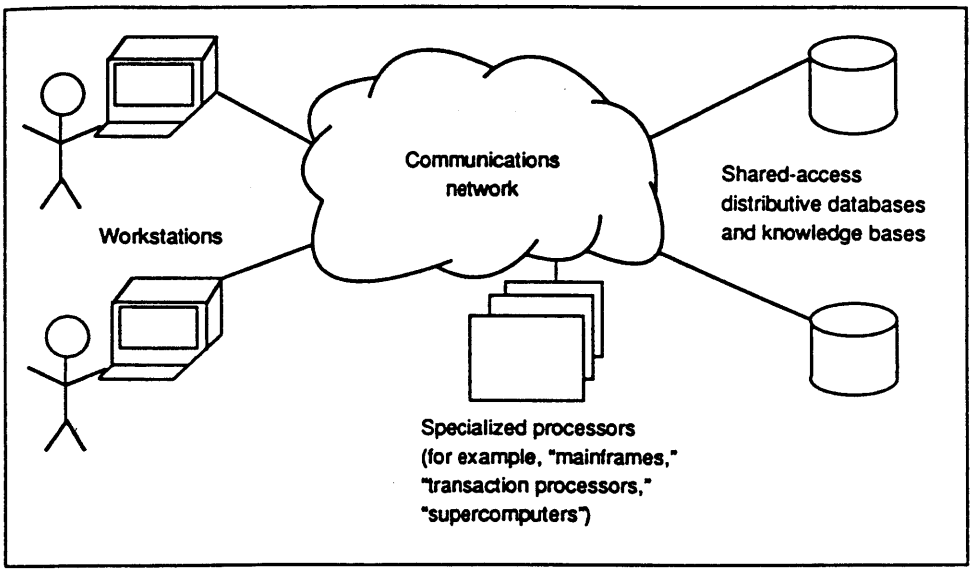


Figure 3. IT Components (Morton,1991, p.35)

Hardware is the physical unit, or computer, which can range from a personal desktop computer to large mainframe computers. Software is the operating "language" that allows the user to utilize the computing capabilities of the computer. Software includes traditional operating languages like MS-DOS and COBOL as well as specialized applications like Lotus 1-2-3 and WordPerfect. Communication networks include simple, interoffice computer links as well as global networks, like the international telephone system.

The three main components of the IT application considered in this paper are described as follows:

Workstations. The most visible part of the system sits on your desk. While a workstation can describe a wide array of computer systems, this paper focusses on personal computer (PC) workstations. PC workstations range from simple word processing computers to sophisticated computer-aided design (CAD) tools. The PC workstation is evolving from a "dumb terminal", dependant on separate mainframe computing capacity, to an increasingly sophisticated workstation capable of enormous computing power. At the same time, technology is making the workstation easier for the average person to use. Simplified menus, visual guides and other common sense interfaces allow people to perform much more complex work on the new systems without extensive training (Morton,1991). As the workstation becomes more powerful and easier to use, the

user's decision making and cognitive processing abilities are increased. (Morton,1991).

Shared Access Distributed Databases. This is a repository of information that operates like a modern day central file system. Information is gathered and stored "on-line" which means that it can be accessed by other computers operating on the network. A common example of a shared access distributed database is the computerized library catalog system which contains titles and abstracts of information available in certain libraries. Once the information is stored in the database, it can be accessed in different ways from a variety of terminals on the network. A major IT trend is the emergence of affordable distributive databases with enormous memory capacity. Hardware and software technologies are evolving in ways that make it possible to maintain extensive amounts of information on line and to access this information through networks from any location (Morton,1991).

Communication Networks. The network is the system that allows one workstation to communicate electronically with other workstations, databases, and other electronic links to information. Common networks include; **Local Area Networks** (LANs), which connect computer systems in close proximity to one another, as in a single office or building; **Internal Wide Area Networks**, which might tie geographically removed

departments of a corporation together; and **External Wide Area Networks**, which is a network available to the public,like the telephone system (Morton,1991).

An effective network may rely on a combination of these network systems. For instance, a workstation operator may be able to communicate with the workstation in the next office on a LAN, the home office in the next state on an internal wide area network and outside suppliers on an external network (Morton,1991, p.36). Increasing interconnectivity between applications is leading to the development of high performance, high reliability, comprehensive communication networks. More simply, this is the ability to organize and connect the workstation and database components into cooperating information systems (Morton,1991).

Applying Information Technology

There are at least two stages that firms typically encounter as they attempt to take advantage of IT. **Automation** occurs when manual operations are replaced by computer applications. This can replace whole jobs, as many telephone operators and assembly line workers discovered, or can eliminate manual portions of a job, such as computerized spreadsheet calculations that were previously done by hand.

"Informating" (Zuboff,1988) is what happens when automated processes yield information as a by-product. Grocery scanners, for example, automated the price entry

function of the check out clerk but also provided an enormous amount of information. Inventory control, purchasing and consumer buying research were all dramatically affected by this new source of information. Informating involves the use of new tools that produce information that can then be used to open up new business practices or additional market opportunities (Morton,1991).

The combination of enhanced workstation power, increased organizational memory through interconnected databases, and the development of new ways to organize these components through networks is expected to enable new forms of organizational relationships and enhanced group productivity (Morton,1991). We are entering the age of the information based organization, and although there is no clear picture of how these new organizations will look, there are some clear trends that can be identified. The managerial challenge of the future is to actually build the information based organization (Drucker,1988).

CURRENT COMPUTER APPLICATIONS IN REAL ESTATE

Information technology is working its way into the real estate value chain from several directions. Property management applications, computer assisted design (CAD), computer assisted facilities management (CAFM) and automated building systems are all increasingly present in office building operations.

Property Management Software

Probably the most common type of computer application in the real estate business is in property management software. There are literally hundreds of property management software programs available, over 95% of which are accounting based (Hanrahan,1991). Many of the leading office building asset management firms are contemplating changing or upgrading their existing property management software in order to provide more flexible and comprehensive services. Draper and Kramer, a national full service real estate firm, recently publicized their new "information infrastructure" (Heilbrunn,1991,p.60). The firm's previous mainframe accounting system required information to be processed in the home office and then forwarded to the individual properties by mail. On-site managers found that the reports were out of date by the time they were received, and that property owners were increasingly demanding up to date information. The company implemented an on-line accounting system network utilizing the IBM Information Network and Distributed Real Estate Management System (Drems) software. Figure 4 diagrams the basic network configuration utilized by Draper and Kramer (Heilbrunn,1991,p.60).

This system allows on site personnel to access current information from the home office, produce customized reports, and to manipulate the data heuristically. Benefits include faster response times, higher quality tenant and property

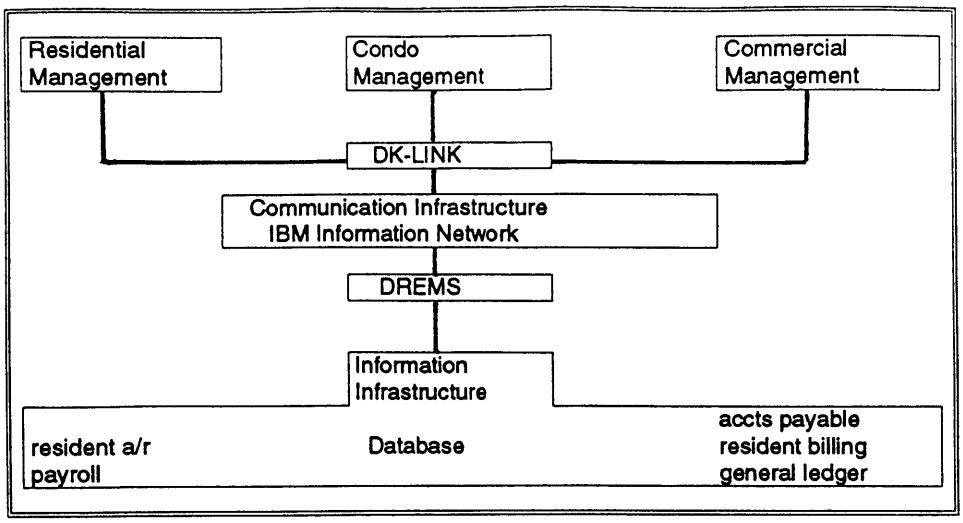


Figure 4. Network configuration for Draper and Kramer (Heilbrunn,1991,p.60)

owner service and fewer redundant tasks. The company believes that property management companies must take advantage of increasingly powerful information systems to order to succeed (p.61).

Travelers Realty Investment Company, which relies on third party property managers to operate its national real estate portfolio, also implemented a computerized information system. In the mid 1980's, they realized that their traditional paper reporting system and centralized data processing was inefficient. Reports were received from the properties, and then reentered into the mainframe computer. Internal asset managers did not have access to current information because of the delay required to update the

centralized data file. The asset managers also needed more information, like lease abstracts and tenant records in order to effectively monitor the property. Bringing new properties into the system took days of inputting property information received from the field.

Travelers changed to a decentralized, PC based computer system in 1989. With the new system, property managers could transmit property information directly into the central database at Travelers. Because the need to reenter data was eliminated, the time required to perform an in-house property analysis dropped by 80 percent. Monthly reports are also transmitted directly into the database, providing current information to the asset managers and eliminating the need for staff accountants to enter the information. The program also allows related property information to be maintained on line as well. The new system gives the asset managers a more complete picture of the property. If the property management firm is replaced, transferring the property information is done by simply downloading the computer records on a diskette (Healey,1989).

Trends in property management software include the increasing use of databases, enhanced user interfaces (e.g. graphics, windows and pull down menus) and more on site computing capabilities. Links outside of the traditional accounting functions are appearing, such as one residential software package that offers on line credit reporting in

addition to the accounting function. A few of these programs are offering limited forms of asset management features, such as financial projection interfacing and consolidated reports. Work order maintenance systems are also becoming increasingly popular in this field (Hanrahan,1991).

CAD Systems

CAD technology began as a simple drafting program that allowed the designer to "draw" on computer. The computer could then produce mathematical calculations from the lines, like wall dimensions, automatically. As the technology advanced, CAD programs began to perform other time saving tasks, like allowing an element to be designed once and then copied to other parts of the plan. Much like the simple typewriter evolved into today's powerful word processor, modern CAD technology can manipulate drawn images in ways never imagined. CAD technology is now used in automobile and spacecraft design, solid modeling, and is the basis for new "virtual reality" computer programs. Architectural CAD packages now produce 3D models, visual perspectives, volume and area calculations, and many other complex tasks automatically. Building elevations, floor plans, architectural elements, and furniture layouts can all be drafted on CAD systems. CAD drawings can be electronically stored, transmitted, overlayed and manipulated heuristically.

Architectural firms are using this CAD technology to

enhance their services to building owners and developers. Cambridge based Sumner Schein Architects designed the Emerald Square shopping mall in North Attleborough, Massachusetts on a Drawbase CAD system (Belliveau, 1990). The developers, New England Development and Pyramid, also depended on the firm to create leasing documents and floorplans. Using the CAD technology, the architects could manipulate the original plans to produce specialized leasing plans. By stripping out extraneous detail and adding information like tenant names, the plan became a communication tool for the center leasing staff. More importantly, by using CAD technology these changes could be made quickly and cheaply. Recalculating leased and available areas for the one million square foot project, which would have taken four or five days by hand, could be done on the system in a matter of minutes (Belliveau,1990).

CAFM systems

Computer assisted facilities management (CAFM) systems evolved out of the CAD field. CAFM programs link plans created on CAD to relational databases. Simple programs allow users to view plans graphically on standard PCs and access information about the plan from the relational database. Information about an office desk shown on the plan, for example, can be stored on the relational database. A user simply selects the desk from the graphic plan to retrieve the

related information. Information contained in the database can also be sorted and retrieved alphanumerically (e.g., produce a report of all desks or all desks purchased on a certain date). Typical applications include tracking furniture, equipment and personnel, as well as facility maintenance planning and control. The majority of this CAFM software is directed at the corporate facilities manager, who has the task of managing company controlled real estate. Although the CAFM programs offer tremendous advantages to corporate facilities managers, this application has not been widely accepted to date. One of the reasons for this is that corporations have been slow to recognize the strategic value in managing their real estate assets efficiently (Cusumano,1990). As a result, many corporate facilities departments are poorly staffed and operated due to their low standing within the corporation. This attitude is changing, however. Large corporations are upgrading their internal facilities management systems or contracting with professional property managers for this service. Many national property management firms are exploring the uses of CAFM as a means of providing corporate facilities services.

Most CAFM programs are "added on" to existing CAD software, and are, therefore, not fully integrated systems. For example, design changes made on the CAD system will not automatically be reflected in the relational database. More advanced applications, however, combine full CAD and

relational database technology into a single, fully integrated program. The Drawbase CAD system, for example, has a fully integrated relational database built into the program. Using this system, the architects for Emerald Square Mall created and maintained for the owner a database that stored and tracked information related to the plans. For example, adding a tenant to the plan would instantly update the database. Reports listing tenants by category or square footage can be created in minutes. Since changes are immediately reflected in the reports, the owners could request "what if" scenarios for the center. The owners also consider the program an asset for continued management of the property. Using the system, the architect can provide equipment and common area maintenance schedules for the center.

