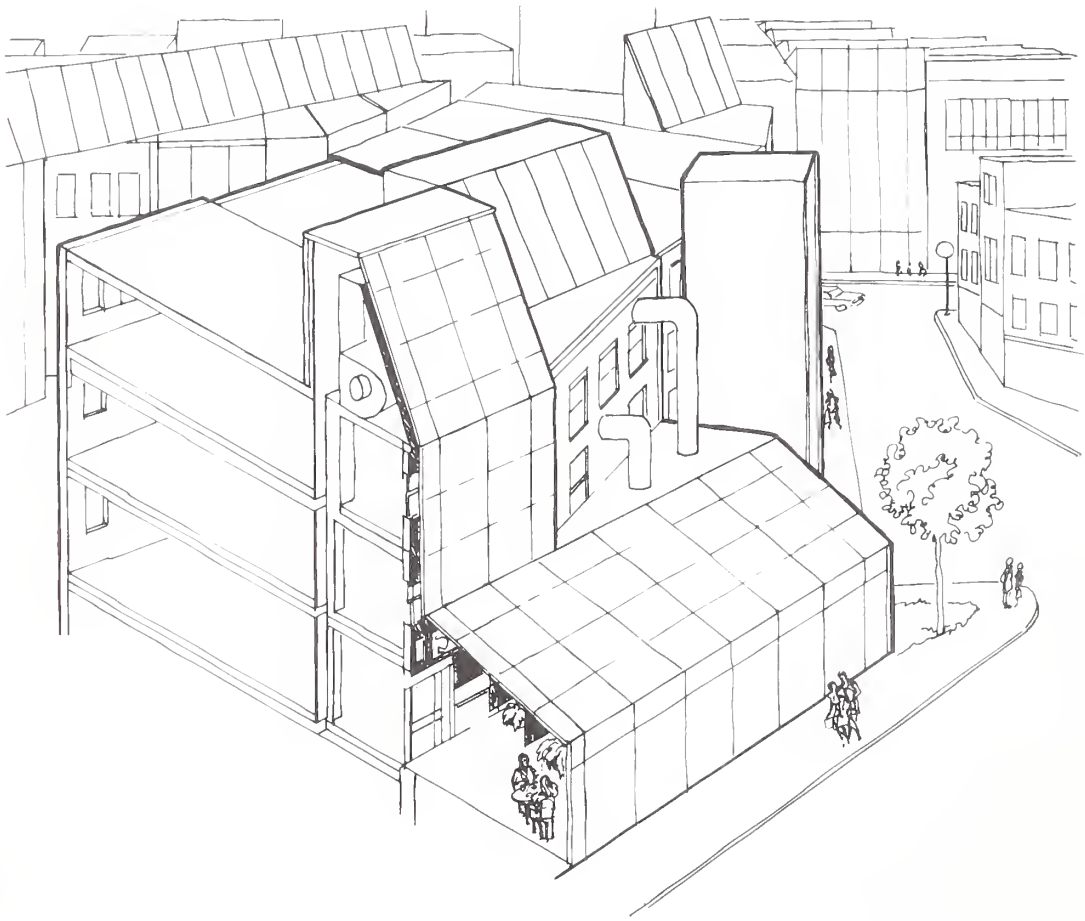
ARCHITECTURAL RESEARCH AREAS

U.S. DEPARTMENT OF COMMERCE / National Bureau of Standards
National Engineering Laboratory / Center for Building Technology / Environmental Research Design Division

SITE DESIGN

The Architectural Research Group (ARG) has been developing techniques for the computerized synthesis of climate data which will represent the micro-climate on building sites. ARG is now creating graphic representations of such data for use by designers. A method for computing micro-climate influences on the energy efficiency of a variety of architectural massing configurations has been initiated, as has an investigation of pedestrian acceptance of outdoor or unconditioned spaces in the built environment. In conjunction with the American Institute of Architects, Department of Energy, National Oceanographic and Atmospheric Administration, and American Society of Civil Engineers, ARG is developing site design criteria and guidelines in these areas. ARG is also studying the retrofit applications of solar technologies to commercial buildings in cities, concentrating on passive techniques applied to groups of buildings. ARG will be investigating the architectural implications of buildings designed to ensure access of neighboring properties to sunlight.

