Tall Buildings: 2000 and Beyond

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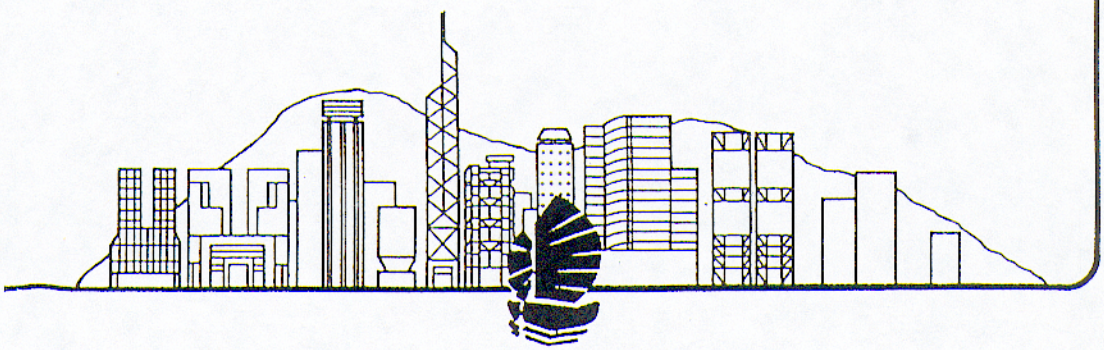

Designing User Friendly Tall Buildings

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Energy efficiency was the buzz word for office building design in the 1970s, and smart buildings marked the hot button of the industry in the 1980s. User friendly buildings is becoming the most important criteria for the 1990s.

HISTORICAL PERSPECTIVE

An energy efficient office building design attempts to minimize operating costs, and smart buildings incorporate state of the art electronic convenience, especially with regard to communications. User friendly buildings integrate energy efficient and smart building technology with state-of-the-art environmental system technologies to improve productivity in the office workplace by enhancing the quality of the ambient office environment. Oddly enough, it has been the overemphasis of energy efficiency in office buildings that has largely created the poor environmental performance that now exists in many commercial structures, causing users to demand a higher standard of control.

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Initially, building technology in the 1980s focussed attention on minimizing energy usage. Sophisticated mechanical and electrical systems evolved and new building products were utilized in office construction. These same factors, however, combined to create a polluted and often uncomfortable indoor environment, one that has manifested itself in increased employee complaints, reduced productivity and even disease. The resulting lawsuits have placed enormous pressure on designers, builders, building owners, managers and employers to revise their priorities.

DESIGNING A HEALTHIER WORKPLACE

Now that we know how to make buildings efficient to operate and convenient to use, surely we can now also design user friendly office buildings that actually increase productivity, reduce worker grievances and minimize interpersonal stress among occupants. We can design surroundings that actually provide a healthier workplace, an office that literally contributes to the mental and physical well-being of building users. After all, the key purpose of office buildings is to provide an atmosphere in which people can perform productive work.

Table 1 lists the 25 tallest buildings in the world, their location, the number of stories and their use. All of these tall buildings contain office space and in 20% of them, office is given as their principle use.

For many owners and managers of tall office buildings, the problem of the nineties will be how to rectify existing problems, or in other words, how to make the existing buildings user friendly.

For those owners and managers faced with developing and leasing new office space in tall buildings, the problem will be to address the issue of environmental quality for new user-friendly projects. Market research by developers and corporate tenants indicates that tenant/employee productivity is at least as important, if not more so, than location. Potential tenants are demanding that buildings do more than meet minimum standards. They are seeking to lease space in a building that provides the high quality conditions of comfort that will enhance the productivity and performance of their employees. In other words, tenants of A grade office buildings are no longer satisfied to travel in economy class when business or first class is available. In fact many tenants are more than willing to pay the premium to upgrade.

USER FRIENDLY DESIGN

An office building that is not user friendly and that does not achieve adequate environmental conditions can affect not only the health of occupants but also office productivity. If building occupants are satisfied with their indoor environs, the prevalence of complaints about health and comfort is lower, truancy is decreased and the work place is generally more productive. This has been demonstrated in one study of Vancouver office workers before and after their company relocated to a modern-type office building (Sterling and Sterling, 1983). Figure 1 demonstrates a dramatic increase in absenteeism related to the prevalence of health and comfort complaints after

Table 1 25 Tallest Buildings for 1989[a]