Olympia and York's Canary Wharf project also utilized this new technology. With over five million square feet in the first phase of the project, O&Y needed an effective way to keep track of the leasing activity. Dyer/Brown Architects, in Boston, was hired to implement a fully integrated CAD/CAFM system to track this process. The program began as a plan management system, whereby Dyer/Brown provided monthly leasing status reports in graphic and alphanumeric format. These reports detailed the status of each building, as well as cumulative totals for the project. On line CAD plans were maintained as well, allowing the leasing team access to current information between monthly reports. The leasing team

communicated changes to the architect via fax or telephone, which would then be entered into the system. A computer link between London and Boston "downloaded" the revised plans to the London office each night, so that the CAD plans in the leasing office were current (Kelly,1992).

In the early phases of the Canary Wharf project, the leasing team relied on Dyer/Brown to provide area calculations for proposed tenants. Eventually, Dyer/Brown devised a simple method for the on-site team to perform this task using the on site terminal. As the project team grew accustomed to using the system, new functions were designed into the program so that they could perform more tasks directly on the system. For instance, the project manager preferred to analyze the project figures using Lotus software. Dyer/Brown designed an external link to Lotus software so that project figures could be downloaded from the CAD/CAFM system directly into a Lotus template (Kelly,1992).

Dyer/Brown also provides CAFM service to several office tenants. At Canary Wharf, Texaco occupies 250,000 square feet which was designed on a CAD system. They hired Dyer/Brown to convert the plans into a CAFM program which they use to track furniture, equipment, personnel and computer network cabling. A downtown Boston law firm had their floorplans converted to a CAFM system by Dyer/Brown which they use to track personnel and equipment. This system is designed so that one of the law firm secretaries can modify names and furniture layouts on her

standard PC even though "she doesn't know the first thing about CAFM systems" (Kelly,1992).

Curt Fentress, a Denver based architect, wrote that CAFM programs can store vast amounts of information on financial, operational and leasing data, thus providing property owners, leasing agents, and property managers with current information at their fingertips (1991). Fentress proposes that this information system could be a competitive edge in a cost driven market, allowing for higher quality management of properties. Fentress also advises real estate firms to utilize professional CAFM service organizations, like his architectural firm, to maintain the system. Many architectural firms now offer CAFM as an additional service, but the necessity of relying on an outside company to utilize the system is somewhat limiting (Cusumano,1990).

Intelligent Buildings

Another application of information technology to office buildings is the "intelligent building" (Tateishi,1989,p.55). The intelligent building concept originated with construction of the City Place building in Hartford, Connecticut about ten years ago. This building, termed a "smart building", was one of the first to utilize a computer controlled energy management system. While computer controlled systems have become standard in class A office buildings, the concept of intelligent buildings has stalled somewhat in the United

States. In Europe and Japan, however, intelligent buildings are continuing to evolve. In Japan, new buildings include fully automated HVAC and security systems, presence-sensitive light switching, and pre-wired fiber optic networks. Enhanced telephone and data communications capabilities as well as computerized business resource libraries are being offered to occupants of multi-tenant buildings in Japan. The Japanese concept has grown to include a complete building environment that offers services beyond comfortable office space. This allows building owners to create more value from their buildings and occupants to become more efficient (Tateishi,1989).

As these buildings become more intelligent, they also grow more complex. Therefore, one of the trends in managing these intelligent buildings has been to utilize state of the art CAD based CAFM programs. Tracking fiber optic cable networks, monitoring automated building systems and changing office layouts mandates a commitment to new information technology systems as a facilities management tool (Tateishi,1989).

The next chapter will focus on a specific software program and office building asset management team.

CHAPTER TWO - THE SYSTEM AND APPLICATION

This chapter describes the specific computer software program and asset management team used as the basis for this research. First, the Argos Facilities Management program is described. Then an overview of the building and asset management team to which the program was applied is presented.

THE ARGOS SYSTEM

The IT system utilized in this research is a fully integrated CAD/CAFM facilities design and management program. It has many of the features of standard CAFM programs, but has additional features designed for asset management and building operations applications. Argos Systems, the software developer, has been a pioneer in CAD based applications since it was founded in Finland in 1979. Clients in Finland apply their software to mechanical engineering, plant design and piping, residential building and other tasks. A version of the system applied in this research is used by Hewlett Packard to track their computer network system in Finland. Argos opened a U.S. office in 1991.

The Argos system combines architectural CAD technology with a fully integrated information database. The CAD technology is very advanced, with features that make design faster, easier and more reliable. All functions are performed on screen, with "pull down menus" and multiple windows for

manipulating several pieces of information at once. For example, when designing an office suite, the operator uses pull down menus to select the type of wall, door or other feature required. Pull down menus are customized choice lists that appear on screen for each design element, allowing the operator to choose from a pre-selected list. Once selected, a mouse is used to place the feature and the computer draws in the element using correct architectural notation (e.g. double lines for double sided drywall). These pull down menus can be programmed to contain architectural elements, furniture, equipment and other design features. Once a standard feature, like a building standard door, is added to the menu, the designer can repeatedly place the door in one step and the related information about the door is automatically included. It is also possible to program groups of elements, like standard office furniture layouts or entire office suites, into these pull down menus which can simplify the designer's task. The system has an automatic "clean up" feature that adjusts the drawing when features are added or removed, like removing the underlying wall section when a door is added.

The system can produce 3D models, area calculations, wall dimensions, interior perspectives and other information automatically from the design. It can generate complete material lists (down to the number of drywall screws), calculate electrical and HVAC loads, and provide reports on an ad hoc basis. Changes to the plan are reflected in these

automatic calculations immediately.

The fully integrated database allows seamless interaction between the graphic design and accompanying numerical and textual information. As the design is created, the database records the information related to the design. The resulting plan is a complete document containing graphic, alphanumeric and textual information. The value of this plan is much greater than simple paper drawings. The plan can be used to track furniture, office equipment, computer networks, or any other relevant information. Design specifications for elevators, compressors and other equipment can be linked to the plan itself. If the operator needs to know how many doors of a specific type are included, this can be produced automatically. If an office suite is expanded, the attached datacard containing square footage of the suite will automatically reflect the new square footage. Information can be accessed graphically from the plan or directly through the database.

Technically, the system runs on a 50 mips (million instructions per second) Unix workstation. A system workstation includes one 16 megabyte central processing unit (CPU), a 17 inch color monitor, and a 424 megabyte hard drive. Control is achieved through a standard keyboard and a mouse. The average cost of the system workstation, including a laser printer, is between $10-20,000. The software package costs between $15-25,000 per workstation, depending on the number of

workstations and type of program. For the asset management team used in this research, it was assumed that a total of four workstations would be required. This application, therefore, indicates an investment in hardware and software of between $100-150,000. In a network environment, standard office PCs can also be tied into the system, allowing the PC operator to access and update the database. Standard PCs can also utilize some of the graphical functions, like reviewing floorplans. The software is designed in industry standard operating and database management environments, enabling it to interface with other software packages written in standard programming language (SQL-based).

The user interface with this system has been designed for maximum ease of use. Using the keyboard and mouse, the operator works with an on screen menu containing "icon" commands. These commands are customized to fit the user and often perform several tasks at once. For example, a design change could be automatically stored in the database and transmitted to other users for review in a single command. Or a customized report containing several related pieces of information could be programmed into a single command (e.g. produce a description and graphic display of all building equipment requiring service for the month). Most tasks utilize the command icons in conjunction with "hot buttons" contained on the document or image itself. Hot buttons are plan symbols that provide additional information when

activated. For example, design features on the plan like walls, doors and equipment are hot buttons. To review the specifications for an elevator, the operator would first activate the icon command for data card retrieval and then activate the elevator symbol. The elevator data card then appears in a separate on screen window. Activating these symbols is done by guiding the on screen curser to the symbol with the mouse and clicking the mouse button ("point and click"). Hot buttons can also be a field in a data card which provide successive layers of related information. For example, the basic data card for an elevator might include a field for maintenance. By activating this field, the user can retrieve the entire maintenance history for the elevator.

This point and click method, combined with graphics, greatly simplifies user interface. Using an elevation of a building, for example, the user can point to the fifth floor and retrieve the floorplan. From there, the user can retrieve lease information, fixture specifications or any other type of information tied to that floorplan. The combination of graphical and database interface capabilities make this type of technology an excellent tool for storage and retrieval of all types of building information (Kelly,1992).

Pre-existing drawings and plans can be introduced into the system several ways. If the design is done on another CAD software program, it can be transferred through DXF transfer, which electronically converts the plans into the Argos format.

The quality of this electronic transfer depends on the original CAD software and can produce the entire "intelligent" drawing or just a "dumb" image. The dumb image is like a paper drawing, it reflects the walls, doors and plan graphics but does not allow the system to perform any additional calculations. If the dumb image is traced over on the system, then it becomes a completely intelligent plan. Likewise, a paper drawing can be easily "scanned" into the system, which will faithfully reproduce the drawing as a dumb image.

Pertti Vulli, president of Argos, stresses that their concept in software is to develop the technology with maximum flexibility for customization. Instead of producing a finished product that requires a company to adapt their process to the software format, Argos develops the basic technology, and then customizes the final product to fit specific applications.

The Argos software package utilized in this research is a customized application of the technology described above. Based on interviews with the asset management team, the software was adapted to incorporate specialized functions for team members. Specific building information, like elevations, photographs and floorplans were used in creating the program. The program was then presented to and discussed with the team. The fact that the program was developed in the space of several weeks is a testament to the flexibility of the basic technology. Some applications discussed with the team were not incorporated into the actual demonstration, due to time

constraints. Every application discussed, however, has already been created for other types of users or exists in the basic software package.

THE ASSET MANAGEMENT TEAM

The asset management team studied in this research operates two distinctive towers occupying an entire city block in Boston's Back Bay district. Built in two phases with over 1.2 million square feet, the office building boasts granite facades, marble lobbies and luxurious interior finishes. The project is the result of a joint venture between an office building developer and two major institutional real estate investment funds. The developer has built over 75 million square feet of office space in the United States and currently manages in excess of 45 million square feet of prime office space.

The first phase of the project was completed in 1988, with the second phase following in 1991. This project was built as a speculative venture, with only about 25 percent of the first phase leased when construction began. After successfully leasing the first phase in the open market, the owners decided to press ahead with the second phase in 1989, once city approvals were received. This was not without risk, since there were no advance leasing commitments, and the office market was clearly weakening. Through aggressive marketing and professional asset management, the total project

is now 95% percent leased, with over thirty-five tenants ranging from 250,000 to 2,000 square feet in size.

The development firm is the managing partner for the joint venture and their on-site project manager has general responsibility for all aspects of the property. Each of the joint venture investment partners also have asset managers assigned to monitor the property as well. For the purpose of this paper, the development firm's project manager is considered to be the project asset manager, since most operating decisions are made by this individual. In addition to the asset manager, construction management and property management are handled within the development firm. Leasing is handled by the asset manager, with the assistance of an independent leasing firm.

The leasing firm has assigned one individual as the project leasing agent. The agent maintains an office at the building, in the developer's suite, in addition to a permanent office with the leasing firm. The construction manager is primarily responsible for handling tenant design and construction for the project. The property manager, with a staff of two assistant property managers, eight building engineers, and two accountants, handles the day-to-day management of the project. All members of the asset management team described above share an office suite at the building. The value chain for this asset management team is shown in Figure 5.