A broad plan to investigate site design is now being prepared. The need for such a plan is indicated by complaints from the building industry and government studies. These show that zoning and site improvement relations cost developers more than building regulations. Current site regulations generally are intuitively based and vary widely between jurisdictions. Such restrictions can cause substantial expenses to builders through wasted land and energy-inefficient site plans. A large potential exists for improved site design and reduced building cost through the systematic development of performance-based site standards. Such standards could be used for climate, soil, drainage, traffic, and acoustic characteristics of sites, thereby promoting more energy efficient, useful buildings and better land utilization.



BUILDING CIRCULATION

In recent years the Federal government has recognized the need to accommodate handicapped users of the built environment (Public Law 90-480, the Architectural Barriers Act of 1968; PL 93-112, the Rehabilitation Act of 1973; ANSI Standard 117.1). The provisions of this legislation and standard are already affecting buildings in many sectors. The Federal government currently regulates, via the Occupational Safety and Health Act, emergency egress from workplaces using the National Fire Protection Association's Life Safety Code (1970). Egress from nursing homes is also now regulated (via Title XVIII of the Social Security Act and PL 94-182) using different editions of the same code.

Recent research at NBS, however, has shown that the circulation provisions found in such codes lack a rigorous empirical basis. Most pedestrian movement in and around buildings, for example, neither involves the disabled nor occurs during emergencies. Yet, the design of general building circulation systems is governed by regulations concerning emergency egress and the handicapped. As a result, designs for normal pedestrian movement do not always reflect the requirements of the occupants and organizations housed within buildings.

Consequently, the Architectural Research Group has been investigating the characteristics of pedestrian flow on stairs and ramps to determine their safety characteristics and carrying capacities. A program to simulate the egress of people during fires was completed in 1979. A conceptual framework is being developed to include a greater variety of building circulation elements (corridors, doorways, etc.). It is anticipated that the framework will serve to guide the analysis of various design configurations. The work will be based on past and future NBS field research. Findings will then be compared with performance levels implied in existing regulations. Recommendations on how to improve design criteria will be presented to standards and codes groups.

Research on building circulation is necessary to determine the impact of meeting recent safety and accessibility regulations on both users and the environment. That improved building circulation can result in significant cost-savings has been established. British hospitals realized savings equivalent to 8.5 percent of annual employee salaries after reducing unnecessary worker circulation by 25 percent.

INTERIOR SPACE REQUIREMENTS

A program on interior space requirements is examining how the physical characteristics of offices and office buildings affect user activities. Results can be used to improve or establish the functional criteria and decision rules for planning office space. The program also will investigate the applicability of concepts and measures which link space with behavior in offices to discover if such approaches are transferable to other types of environments.

Reviews of administrative criteria (space allocation based on rank, for example) and functional criteria (space allocation based on user activities) will be conducted in this program to determine their impact on user activities. The empirical basis of any regulations regarding office space and circulation also will be examined. In summary, the aim of the program is to increase the efficiency and utility of office layouts. To this end, design guidelines, based on study results showing that improved efficiency or utility will result from their adoption, will be prepared for building and interior designers and space planners for both the Federal and private sector.

Office configuration is another target for study. The open plan office is one example. This increasingly popular alternative now accounts for 10 percent of all U.S. office space. Although some case studies of open offices have found increases in worker productivity on the order of 10 percent—a clear increase in efficiency—other studies have reported failures of open offices due to unacceptable environmental conditions relating to privacy, noise, and space organization for office staff. Sound design guidelines could reduce such problems, helping to make decisions about the applicability of various approaches to space and circulation arrangements in open offices.

Energy use in office buildings is a second target for study. The recent emphasis on performance-based energy standards has created a need for quantified distributions of space required for current office staff activities. This data, which has not been collected to date, is essential to achieve normalized energy budgets. The ARG program on interior space requirements will determine current average space requirements, include possible future activities and their space requirements, and project trends. The program also will explore space requirements of other building types, taking into consideration their different occupancies and activities, to help frame rational energy budgets for these building types.

Without such empirically-based interior space and circulation criteria, no means seem available to assure office configurations that are useful, efficient, and meet requirements for the energy budgets now under consideration.

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