NAME OF BUILDING	CITY	STORIES	USE
Sears Tower	Chicago	110	Office
World Trade Center (North)	New York	110	Office
World Trade Center (South)	New York	110	Office
Empire State	New York	102	Office
Bank of China Tower	Hong Kong	72	Office
Amoco	Chicago	80	Office
John Hancock	Chicago	100	Multiple
Chrysler Building	NewYork	77	Office
Library Square Tower	Los Angeles	75	Office
Texas Commerce Plaza	Houston	79	Office
Allied Bank Plaza	Houston	71	Office
311 S. Wacker Drive	Chicago	65	Office
Columbia Center	Seattle	76	Office
American Int'l. Building	New York	66	Office
One Liberty Place	Philadelphia	60	Office
First Bank Tower	Toronto	72	Office
40 Wall Tower	New York	71	Office
Interfirst Plaza Tower	Dallas	70	Office
Citicorp Center	New York	59	Multiple
Overseas Union Building	Singapore	63	Multiple
Scotia Plaza	Toronto	68	Office
Transco Tower	Houston	64	Office
900 N. Michigan	Chicago	67	Multiple
AT&T Corp Center	Chicago	64	Office
Water Tower Place	Chicago	74	Multiple

[a] Source: Council on Tall Buildings and Urban Habitat

relocation. Both of these factors reduced office productivity. In a related study, Fireman's Fund Insurance found that improving the environment of two California office buildings by increasing the ventilation, decreased occupant complaints by 40% (Hicks, 1984).

Often buildings that are not user friendly develop a reputation as "Sick Buildings." There are more and more reported incidents of so-called "sick" office buildings. This problem was first recognized and studied in Scandinavia in the early 1970s and has subsequently been widely studied throughout Western Europe and North America. The most common symptoms reported by occupants of these buildings include mucous membrane irritation, eye irritation, headaches, lethargy, fatigue, nausea, dizziness and skin rash or itchiness. In addition, the occupants of "sick" buildings often report problems with the environmental control systems such as a lack of fresh air, stuffiness, inadequate temperature control and unpleasant odors.

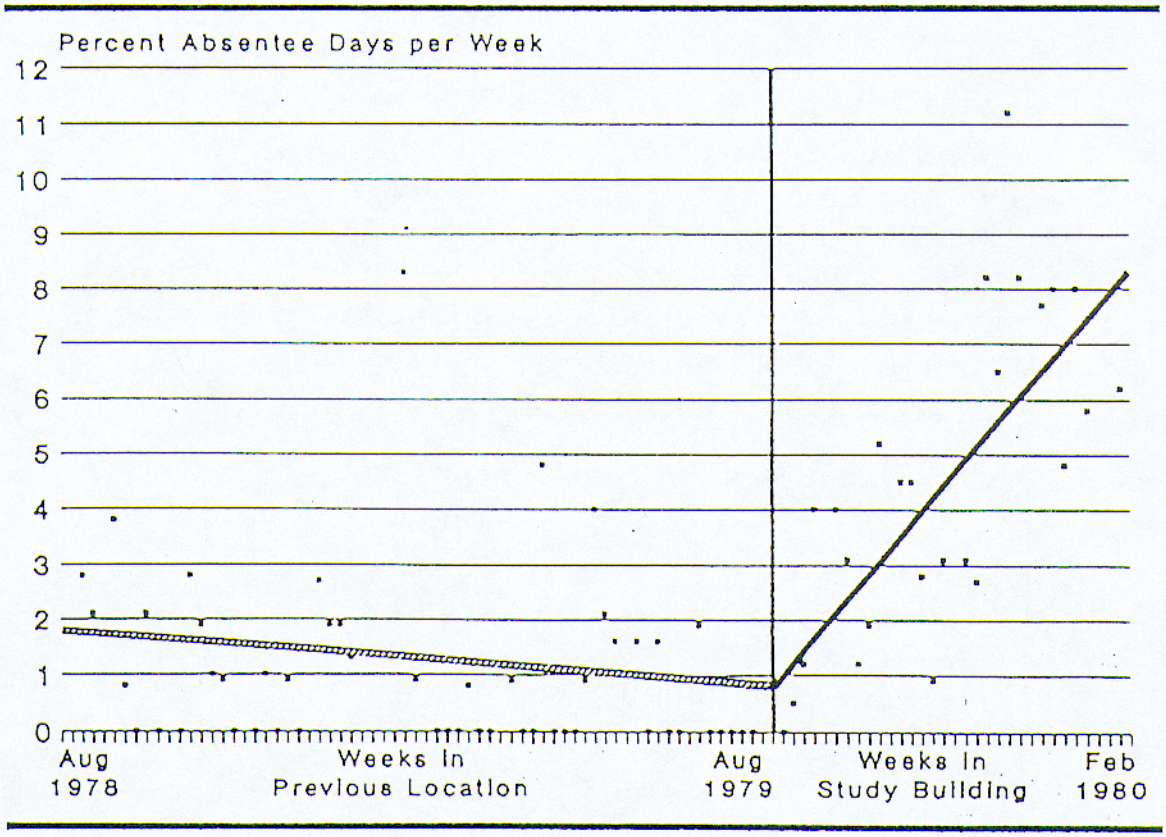

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Fig. 1 Absentee rate of office workers before and after relocation

There have now been several hundred investigations of sick buildings carried out in North America and Western Europe. The results of nearly 400 of these investigations comprising over 100,000,000 square feet of buildings have been synthesized into a computer database, the Building Performance Database (Collett et al, 1989). Table 2 summarizes the factors identified by the investigators that had contributed to sick building problems. 49% of problems were a result of ventilation and air conditioning systems and a further 28% were a result of indoor pollutants. Nearly 80% of sick buildings could be cured and the buildings made user friendly by improvements to environmental systems or renovations with environmentally safe materials.