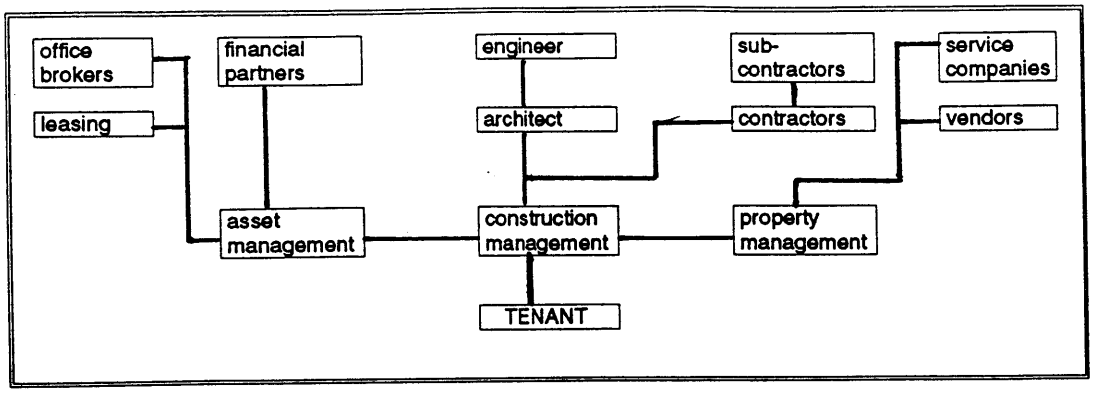


Figure 5. The asset management team value chain

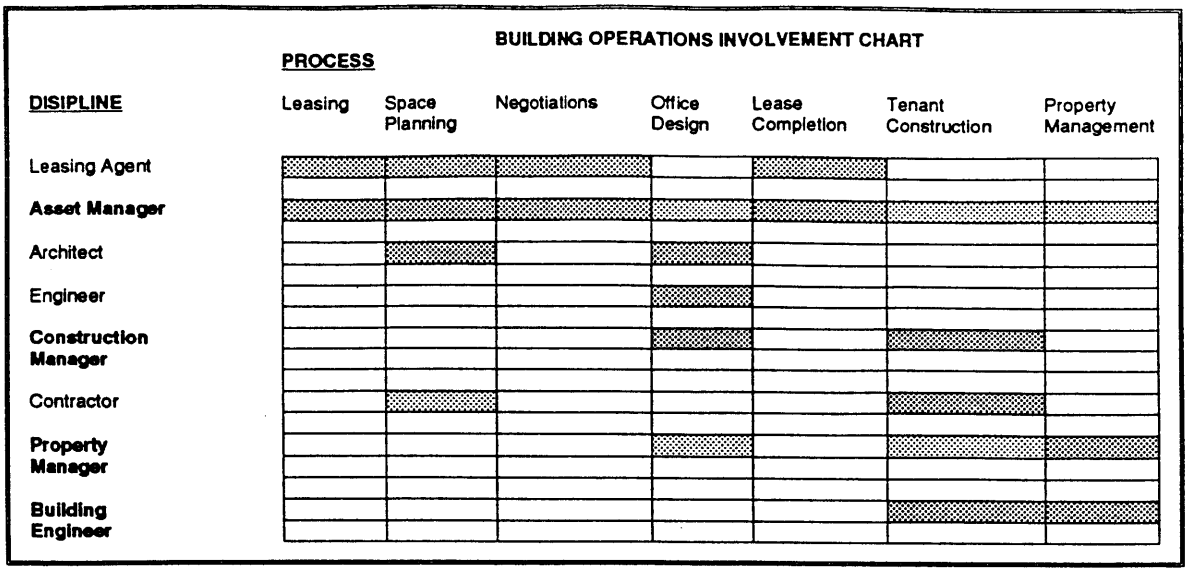
It should be noted that while this research focusses on the creation and maintenance of value in an existing property, this is actually part of a broader process. The real estate process for this project actually
began in the mid 1980's, when the concept for the project was first developed. On this scale, the process ends with the eventual sale or destruction of the property. Since the life cycle of a class A office building is typically 30 years or more, the asset management process described herein is responsible for the majority of the value created over the life of the project.

The next chapter will explore how the Argos system can be applied to the daily work process of this asset management team.

CHAPTER THREE - APPLYING THE TECHNOLOGY

This chapter breaks down the building operations into ten phases in a typical lease deal cycle. Activities involved in each phase are described as they are currently performed by the asset management team. Attention is focussed on the tools used in the process, and the sources of communication and information distribution among the team. Following each phase, the same activities are described using the Argos software package that was demonstrated to the team.

As was previously mentioned, each member of the core asset management team was interviewed regarding their function within the team. Based on these interviews, the process of operating the building is described in detail on the following pages. Since the property value is entirely dependant on securing rent paying tenants, the process begins with a prospective tenant's first introduction to the building (leasing), continues through the negotiation and office design phase (leasing, asset management and construction management) and ends with the tenant taking occupancy in the building (construction management, property management). The building operations chart shown in Figure 6 details the steps and disciplines involved in this process.



Note: bolded titles are directly employed by developer

Figure 6. Building operations involvement chart

Current Leasing Process

The first step in the value chain begins with the leasing agent. The agent identifies potential prospects through other office brokers, direct inquires or with a PC based tenant tracking system. Once identified, a prospect will be given a tour of the building, showcasing attractive features and potential locations for the tenant's suite. The agent has a reduced set of building floorplans taped to the leasing office wall that indicate leased and available areas in the building. These floorplans are maintained by hand, making the task of keeping them current somewhat time consuming. In selecting available spaces to show a prospect, the agent tends to rely more on personal experience with the building since the wall mounted plans are not always up to date. The agent has to be careful to remember which tenants have expansion options or

other rights to certain areas (encumbrances) since these are not shown on the building charts (leasing a space that is encumbered by another tenant's rights can create serious legal problems for the building). Questions about encumbrances, or other details, can be answered by reviewing the lease files for existing tenants. All tenant leases are maintained in a set of central filing cabinets in the office.

During the building presentation, questions about rental rates, expenses, operating hours, amenities and other details are answered, requiring the agent to be well versed in all aspects of the building operations. Since this agent has been with the project for several years, personal experience provides a good working knowledge of the building.

If there is serious interest from the prospect, negotiations will ensue that encompass all aspects of the tenant's occupancy. Typically, the tenant will begin by sending a request for proposal (RFP) letter outlining general requirements for their office. The agent and asset manager respond with a preliminary proposal which outlines standard rental rates, expense charges and other key lease terms. The proposal is drafted by hand and typed by a secretary on a PC. (Given the small staff and heavy workload, the agent says this step sometimes takes days). A standard workletter for building the tenant's suite is included, which provides fixed quantities of materials for construction of the tenant's suite at the owners expense(see Figure 7).

Building Standard Improvements

A. Partitions.

One (1) linear foot of ceiling height partition per "x" square feet of Buildable Area. All required partitions will be 5/8" gypsum board, painted with two coats of latex on 2 1/2" metal studs 24" on center, with 2 1/2" base.

B. Doors and Hardware.

One full height, solid core, mahogany veneer door with a metal frame and lever handle latch set hardware per "y" square feet of Buildable Area.

C. Ceiling.

A 12" x 12" x 5/8" thick fissured-type mineral fiber concealed grid acoustical ceiling throughout the Leased Premises.

D. Lighting.

One 2' x 4' recessed florescent lighting fixture with anodized aluminum parabolic shaped louvers, including initial lamping, per "z" square feet of Buildable Area. Common Areas and Building Common Areas on all office floors shall have lighting selected by Landlord.

E. Electrical Outlets.

One duplex wall-mounted 1.5 amp, 120 volt convenience outlet mounted at standard locations with white plastic cover plate for each "xx" square feet of Buildable Area.

F. Telephone Outlets.

One telephone wall outlet mounted at standard locations for each "yy" square feet of Buildable Area with pull wire through the partition.

G. Floor Covering.

An allowance of $zz per square yard of Buildable Area for carpeting shall be provided.

H. Switch.

One single way light switch, rocker type, mounted at standard locations with white plastic cover plate for each "xxx" square feet of Buildable Area.

I. Window Covering.

Horizontal aluminum one-inch slat blinds for exterior windows.

J. Fire Safety Systems.

Flush ceiling mounted fire sprinkler heads to conform with Tenant partition, layout utilizing the Building Standard partition, ceiling, and lighting, for light hazard occupancy design criteria. Manual fire alarm pull stations, exit lights, and audio fire alarm speakers shall be provided at the Building stair doors and elevator lobbies.

K. HVAC.

The HVAC system for the Leased Premises to suit the aforementioned Building Standard Improvements utilizing the Building Standard lighting fixtures for air distribution.

Figure 7. Standard Workletter

Reduced floorplans are also provided in the proposal, indicating the proposed location for the suite. The floorplan is produced by reproducing a section of the base building floorplans on the copier and marking the available area by hand. The agent relates that spending time at the copier manipulating unwieldy floorplans is time consuming and frustrating. Communicating the proposal to other members of the asset management team, if necessary, is done by carbon copy.

Leasing with the Argos system

The agent could accomplish these steps using the Argos system workstation as follows. In order to review available spaces, or other current building information, the agent can activate the Argos system and retrieve the main menu. The main menu (figure 8) is a graphical representation of the building with hot buttons in the form of floor numbers and other symbols. On the right side of the screen, the agent has a command menu with icons for specific activities (e.g.,"retrieve plan" or "produce report"). This command menu is customized for the agent with global commands that perform related steps in a single command. By activating (point and click) the building status command button, the agent is able to query the system for current status reports. Custom reports can be generated, which will show the status of each floor graphically (see Figure 9) or alphanumerically.

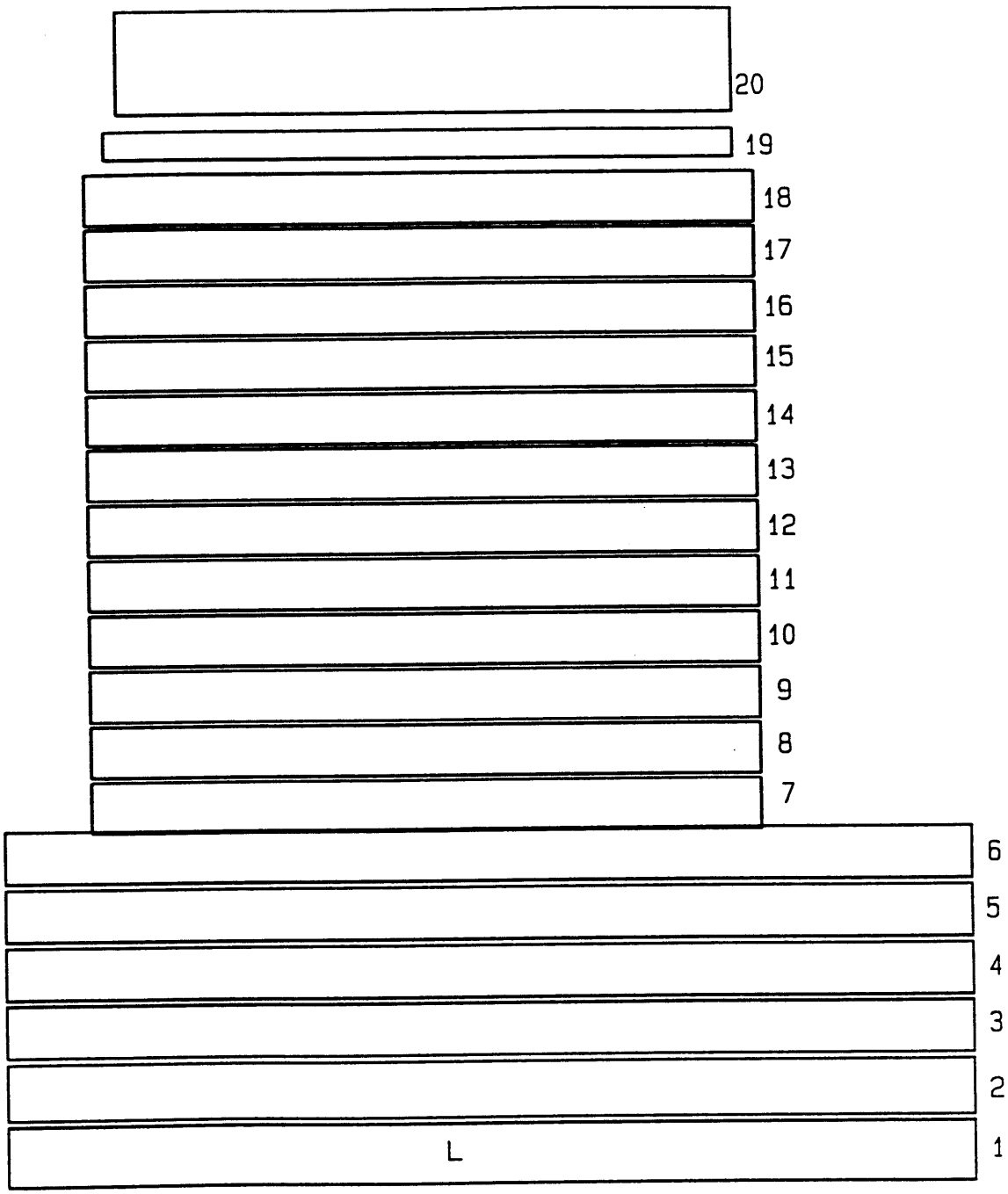


Figure 8. Main building menu

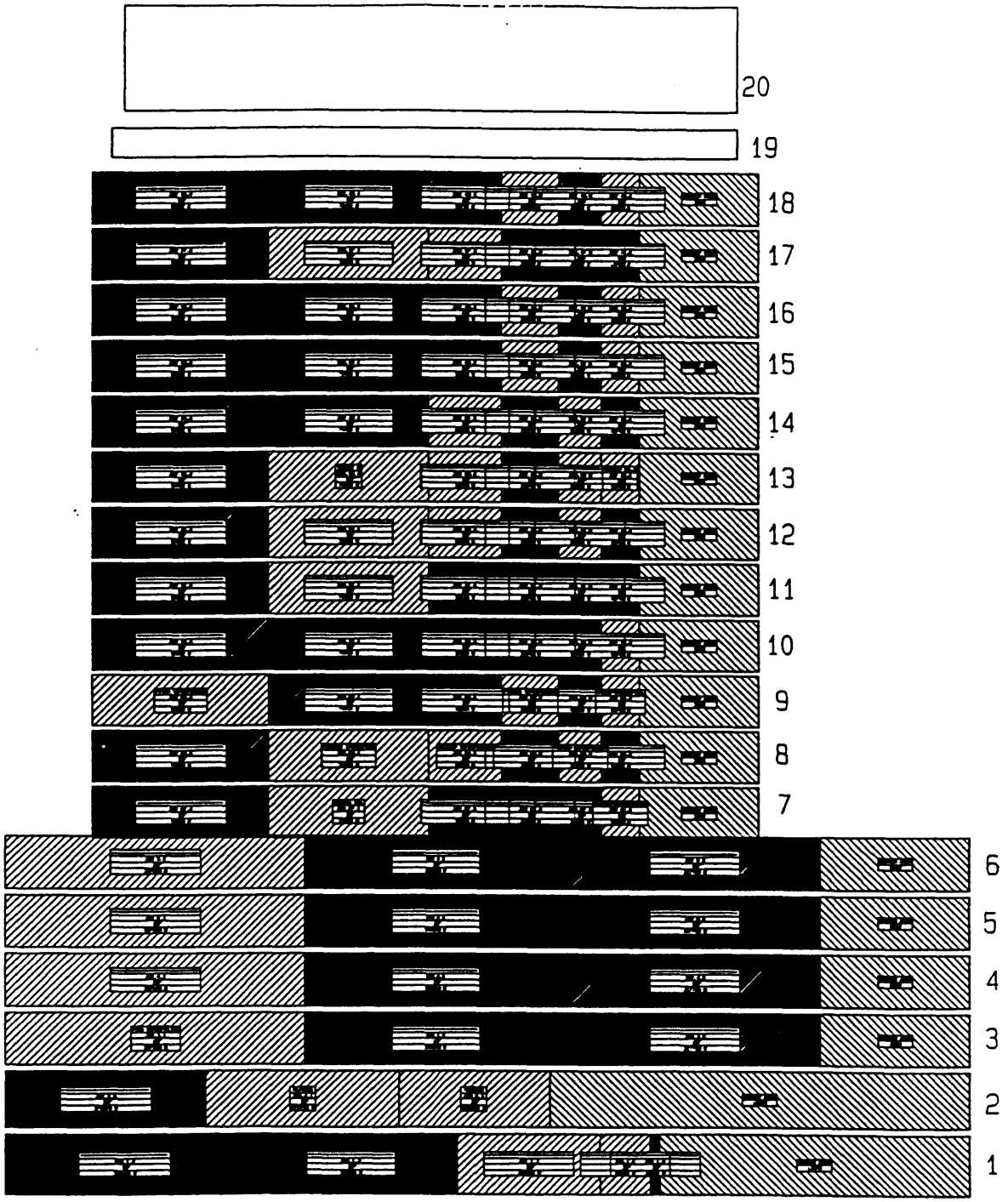


Figure 9. Typical graphic building status report

By activating any of the floor number characters (hot buttons) the agent can retrieve that current floorplan (see Figure 10). This floorplan shows the status of the floor graphically with leased areas shaded and identified by tenant. From this floorplan, the agent now has access to a broad range of information about that floor. Each tenant's data card can be reviewed by activating their I.D. box. The agent would note, when reviewing the seventh floor (Figure 10), a triangular symbol in the unleased area. This indicates the presence of an encumbrance on that space. When activated, the encumbrance symbol reveals a data card listing the tenant and type of encumbrance on that space. Some of the data card fields are hot buttons linked to successive layers of information. The full encumbrance description, the tenant lease summary, or other related information can be retrieved by activating hot button fields on the data card. This allows the agent to review the floor status in detail without leaving the workstation. With the windows format of the program, it is also possible to review related pieces of information at the same time.

To create a floorplan for the proposal, the agent would activate a menu command, and outline the desired area using the mouse (for accuracy, a scaled grid or other templates can be overlayed). The system automatically shades in the area and indicates the exact square footage on the data card showing on screen.

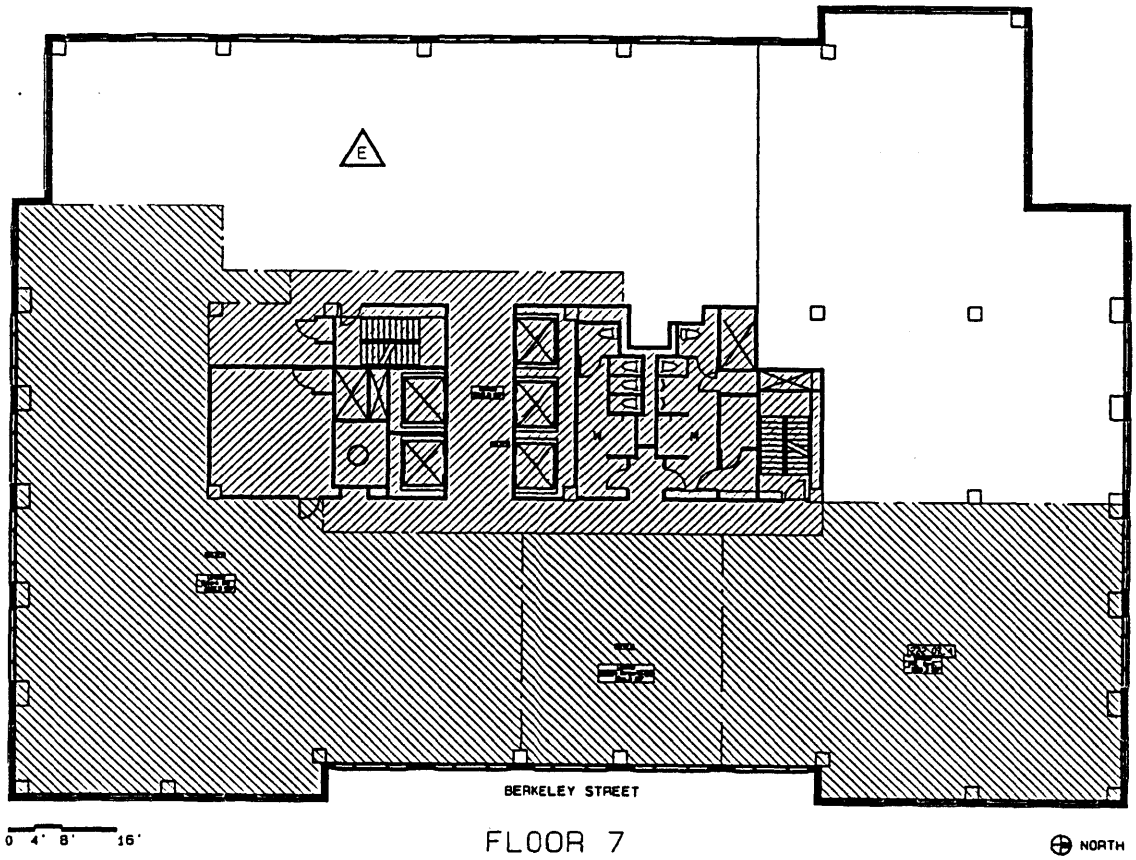


Figure 10. Active floorplan

A title can be typed in for the plan, the scale or perspective can be adjusted, and the floorplan can be printed (Figure 11). The system can also provide related information for inclusion in the proposal from hot buttons on the floorplan. For instance, an interior perspective of that floor could be printed directly from the floorplan.

Since proposals are highly speculative, the agent will probably not want to save this proposed area as a part of the "active" floorplan (the active floorplan reflects the current status of each floor). It can be saved under a separate file for proposals only by activating a menu command in one step. The advantage of creating the proposal file is the ability to produce reports and floor locations for all proposals in the building.

It is also possible to automate the proposal generation. The system can be designed to provide a data card with standard proposal terms applicable to that floor when the proposed space is created. After accepting or modifying these standard terms and filling in details like the name and address, the system can electronically send the information to a word processor for typing. In fact, using the system's own word processing capabilities, the agent can produce the entire proposal on the workstation without the extra step of having it typed by a secretary. By preparing proposal terms on the proposal data card, reports detailing the proposed terms can now be generated.

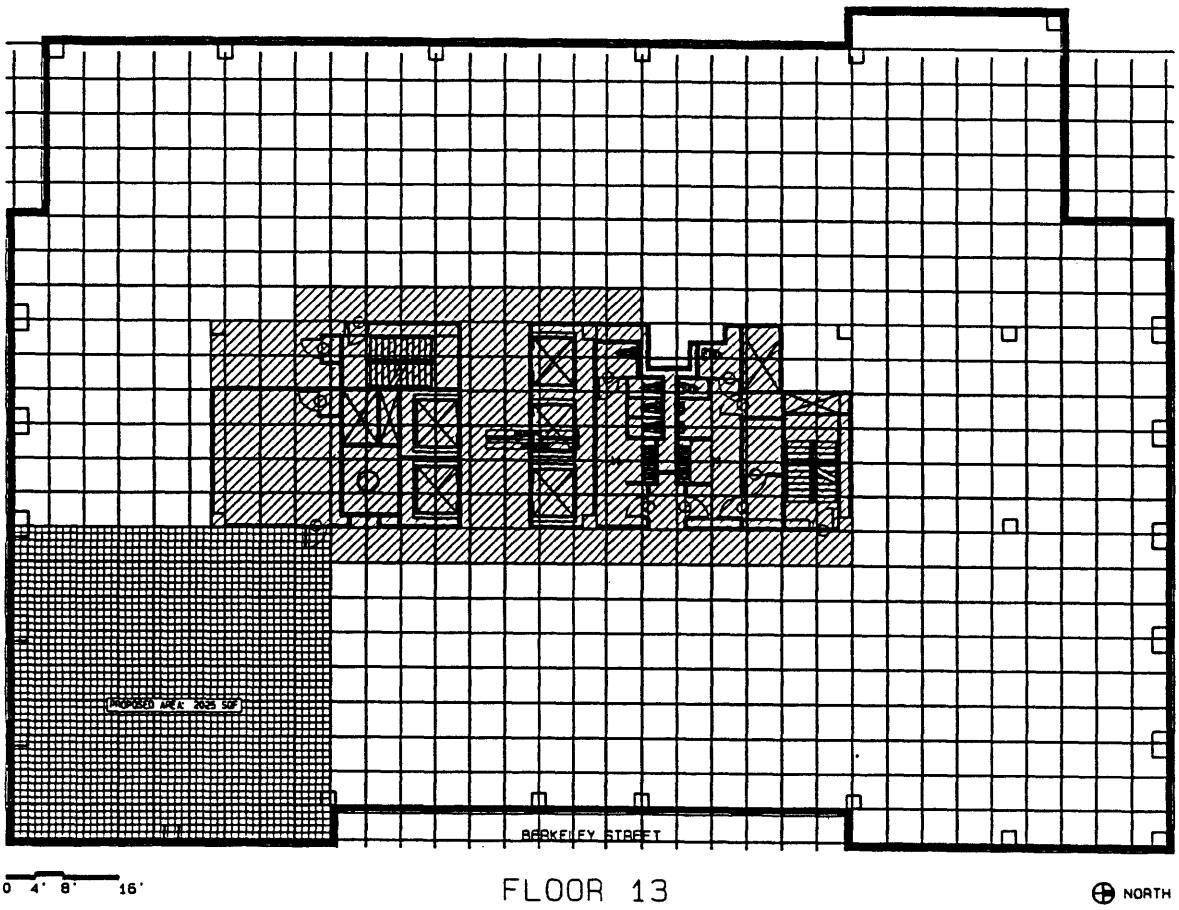


Figure 11. Proposed floorplan

If, subsequently, the agent decides that the proposed location should be reserved for that tenant, the earlier proposal floorplan can be retrieved and entered into the active floorplan as "reserved". The data card attached to the floorplan has pre-selected space status choices in pull down menus (i.e., available, reserved, encumbered or leased). These pre-selected choices not only speed up the task of changing the data card information, but also eliminate errors due to misspelling (misspelling the status will exclude the space from subsequent status reports). Once the area is entered into the active floorplan as reserved, other system users will have the benefit of this information. If the building manager, for example, is trying to decide where to store some excess inventory, the floor status query will now show the proposed location.

Current Space Planning Process

Usually as a part of the early negotiations, the physical design of the proposed suite is addressed. The tenant needs to know how much space they require and whether or not the workletter allowances will cover the construction cost. The landlord is interested because lease negotiations often include cash allowances to cover construction overages. Once serious interest is established, an architect is hired at the landlord's cost, to prepare an initial space study based on the tenant's requirements. This plan is termed a "nickel

plan", because it costs about a nickel per square foot. Typically, the tenant, asset manager, leasing agent and architect will meet to discuss the tenant's requirements. The architect prepares a design for the landlord and the tenant to review, usually in three or four working days. Since the landlord pays for this service, the project architect is usually selected to provide the nickel plan. The project architect is familiar with the building and has the base building plans on a CAD system. (The architect does not, however, have up to date plans indicating existing tenant suites in the building). The nickel plan is printed at the architect's office and sent to the parties by courier.

The nickel plan becomes an important part of the negotiations. For both parties, the cost of building the plan is an uncertainty. The tenant wants the owner to provide assurance that the workletter, or the workletter plus a cash bonus, will cover the construction cost. For the owner, there is a great deal of risk in making assurances, especially since subsequent changes or expensive finishes can dramatically increase the final price. One source of confusion stems from not knowing exactly what quantity of materials is in the plan. In the early stages of the building, "when they had more time", the construction manager would estimate the material quantities by hand. This meant measuring walls, counting doors, etc., from the plan; this takes considerable time and effort. Worse, this had to be repeated each time the plan was

modified. Since the asset management team is very busy, and contractors are willing to perform extra services due to the weak construction market, they now send some nickel plans out for preliminary estimates from local contractors. This takes up to a week for a response. Most of the time, the asset manager and the construction manager review the plan and rely on their personal experience to "ballpark" the cost. The team is careful not to make promises about the final cost of the plan but the negotiations are often based on their best guess as to the cost of the suite.