It has been estimated that up to ninety per cent of the currently available office building stock has a potential for becoming a "sick" building. A recent article in the American Institute of Architecture Journal warns that the single most important area of liability litigation facing architects and engineers is that of public health hazards associated with the environmental performance of buildings (LePatner, 1987). Examples of such litigation to date include materials such as asbestos and formaldehyde products. Other examples are radon generating components of buildings and microbiological contamination of air conditioning (HVAC) systems.

Fortunately, such problems can be eliminated. To create user friendly buildings, architects and engineers need to understand the health and comfort problems that can be created by poor building design. To prevent a user friendly building from becoming "sick", building, managers and occupants need to master a better understanding of the design, operation and maintenance of the systems that service the modern office.

To maintain buildings in a healthy state requires that architects, engineers and interior designers must ensure that the energy, environmental, office landscaping and furnishing systems are capable of surpassing established minimum performance standards in all occupied areas as well as providing requirements of the occupants. Building operators must then make certain that their systems are properly maintained and that tenants do not have access to controls which may affect their neighbors. Thus, the first step towards creating user friendly office buildings is to improve communications between the design professionals, the building owners and managers and the occupants.

ECONOMIC ISSUES

User friendly buildings also require an economic commitment. However, the monetary investment can rapidly be balanced by reduced absenteeism and improved productivity. Although the majority of tall buildings are not owner occupied improved performance for office tenant's employees could be a significant incentive to both remain in a particular location and to pay premium lease rates.

Based on current North American wages, benefits and lease rates a typical office tenant's costs range between $100 to $200 per square foot. Normal absenteeism, which averages 5%, costs $5 to $10 per square foot. A building which does not provide suitable environments can increase absenteeism by a further 2.5% costing a tenant $2.50 to $5 per square foot. To be more specific for every 100,000 square foot of office building, salaries and wages cost tenants 10 to 20 million dollars. A user friendly building can save .75 to 1.5 million dollars in a tenants expenses per 100,000 square feet in absentee costs. This saving can balance a substantial investment in building and systems improvements to enhance user friendly performance. On the other side of the equation operating energy costs are only $1 to $3 per square foot or $100,000 To $300,000 per 100,000 square feet of office space. If increasing these costs improves performance and productivity as well as decreasing absenteeism by providing user friendly environs, tenants would consider this a good business investment.

Table 2 Investigator's Conclusions From Reports Contained in the Building Performance Database

SUSPECTED CAUSE	# OF REPORTS	%
Ventilation Control Problem	159	39.0
Ventilation Infiltration Problem	40	10.0
Indoor Sources	115	28.1
Stress	12	2.9
Ergonomic/Workstation Design	5	1.2
Undetermined Cause	42	10.2
No Problem	35	8.6
Total	408	100.0

UPGRADING EXISTING BUILDINGS

Theodor D. Sterling and Associates Ltd. in collaboration with the British Columbia Building Corporation has developed a strategy to audit the environmental performance of existing buildings with the intention of evaluating their user friendly capabilities (Sterling, 1985). This evaluation or diagnostic strategy includes the following phases:

1) Determine whether a performance problem exists that impacts user friendly capabilities.
2) Identify the probable causes of the problem, for example, indoor air quality, thermal conditions or ventilation control inadequacies.
3) Design and implement modifications to improve user friendly capabilities.
4) Re-evaluate conditions after modifications have been implemented to test the effectiveness of the design solution.

PRODUCING USER FRIENDLY BUILDINGS OR BUILDING COMMISSIONING

The most effective approach to creating a user friendly building is, of course, to design, build and furnish one from the outset. To accomplish this, architects, contractors and their clients must practice the preventive approach called "Building Commissioning". The term "Commissioning" refers to a comprehensive evaluation of a building project to guarantee the effective performance and integration of the energy management, communication and environmental control systems that serve the modern office. Commissioning makes user friendly quality an essential design objective by ensuring the successful integration of all systems into the infrastructure of the buildings. This infrastructure will then have the ability to adapt to office technology, landscaping and furnishing systems, designed to ergonomic standards.

Architects and engineering consultants must work as part of a team with other design specialists and actively pursue their role in building commissioning. Modern offices encompass many system control elements such as temperature, lighting, noise level, the intended physical and architectural characteristics of the space, the intended sense of enclosure and the type and proximity of occupants. User friendly capabilities are a result of the interaction of all of these factors.

Providing optimum conditions in an office building requires the interaction of all involved in the design and delivery process. If proper commissioning is a part of the design and delivery process, environmental performance problems in office buildings will diminish and user friendly buildings will become the norm.

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