Space Planning With the Argos System

Since nickel plans are currently generated by professionals outside of the developer's asset management team, the issue of outside links begins to appear at this stage. While this paper does not address the issue in depth, there are several possibilities for using the system in this phase. Of course, if the project architect uses the same system, full integration can be achieved. Likewise, some CAD systems are compatible with the Argos system, which would allow partial integration using DXF conversion. It is not clear how much intelligence this conversion allows to be transferred. Since most nickel plans are simple designs, and the Argos CAD functions are relatively easy to learn, it is possible employ a designer directly or train an existing staff member for this task. If the nickel plan is not designed on

a compatible system, it can be scanned into the system for review, and certain elements, like walls and doors, could be traced over in order to achieve intelligence for these items.

If the nickel plan design is created using the Argos system, the following design process would apply. The simple nickel plan shown in Figure 12 was designed during the system demonstration in less than five minutes.

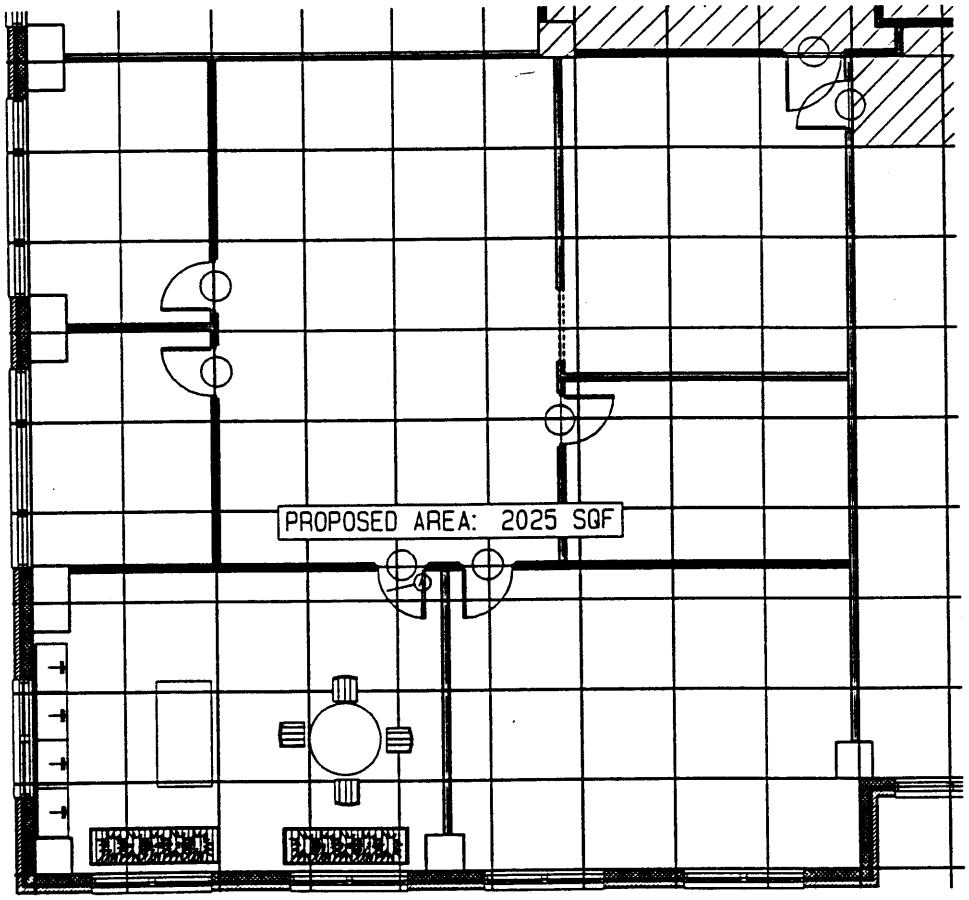


Figure 12. Nickel plan

With the floor in question on screen, the type of wall is selected from a pull down menu. For a project like this, there would probably be two or three standard walls on the menu (i.e., interior, fire rated, or half height). Using the mouse, the operator designates the end points of the wall, which is then drawn in by the system. Doors and furniture are selected from separate pull down menus and placed. The same procedure is used for the rest of the suite to the level of detail required. As was noted in the system description, the furniture layout shown in the nickel plan or entire blocks of offices could be stored in a pull down menu and placed in one step. From this simple nickel plan, the system can produce room dimensions, area calculations, and 3D models, like the executive office interior perspective shown in Figure 13.

Figure 13. 3D interior perspective

The system can also produce an accurate material list detailing quantities or units of materials necessary to construct the offices. Even though the nickel plan is usually not specific regarding the electrical and telephone outlets, lighting and other materials contained in the workletter, it is a simple task to program standard assumptions into the system to produce complete material estimates. For example, electrical outlets can be calculated as a function of the lineal wall footage (i.e., one outlet every six feet). Light fixtures can be based on the size of each office, and so on. With this intelligence, the material list for the nickel plan can be compared to the workletter allowances automatically. Design changes would show up in this comparison instantly. Even though this would not be a final material list, it would improve the value of the nickel plan. Another possibility is for the owner to obtain unit prices (e.g., $750 per door) from a contractor or other source in order to "ballpark" the construction cost based on the material quantity list.

Current Negotiation Process

The lease negotiations usually progress through a series of proposals and counterproposals between the tenant and the landlord. The asset manager becomes directly involved in structuring the proposed lease terms, working closely with the leasing agent. It is the asset manager's responsibility to negotiate an acceptable agreement. The feasibility of any

given deal depends on economic, legal and business issues. The economic return is determined by more than just the amount of rent paid by the tenant. Other terms, like the cost of construction, operating expense charges, parking revenue and even after-hours air conditioning privileges can affect the final return. Legal issues relating to insurance liability, personal guarantees, and termination rights also impact the value of the deal. Practical business decisions about the tenant's financial standing or future subletting rights also must be made. The asset manager makes most of these decisions, based on information provided by the asset management team and an assortment of outside firms. The final lease must also meet guidelines approved in advance by the joint venture partners. If a deal exceeds these pre-approved terms, the asset manager must present it to the joint venture partners for specific approval.

The asset manager analyzes the financial aspects of the deal on a standard PC using Lotus 1-2-3 software. General building information, rent rolls, pro forma projections and related information are provided by a series of large paper binders. Binders are used by all members of the asset management team to track project information related to their work. Theoretically, these binders are maintained so that other team members have access to required information in the event one member is unavailable. In reality, the binders are difficult to maintain since updating them is a redundant task.

Consequently, they are not widely used. Most of the communication and coordination among the asset team members is accomplished through personal contact. The asset management team has been together for several years and is a very cohesive operating unit. Shared offices provide immediate access to one another facilitating ad-hoc meetings and informal hallway discussions which are the primary source of information.

As the negotiations progress, a general agreement is eventually reached with the tenant. While the exact terms may not be finalized, at this stage both parties feel comfortable with that an agreement can be reached. By now attorneys for both parties are reviewing the proposed lease, financial statements are requested, and the finer points of the deal are discussed. The construction manager begins to get involved in estimating costs for the floorplans, and the property manager may be consulted on operational questions as the deal takes shape.

Negotiation Process With Argos System

One of the central concepts of utilizing the Argos system is that it should be a tool used by the asset team members to accomplish their work. By using the system in their daily tasks, the team creates a record of "real time" information that can be shared. Instead of binders on the shelf, each member's work would be reflected on the system. In this

manner, the system becomes an important information and coordination tool for the team. The impact of this resource becomes apparent as team members search for information required to do their job. The asset manager, for example, needs information about many different aspects of the project in order to make decisions on the lease terms. Using a system workstation, the asset manager can run Lotus software as before, but now additional information is available "on line". For instance, the asset manager can review the proposed floorplan, adjacent tenants and their lease terms, and the financial analysis of the proposed deal at the same time. In order to estimate the impact of the deal on the total building economics, the latest tenant rent roll can be imported from the system directly into the Lotus spreadsheet. This ability to access information from all points of the asset management chain enhances the asset manager's decision making ability. Although the system is not intended to replace the personal contact among the team members, it will reduce the amount of time members spend seeking information. Each asset team member can access authorized information from the system to assist them in their work. In addition, electronic communication between members is now possible. Instead of passing around paper copies of a proposed floorplan for review, team members can retrieve and send the latest plan on the system.

Current Design and Pricing Process

Once a general agreement is reached, and while the fine points of the lease are being negotiated, final design and pricing of the suite begins in earnest. The construction manager is responsible for coordinating this process; an incredible amount of detail is involved. First, an architect is hired to develop the final floorplans. Since the cost of this service is borne by the tenant (or it comes out of the cash bonus included in the lease), the tenant usually selects the architect. About 80 percent of the tenants use the building architect, but tenants with large or complex offices often use their preferred architects. An engineer is also retained to design mechanical, electrical and plumbing systems. Since the engineering design affects building systems, the landlord usually restricts this work to one or two firms that are familiar with the project.

The construction manager arranges weekly coordination meetings with the tenant, architect, engineer and asset manager (or leasing agent) present. A schedule like the one shown in Figure 14 is established with target dates for project milestones. During the design process, it is not unusual for the floorplan to have several iterations which must be reviewed by each party. Usually, the architect will revise the plan and send out paper copies to the parties by courier.

J. The Tenant Design and Construction Schedule

MILESTONE	DATE	TASKS
Today Start Cost Estimating	April 13, 1992	moving co tele vendors
B-1 Submission	April 14, 1992	
Cost Estimate Due Redesign/Value Engineer	April 24, 1992	
Go Out to Bid	April 30, 1992	
Submit For Permit	April 30, 1992	
Bids Due	May 14, 1992	
Pricing Letter Sign-off Award Contract Meet with Contractor Re-Issue Plans Pull Permit	May 21, 1992	
Start of Construction	May 25, 1992	tele vendor
Meet w/Property Mgmt	During May	moving co
Substantial Completion	July 24, 1992	
Tenant Move-in Term Commencement	July 31, 1992	

Figure 14. Typical design and construction schedule

The plan is sent out for pricing estimates as it nears completion. Depending on the size of the suite, the plan may be competitively bid among as many as seven contractors. Again, the workletter allowance complicates the information. Contractors must submit their bids in two parts, standard (or workletter) items, and non-standard items. The owner pays for items covered by the workletter without regard to cost, and non-standard items are subject to maximum cash allowances. However, sometimes contractors will shift costs out of the workletter into the non-standard category in an effort to make their bid more attractive to the owner. (The tenant pays for any cost which exceeds the cash allowance). Equally confusing is the issue of balancing credits for workletter items not used. If, for example, the plan does not use building standard lighting, the non-standard portion of the bid should be credited for the savings from the workletter portion. To complicate matters further, many of the building standard items (i.e., lights, doors,etc.) were purchased in advance and stocked in the building. This requires the construction manager to track existing inventory and account for the cost of using the inventory in construction. The amount of detail involved is evidenced by the number of binders on the shelves ringing in the construction manager's office. There are binders for inventory, plans under construction, plans in the design stage, and so on.

Reaching the final office design usually takes four to

eight weeks, depending on the complexity of the office. One major time requirement is the bidding itself, since it takes one to two weeks for the contractors to respond. It is not unusual for the plan to be revised (value engineered) and re-bid after the first round of bidding, which can slow the process down considerably.

Design and Pricing With The Argos System

Once again the issue of outside links arises in this part of the process. The ultimate goal in fully utilizing the Argos system is for each professional involved to be linked on a fully compatible systems. In the short run, this might be achieved with a one or two outside firms, but would limit the developer's flexibility in choosing or changing firms. Any firm seeking to exploit this technology will, no doubt, explore strategic links with outside firms at some point.

In lieu of external system links, the construction manager could introduce CAD documents to the system using DXF transfer. If the plan is fully integrated, then some intelligence is available at that point. If the transfer produces a dumb image, or if paper plans are scanned into the system, there are several ways to utilize this information. Even dumb images can be manipulated, overlayed, and otherwise reviewed on the system. Different members would have access to the most current plan, and could attach notes or comments to the image. The construction manager can track schedules,

costs, inventory, and bids by attaching the information to the floorplan in the system. This allows for all of the details related to a project to be stored in a central location, and makes it easier to track progress. The system can also be used to track existing inventory, by quantity and location in the building. Since the construction manager must keep up with the monetary value associated with the inventory, the system can calculate total value based on the inventory material list. Changes in inventory would automatically be reflected in the value report.

Theoretically, the design, engineering and pricing phase is an excellent application of the system's CAD capabilities. If the architect, engineer, contractor and building owner all used compatible systems, the process could be greatly simplified. For instance, the plan could be communicated electronically between the parties, instead of relying on courier service. The architect and engineer could work with current floorplans from the building database. As the plan is modified, changes would show up on the other party's plan immediately, flagged for attention. Telephone discussions between the parties could be enhanced through the electronic plan link, where changes can be discussed in real time. Area calculations, material quantity estimates and other routine calculations now performed by the architect, engineer and contractor separately would be automatic. The owner would have much better information about the plan, including exact

material lists. Credits for existing inventory could be automatically tracked, as well as the location of the inventory. If the owner had per unit costs from contractors, there would be no need to wait on subsequent bidding, which could shorten this process by weeks.

Current Lease Completion Phase

Once the details in the lease have been agreed upon, and both parties are comfortable with the office plans and construction costs, the formal lease document is signed. In addition to the legal language in the document, graphic lease exhibits depicting the location of the suite and any areas covered by expansion options or other rights are also included. As before, these exhibits are prepared by hand on the copier. From this point forward, the obligations and rights of both parties are governed by the terms of the lease. Responsibility for the lease shifts among the asset management team as they enter the production phase of the process. The construction manager has the lead role while the space is under construction, and the property manager becomes increasingly involved as occupancy approaches. The leasing agent has no further involvement, and the asset manager assumes a more supervisory role. The construction manager is usually familiar with general lease terms from being involved in the plan design and pricing. For the property manager, however, often this is the first point of contact with the

deal.

Copies of the lease are circulated, which is the primary source of information about that deal for the asset management team. It should be noted here that the actual lease document is a lengthy document containing esoteric legal terms, fine print, and any number of attachments, addendums and modifications. In short, it is not a user friendly document. Each member of the team uses the lease document as they perform day-to-day functions. The leasing agent submits a commission request based on the lease rental schedule. The asset manager keeps some personal notes on the lease, which will be the basis for future reports to the joint venture partners. Several days or weeks later, the property manager will retrieve information from the lease in order to begin coordinating move in details. One or more of the accounting and property management staff will also review the lease to project future rental income or to invoice the tenant for rent. As the property manager points out, this method of information distribution results in the same information being input into the work process at different times, by different individuals, as the lease is assimilated into building operations.

Lease Completion With The Argos System

By combining the Argos system with some changes in the work process, gains in efficiency, communication and

coordination are realized. In preparing the final lease exhibits, the asset manager (or leasing agent) would produce the exact exhibit on the system and print it out. At the same time, the information is then saved to the active system floorplan. In this manner, encumbrances and tenant locations are introduced into the system. Since the lease exhibit and the system notation are created simultaneously, accuracy is ensured.

Once the lease is complete, different members of the team build the tenant system file as they perform their usual tasks. The leasing agent submits a request for commission by completing a tenant lease summary on the system. This lease summary is part of the tenant's file, accessible as a field in the datacard attached to the floorplan. The asset manager checks the information in the lease summary as part of the approval for the commission request and adds additional information or comments as necessary. Each member of the team can now access this summary in order to perform their work. Additional information is added or amended as the lease is assimilated into the building operations. The system can download rental schedules, invoicing information or other information directly into specialized software programs. The accountant, for example, can transfer information directly into the accounting software program, and only review the lease to find specialized information. In fact, it is possible to scan the entire lease document into the system so

that lease language reviews could be accomplished on the workstation.

Current Construction Phase

As the final office design takes shape, the property manager and building engineer review the plan to catch any operational concerns and to ensure that the design is coordinated with the building systems. Although the design engineer utilizes base building plans in designing the office systems, these plans do not contain current information on existing tenants or other alterations. For example, a new office plan may include dedicated electrical circuit for a mainframe computer. Even though the base building plans indicate adequate power supply to the floor, often the design engineer is not aware of the current power usage on that floor. The building engineer usually verifies that the required power is available on the floor in question. If additional power must be run to the floor, this cost needs to be communicated to the construction manager. The same logic applies to other building systems. As tenants begin to occupy a floor, for example, the HVAC system is reworked to accommodate the offices. The building engineer must be sure that any new offices designed for the floor can be adequately heated and cooled. Typically, the engineer will review the proposed plan, in paper form, and retrieve other base building plans from the central flat file if necessary. Sometimes, the

system in question is physically checked to verify existing conditions.

Once the plan and pricing has been agreed upon, construction begins. A typical office suite will take six to eight weeks to construct. The construction manager is responsible for coordinating the job, which includes authorizing invoices for completed work, handling change orders, and tracking the estimated completion date. The property manager begins to meet with the tenant regularly to arrange moving details and occupancy issues. The building engineer inspects the physical construction to be sure the quality of the construction is acceptable and that building systems (e.g., HVAC) are properly installed.

Technically, each construction job in the building is not complete until the contractor has turned a complete set of as-built construction documents over to the asset management team. This rule was designed to provide the property management and building maintenance staff with a permanent record of the improvements for future reference. The plans are also used for the maintenance and future remodeling of the suite. In practice, many times the plans are not changed to reflect field modifications or change orders, or a complete set is not delivered. The building manager keeps most of the plans in large flat filing cabinets, but there is a sizeable amount of unfiled plans cluttering the storage room. Organizing this assortment of documents, and keeping the files

current, is a daunting task which is often deferred in favor of other priorities. As a result, the plan files are somewhat unorganized and cumbersome to use. Consequently, the building engineer and maintenance staff tend to rely on their working knowledge of the building in performing their day to day duties. Since they inspect new construction and work with the building every day, this "working knowledge" is usually very accurate.

Construction Phase With The Argos System

The Argos system can be applied several ways in this process. First, as a plan storage and retrieval tool, the system is very effective. Plans stored on the system, whether "intelligent" or not, can be manipulated, retrieved and overlayed in various ways. If the building engineer needed to review a proposed plan on the 14th floor, for example, the first step would be to call up the plan from the system. Using the active 14th floorplan as a background, the engineer can retrieve and overlay any other plans onto the proposed suite. For example, in order to check the HVAC system, the HVAC plan for that floor can be selected from an alphabetized pull down menu of all plans for that floor. If the engineer is uncertain of the name of the plan required, all of the data cards for plans relating to the 14th floor can be reviewed in order ("scrolled"). The plan data cards have hot button fields allowing, for instance, the engineer to quickly preview

a reduced image of any plan from the data card. In this manner, it is possible to scroll through an image of every plan to find the correct one. Once the correct HVAC plan is found, it can be overlayed onto the proposed floorplan as shown in Figure 15. Instead of going to the plan room and retrieving related plans, the plan can be accessed and manipulated in many different ways on the system. Since the system database also tracks the plan date, the operator can easily verify that the plans are current.

Since this part of the process generates a great deal of information that becomes part of the physical building once the tenant suite is complete, the issue of introducing information generated outside the system is again relevant. For documents produced on non-compatible CAD systems, or by hand, some or all of the information will need to be introduced. Scanning the plan into the system will provide complete plan storage and retrieval capabilities. The ability to manipulate, print and overlay the plan on the system is more useful than the current plan storage and retrieval system. If certain portions of these dumb plans, like electrical or computer networks, need intelligence in order for future tracking through the system, these elements can be traced over to fully integrate them into the system.

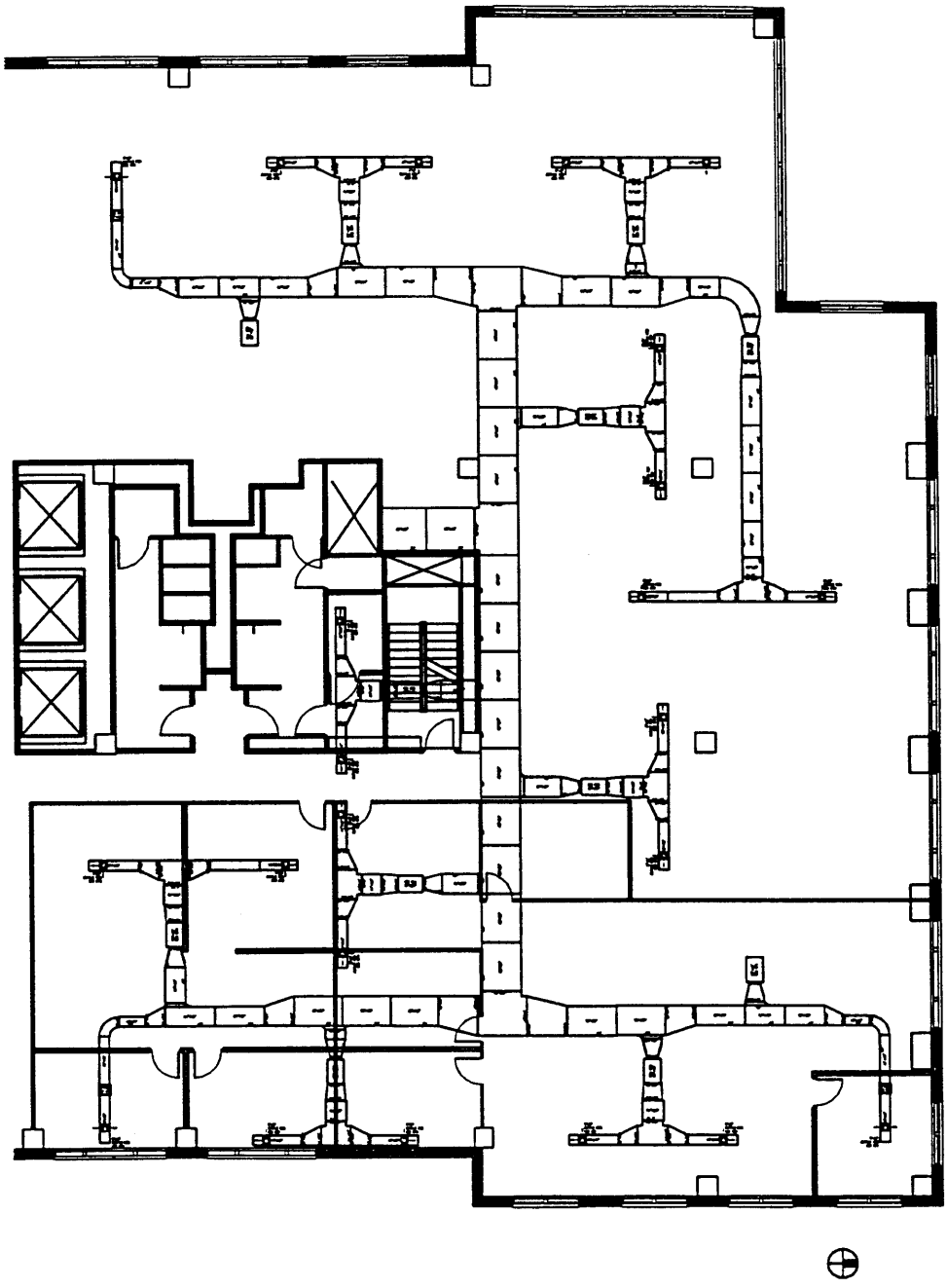


Figure 15. HVAC plan overlayed onto a proposed floorplan

Of course, if the design architect and engineer utilize the Argos system or a fully compatible system, full intelligence is achieved. With intelligent plans, the system can automatically monitor the suite's impact on building systems. For example, the engineer can automatically calculate the electrical load on each circuit board on the floor. The same function can be used to calculate HVAC loads, weight distribution and other physical impacts of the suite.

Current Tenant Service Process

Once construction is complete, the tenant moves in and the lease term commences. From this point forward, the property management staff is responsible for providing a clean, comfortable environment and the necessary services for the tenant to conduct business. While this sounds simple, it involves everything from contracting for janitorial service to replacing the roof if necessary. A key element in tenant satisfaction is how well the property management staff responds to tenant service requests. If a tenant has a problem (e.g.,office too hot), they call the property management number. The property management secretary takes the call and fills out a form in the service request log book. This records the date and time of the call, the tenant name and the nature of the request. A service work ticket is created by carbon copy when the entry is made. This ticket is removed by the secretary and placed in a special slot on her

desk for the maintenance staff to pick up. (The maintenance staff has separate offices). One of the maintenance staff comes by regularly and picks up the work tickets which are organized and distributed by the chief engineer. Once the service is performed, the time of completion is recorded on the ticket and signed by the tenant. The ticket is then returned to the property management secretary where the time of completion is recorded in the service request log book. In this manner, a record of service requests is created, allowing the property management staff to monitor the process. Reviewing the log book is time consuming, since the data is organized by time of call. For example, it can take hours to determine how many calls from a particular tenant were received over the last few months.

Tenant Service With The Argos System

Using the Argos system, this process could be replicated in an electronic method. Instead of entering the service request in the log book, the property management secretary would type the request into a standard PC on a service request data card. The system would automatically print out a work ticket in the maintenance office. Once the service is complete, the maintenance employee would either return the ticket to the management secretary to be entered on the data card or type the information directly into a PC in the maintenance office. By performing these steps on the system,

monitoring the process changes. For example, instead of checking the log book for pending service requests, the property manager can query the system for a request pending report. This can be reviewed graphically (as shown in Figure 16), or by written report. The system can be programmed to produce a pending service request report daily, or can produce a regular report of all service requests arranged by floor, type of request, or any other category. This allows the property manager to sort the data in order to check for patterns. If, for instance, the west side of the building produced most of the HVAC service requests, it might indicate a balancing problem with the mechanical system. Equally as important is the integration of this information through the database. Each tenant's lease summary has an active field for service requests. If the property manager is planning to visit a tenant, the tenant's service request history can easily be reviewed to prepare for the meeting.

Current Building Systems Maintenance

The maintenance staff has separate offices near the main equipment rooms of the building. Maintaining the building involves servicing and repairing elevators, chillers, pumps and other components of the building systems. This task requires maintaining information about the equipment, such as the warranty and service history, in addition to scheduling regular servicing. The office walls are full of charts and

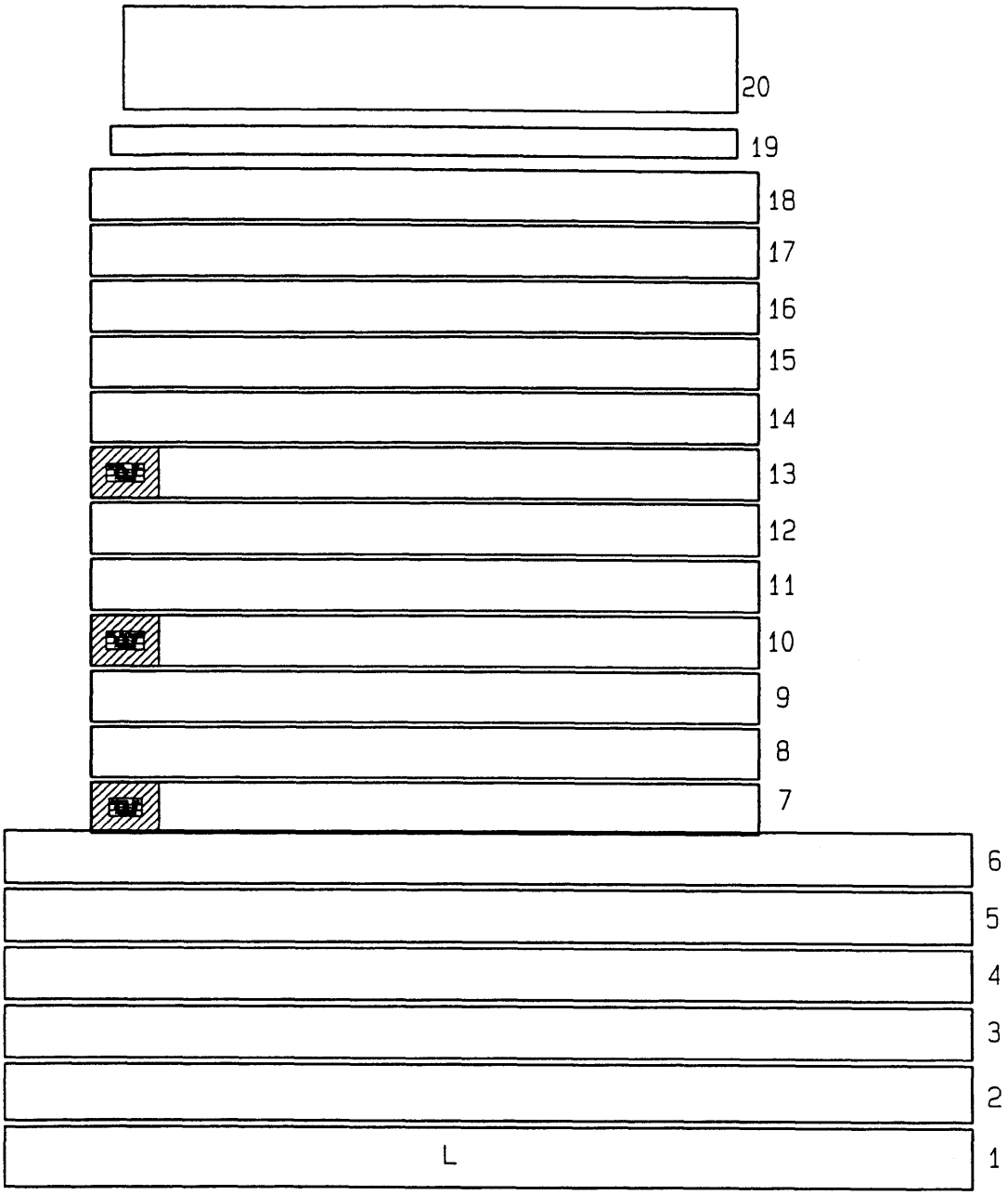


Figure 16. Graphical pending tenant service requests

tables tracking scheduled maintenance for building equipment, service order requests from tenants and other key building information. Once again, the process is well organized. There are three primary sources of information about the building equipment. Specifications , warranty information and service records are kept in a series of filing cabinets. Maintenance scheduling is accomplished with a wall mounted chart listing the equipment, the service required and the date it was accomplished. Original architectural, engineering and construction plans are maintained in the flat filing cabinets. Because the systems are separate and searching the files for service histories or plans is time consuming, the staff tends to rely on personal knowledge of the building in completing their tasks.

Building Maintenance With The Argos System

The Argos system is used in this process to organize information and coordinate maintenance schedules. Service scheduling, background information, and service histories can all be linked to the original plans. The chief engineer can produce service schedules from the system, with the service history and original specifications printed on the work ticket. If an elevator fails, the property manager or the building engineer can view the location of the elevator, its service history and original shop drawings from their workstation. All of this is accomplished with a few commands

on the computer.

This application once again begs the question of introducing existing building information into the system to achieve intelligence. First, the base building plans are converted into the system through DXF transfer. All base building plans are on CAD. Critical equipment and systems are then made intelligent, attaching relevant information to the item through the floorplans. This process can be done all at once by contracting with the system designer for this service, or can be accomplished over time. Since dumb plans in the system become intelligent as they are modified, it is possible to begin with only basic information in the system and allow the intelligence to grow over time. For example, as elevators are serviced the service record and specifications could be entered at that time. By beginning with a few basic functions and allowing the staff to become familiar with the system, future intelligence can be added in areas the staff decides is most important.

Current Lease Administration

The other main function of the property management staff involves enforcing the tenant's obligations under the lease. The tenant's main responsibility is to pay rent, and a pro-rata share of building operating expenses. Often the lease language provides for staggered rental schedules, free rent periods or caps on the amount of expenses that can be charged.

Other details (e.g., insurance certificates and estoppel letters) must also be tracked. As was previously noted, the primary source of information for the management and accounting staff is the lease document itself. The property manager usually reviews the lease and enters certain terms into a tenant list that is maintained on a personal PC. Once the tenant actually takes occupancy, the occupancy date must be noted in the lease file and passed to accounting in order to track rent and expenses. Typically, accounting will review the lease and enter the appropriate financial terms into their accounting software program.

From this point forward, accounting uses specialized software to track expenses and revenues. They produce reports that are used as the basis for analysis by the property manager, asset manager, and ultimately, the joint venture partners. Again, since key information is entered separately by each function, the redundancy often results in mistakes or differing interpretations. The time lag in receiving information creates confusion because related reports produced by different functions often do not match. Lease details also become a headache. The property manager described a recent example involving tenant estoppel letters, which are a legal form confirming the lease agreement is in force. The letter is submitted by the tenant and filed by the property management secretary upon receipt. A joint venture partner called the asset manager to inquire about the status of the

estoppel letter for a certain tenant. The asset manager walked down to the property manager's office and repeated the question. To answer the inquiry, the property manager had to go to the central lease file and search for the letter. This type of request for information happens frequently and causes the property manager to comment,"there is so much information to track and so little time - how can we keep up with all these details?". The asset manager commented that a previous attempt to create a central file for all information on the project failed because it became impossible to maintain. The process of copying everything for the file, reminding people to return items they remove, and the necessity of getting up to search the file is just too cumbersome.

Lease Administration With The Argos System

Using the Argos system as an electronic central file eliminates much of the redundancy of maintaining a paper central file. The difference is that as people use the system to accomplish their task, it automatically records the information. Other team members can then access the information "on-line". In this manner, each individual is able to build on work created previously by others. As we saw in the lease completion example, the very first lease summary entered into the system by the leasing agent becomes the basis for future work. By having the individual responsible for an activity enter the information, the quality of the information

is good and misinterpretations are less frequent. Subsequent handling of the work product allows the information to be checked and updated. For example, when the tenant takes occupancy, the property manager can retrieve the lease summary and enter the correct lease commencement dates. The rental schedule can be checked against the lease, and the property manager can clarify any uncertainties with the asset manager if necessary. By the time the accounting staff retrieves the information, it will have been checked at least three times. There is also a savings in time, since each team member escapes having to enter basic information like the tenant name and contact. Reports can be generated based on shared access, "real time", information with a higher degree of accuracy and correlation.

Tracking details like the estoppel letters is also simplified. When the estoppel is received, the property management secretary uses a standard PC to retrieve the tenant's lease summary from the system. The field for estoppel is marked as received and the estoppel letter is "scanned" into the system before filing the hard copy. When the joint venture partner calls the asset manager to inquire about the estoppel, the asset manager "asks" his workstation. Not only does the lease summary show the estoppel is received, it can produce the scanned image so the asset manager can review the specific language of the document. The property manager can now produce summary reports regarding estoppel

letters, and have the system flag tenants that fail to submit the document. Once the system is operational, the asset team's ability to produce reports on an ad hoc basis is greatly enhanced. Reports listing all tenants by lease expiration, credit rating, size or type of business can be generated in minutes. If the building is subsequently sold or refinanced, the quality of the information available and the ability to easily transfer this information might improve the value of the asset.

Current Reporting

A variety of reports are generated by the asset management team for reporting to outside parties. One of the main reporting functions is handled by the asset manager, who is responsible for maintaining contact with the joint venture (JV) partners. The joint venture partners each have an asset manager responsible for overseeing the project (the JV asset manager). Communication between the JV asset managers and the project asset manager is currently handled through written reports, site visits and telephone conversations.

Reporting With The Argos System

The Argos system is designed to facilitate communication between locations using direct computer links. The Argos system can allow each of the JV asset managers to access "on-line" information in a variety of ways. Full integration is

possible if the JV asset managers used the Argos software and workstation. Since the level of detail required probably does not warrant this expense, a simple PC connection might be appropriate. Using a phone modem link, the building system could be programmed to "download" specific information daily or weekly into the JV asset manager's PC. This would allow the JV asset manager to review current tenant rent rolls, status reports and many other types of authorized information. In addition, the asset manager could now review graphic documents such as building floorplans on the PC. Proposed leases that required approval could be discussed with the latest floorplan showing on the JV asset manager's PC screen.

Each of the steps described in this chapter were discussed with the asset management team. Many of the steps were actually demonstrated on the system, others were described verbally. The asset management team's reactions to the Argos system are presented in the next chapter.

CHAPTER FOUR - RESULTS

Discussions about the practicality of this type of technology occurred on several occasions with the asset management team members. This chapter begins with an overview of the comments and concerns raised during these discussions. The final section of the paper draws conclusions about the practicality of the system and the potential for protecting and enhancing office building value through the technology.

ASSET MANAGEMENT TEAM FEEDBACK

Reactions from the asset management team were gathered through a group discussion and several personal interviews. Immediately following the system presentation, the group discussed the implications of utilizing this type of technology. Six of the asset team members were present; the regional partner, the asset manager, the leasing agent, the property manager and two assistant property managers. The president of Argos Systems and the software designer who built the demonstration model were also included. In addition to this thirty minute discussion, individual interviews were conducted with the leasing agent, the asset manager and the property manager. The leasing agent was interviewed by telephone. The asset and property manager were interviewed in a joint meeting that lasted about two hours. The asset manager reviewed this material to be sure that this section

accurately represents their reactions. The issues discussed with the asset management team generally fell into five categories: benefits, implementation, risks, justification and potential for competitive advantage.

Benefits

The system presentation suggested several benefits to the team. The group agreed that the ability to create, store and share information on a single system is a very appealing concept. Because each member of the team depends on current information to produce work, shared access to one information database would reduce time spent seeking information and increase accuracy among the work produced.

The property manager believes that the ability to use previous work products, like the asset manager's lease summary, would be beneficial. In general, passing the torch from the leasing team to property management is done "from a distance". Steps completed in the current process often do not result in any permanent record, making it hard to trace decisions or information. Usually, the final lease document is the only source of information for the property management department. So much information is buried in the lease, that the property management staff suffers from "information overload". Summaries of the basic terms and conditions would help introduce the deal without requiring the managers to learn each lease from scratch. Related references like floorplans and proposals would also help clarify the lease.

The integration of separate software systems was another perceived benefit. The existing property management software program has some redundancies because there is no electronic link between systems. For example, there are three sets of cash flow programs, each of which requires the information to be keyed in separately. The firm currently has a national committee studying property management software. In the new programs under review, they are looking for more integration between functions. After viewing the Argos system, however, the property manager said he was not sure they were "stretching" far enough in their search because, to date, they have focussed almost exclusively on property management software packages. The scope of the Argos system encompasses more information than property management programs are designed to handle.

The asset manager believes that the technology could dramatically improve the reporting capabilities of the team. He notes that in the current market climate, owners and investors tend to have higher expectations for the quality and quantity of information provided by the property asset management team. In the "old days" when project returns were high, investors were not as concerned about the details of operating the property. In the current market, however, they want detailed reports listing everything from landscaping plants to bathroom supplies. It requires a powerful system to provide this kind of information. With an integrated database

system, not only would the quality and quantity of the reports improve, but the time required to produce the reports would be reduced.

The property manager commented that by automating activities on the system, "meaningful data" is created as a by-product from the activity. For instance, by automating the tenant service requests, the data can be sorted in order to spot trends and problems. If most of the HVAC calls occur at a certain time of day or from one side of the building, that information would help the engineer determine the problem. With the current system, sorting the data is just too cumbersome. The leasing agent mentioned that producing floorplans and graphics on the system would be an improvement over the current process of reducing plans on the copier. This activity would also produce data by storing proposed locations on the system.

Another benefit is the ability to share information stored in the building database. The asset manager commented that because their firm prides itself on high standards for property management, the ability to share information between offices is important. For instance, they try to keep a national tenant list available for all offices, but pulling it together takes so much time that it is approximately a year out of date. Sharing information means lessons learned in one office can be passed on so that the whole company benefits from the experience. The building "history" might also

translate to a higher value for the property upon sale, since it can be easily transferred.

Implementation

Implementing the system was another topic of discussion. The leasing agent feels that the amount of training required to learn such a system would be the greatest obstacle to overcome. Everyone agreed that the level of computer literacy among the staff is good, but that additional training would be necessary. Given their brief introduction to the system, no one could estimate what the learning cycle might involve. However, they believed that the enhanced user interfaces, like graphics, "point and click" commands and customized menus, would help build confidence with the system.

To the asset and property managers, one of the biggest challenges in implementing the system is integrating it into the work process. Most of the steps shown in the presentation are currently performed with a variety of methods and tools. In order for the system to capture information without requiring redundant steps, it must be used as a tool in creating the work product. Although the system demonstration showed this can be done, it will require a great deal of time and effort to replicate the entire process on the system.

Another issue in implementing the system is timing. The regional partner for the firm lamented the fact that this "tool" was not available when the project was conceived. By incorporating the system into the original design of the

project, not only could the full power of the technology be exploited but the cost of the software and hardware could be included in the original construction budget. With an existing building, the cost of getting plans and information into the system must be addressed.

Risk

Several risks of using the system were also mentioned. The property manager expressed concerns about being on the "bleeding edge" of technology. What if they spent time and money trying to implement such a system only to find that it became obsolete in a few years? The regional manager expressed concern about continually having to spend money to upgrade the memory or hardware of the system.

The asset manager pointed out that one danger in utilizing the system is trying to do too much. The trick, he said, would be to focus the system on basic information. People may get carried away with tracking details that are superfluous, and this will reduce the efficiency of the system. For instance, tracking doorknobs might be nice, but is it really necessary? Tracking things that cost money or create revenue, like leases, management agreements and contracts would be important.

Justification

At least one team member felt that the benefits to be gained do not justify the investment in time and money required to implement the system. The leasing agent commented

that while slick graphics and computerized information tracking are nice, the system would be a poor investment in the current market climate. Even though the existing systems are somewhat cumbersome, they seem to work just fine. Presently, the agent said, the building activity is slowing as it leases up, making available spaces and prospect information easier to track.

The property manager pointed out that, to his department, the payoff is in the information available at the end of the cycle. He stated that it will be difficult to identify specific savings from the system. While there is a great deal of value gained from better information management, the payoff may not be seen immediately. Everyone agreed that in order to justify the system, the value must be clearly demonstrable to investors and financial partners.

Competitive Edge

Perhaps the most important issue discussed is whether or not developing such a system would provide a competitive edge for the company. The asset manager commented that they are studying industry trends in order to formulate their strategy for the future. Their current position as one of the nation's top developers was earned by leading the industry, not following. In the 1960's, the standard office tower was an unassuming "box" with little, if any flare. Their company built several major buildings designed by some of the most progressive architects of the time that were a dramatic

departure from the standard. These "architecturally significant" office towers gained wide acclaim. Eventually, as their style of "statement" buildings caught on, their "cutting edge" reputation attracted business and caused the firm to flourish. In the asset manager's opinion, the industry is shifting again, and this new technology may well be the trend of the future. Only by committing time and resources to explore the possibilities will they be able to lead the industry as they have in the past.

The asset and property managers believe that if the technology can be can be successfully integrated into the asset management process, it will lead to new sources of business. The property manager believes the system would be a factor in competing for third party property management contracts. With so many different types of software programs in the market, each one designed for a specific use, a single integrated approach would be appealing to an owner. Since owners want detailed information, in their own report format, the flexibility of the system to link to various types of software would be a great advantage.

The Argos system also suggests the possibility of expanding the concept of tenant services in an office building. Once the technology is integrated into the building operation, offering facilities management services to tenants is a natural extension of the system. This could enhance the value of the property, differentiate the team in the

marketplace and possibly generate additional revenues.

The same expertise acquired in operating multi-tenant buildings could also be applied to the growing field of facilities management. Many large corporations are realizing the need to manage their facilities more professionally. Since many of these companies are also trying to downsize, many are turning to third party facilities management contractors. The Argos system, with its powerful facilities management capabilities, could be an effective tool in capturing some of this market.

In summary, the asset management team believes that the technology presented is applicable to the asset management process. Eliminating redundancies, sharing information and creating a building "history" that can be shared with others are three big advantages of the system.

CONCLUSIONS

There is little doubt about the need to improve the information systems currently used in real estate asset management. Although there has been substantial progress made in automating separate functions, like accounting and finance, very few applications integrate the disciplines. The lack of integration causes redundancies, mistakes, and inefficiencies in the flow of information. Other industries, like manufacturing and banking, have utilized new computer tools and technology (information technology) to overcome this

problem. Real estate operations can benefit from this technology as well.

One of the most promising technologies available for integrating the real estate disciplines are the new CAD/CAFM based systems with fully integrated relational databases. The Argos system researched in this paper offers a way to enhance individual production and integrate the asset management team with more sophisticated tools and information. The system records the information created during the process and organizes it in relation to the physical elements of the building. The ability to share work products and information from this database among the asset management team reduces redundant tasks, promotes greater accuracy in work and enhances coordination among the disciplines.

Strategic asset management, as described in the introduction to this paper, is concerned with protecting and enhancing the value of the building. The first goal in utilizing this system should be to **protect** the asset value by organizing and preserving information about the asset. Since each building is a unique combination of material, equipment and tenants, there is no universal owner's manual for operating the asset. Without key building information the asset and property manager are like auto mechanics trying to "feel" their way around an exotic sports car. Poor information leads to bad decisions.

At this level, tenants do not care whether the building

is operated with state of the art technology or rubber bands, as long as they get what they want. Usually, they expect clean, comfortable space and a building infrastructure that works. They want their lease administered fairly, with no double billing or exorbitant expense charges. Prompt service is an added bonus. Ask any real estate manager how hard it is to provide this basic level of service! Building heating and cooling systems rarely keep all of the tenants happy. Roofs leak, elevators stick, and tenant service requests sometimes get lost in the shuffle.

By **automating** the building operation wherever possible, operations are streamlined and information that is created and used during the process is recorded and organized in the building database. This building history provides information that allows the asset management staff to become more efficient and effective. To the extent that better information systems allow for better management, the asset value is protected. In today's market, providing "no surprises" is the minimum level of service required. To be a player in this market, asset and property managers must learn to protect the asset through better information management.

The second goal of the implementing the system should be to **enhance** the value of the asset. This requires more than merely automating; the process must be "informated" (Zuboff,1988). Informating is achieved by utilizing the information produced through automation to open up new forms

of service and market opportunities. Since the tenant is the key to value, enhancing the tenant's perception of value for the building is the real task. At this level, the basic information system can be used to expand and enhance the value of the building to the tenant. By combining the workstation power of the system and the building information database, the asset management team can help the tenant utilize their space more efficiently and effectively. For example, the CAD intelligence of the system can allow the tenant to plan their space better through visual aids and automatic estimating capabilities. A tenant's ability to manage their office can be improved through the facilities management capabilities of the system. Tracking computer networks, furniture, equipment and personnel is a service that many tenants now obtain from outside architectural firms. Who better to offer this service than their own landlord?

Asset and property managers must realize that offering clean and comfortable space is not enough in the current market. The office building is a critical part of any tenant's business infrastructure. As the business environment grows more challenging and complex, asset and property managers can enhance the value of an office building by providing services that help the tenant compete. Tenants will pay more for a building that enhances their efficiency and effectiveness. Landlords in Japan offer video conference facilities, computerized business libraries and fiber optic

cabling networks to their tenants. Their goal is to make their tenants more efficient and to add value to the building. The office building is evolving from a "dumb" structure into an "intelligent work environment". This evolution requires asset and property managers to develop new tools and techniques which increase the value of the building to the tenant.

On a broader scale, individual building information systems can be linked, allowing firms that control multiple properties to sort data from a larger field. For firms that operate millions of square feet of space, the combined information contained in these properties can be "mined" using modern computer technology, to discover new ways and more efficient methods to conduct business. The true value of a building database will not be known until it is created and effectively utilized. Trends in other industries suggest that new business methods and market opportunities often arise as a result of automating and informating the process.

Implementing this new technology will require a long term commitment. Since this type of system is new, there is a lot of work ahead for any firm that decides to pursue the concept. Leadership and vision are critical in realizing the true value of the system. Merely automating tasks will not produce any sustainable competitive edge for a company. The system serves as a basis for gathering information that can be analyzed to discover new business techniques and services.

In summary, in order to be a player in today's market, the first requirement is to **protect** the value of the asset. This can be accomplished through **automation.** In order to be a leader in the market the value of the asset must be **enhanced.** The key to enhancing the value of the asset is in **"informating"** the process. Only with leadership, resources and vision can this "toy" become the basis of a true competitive advantage.

BIBLIOGRAPHY

BELMONTE, LUIS A. "Retaining Tenants in a Soft Market," Commercial Investment Real Estate Journal, Vol. 10, Iss. 4 (Fall 1991), pp. 48-50.

BIRCH, DAVID L. AND RICHARD J. BEHRENS. "Opportunities in Office and Industrial Real Estate: Finding Gold After the Rush," Real Estate Accounting & Taxation, (Fall 1991), pp. 22-29.

BELLIVEAU, MAURA. "Taking CAD Beyond Design," Design Management, (March 1990).

CONOVER, DONALD E. "Real Estate Investing During Difficult Times," The Real Estate Finance Journal, (Spring, 1992), pp. 13-16.

CUSUMANO, MATTHEW AND KENNETH F. EICHLER. "Utilizing Computer-Aided Facility Management," The Real Estate Finance Journal, (Summer, 1990), pp. 39-43.

DRUCKER, PETER, F. "The Coming of the New Organization," Harvard Business Review, (Jan/Feb. 1988), Vol. 66, No. 1, pp. 45-53.

EQUITABLE REAL ESTATE INVESTMENT MANAGEMENT, INC. "Emerging Trends in Real Estate 1992.

FENTRESS CURT W. "Improving Efficiency with Computer Aided Facilities Management," Commercial Investment Real Estate Journal, (Spring, 1991), pp. 24-27.

GLICKMAN, DAVID. "Industry Experts Speak Up on the Future of Asset Management," National Real Estate Investor, (January 1992), pp. 100.

HANRAHAN, MICHAEL J. "Trends in Property Management Software," Journal of Property Management, (Sept./Oct. 1991), pp. 54-58.

HEILBRUNN, JERRY F., CPM AND FRANK WOJCIECHOWSKI. "Integrating Computers for Customer Service," (July/Aug. 1991), pp. 60-61.

HEALEY, WARREN R. AND WILLIAM WENDT. "Standardizing Decentralization for Asset Management," Journal of Property Management, (Sept./Oct. 1989), pp. 64-67.

HERZBERG, MICHAEL A. AND JOHN F.C. PARSONS. "What Plan Sponsors Are Saying About Real Estate," Pension World,

(September, 1991), pp. 16-18.

KELLY, TED M., Dyer-Brown, Interview June 26, 1992.

KROUCH, WILLIAM T., LaSalle Partners, Interview July 6, 1992.

LEARY TED AND RON SILVA. "Real Estate In the 90s: Profits To Be Earned the 'Old Fashioned Way'," Pension World, (September 1991), pp. 10-11.

MACOMBER JOHN D. "Strategic Planning for New Computer Applications in the Development Process," Urban Land, (August 1989), pp. 12-15.

MORTON MICHAEL S. SCOTT. The Corporation of the 1990's: Information Technology and Organizational Transformation, New York, Oxford University Press, 1991, pp. 3-60, 122-157.

NOVITSKI, B. J. "CAD Consequences," Architecture, (May 1992), pp. 109-112.

PORTER MICHAEL E. Competitive Advantage, New York, The Free Press, 1985, pp. 33-63.

PORTER MICHAEL E. AND VICTOR E. MILLAR 1985. "How Information Gives You Competitive Advantage," Harvard Business Review, Vol. 63, No. 4. pp. 149-159.

ROCKART, BENJAMIN. "The Information Technology Function of the 1990s: A Unique Hybrid," Center for Information Systems Research, Working Paper Series #225. (June 1991).

SEARS, MARK, Hines Interests Ltd., Interviews June-July 1992.

TATEISHI, MAKOTO. "Intelligent Buildings Must Meet Needs of Tenants," Business JAPAN, (October 1989), pp. 55-62.

STUDLEY, JULIEN J. 1992 Studley Outlook, Vol. 34, No. 2, (Feb. 1992).

WHEATON, WILLIAM C. "The Prognosis for Real Estate: An Inevitable Recovery?", MIT Departments of Economics and Urban Studies and Planning Working Paper #40, (January 1992).

ZUBOFF, S. 1988 In the Age of the Smart Machine: The Future of Work and Power. New York: Basic Books.