

INTEGRATING DISCIPLINES

E. Sterling

C. Bieva

ABSTRACT

Communication between disciplines is the key to the creation of building environments that promote and enhance the well-being of their occupants. This paper describes the development and organization of an international conference designed to facilitate an exchange of information between the various disciplines involved in the design, operation, and construction of buildings and those disciplines that assess the impact of building environments on human well-being. The conference, titled "Building Design, Technology and Occupant Well-Being in Temperate Climates," was held in Brussels in February 1993 and was attended by architects, engineers, building operators, doctors, lawyers, toxicologists, government legislators and policymakers, and research scientists from 25 countries.

INTRODUCTION

The last decade of the 20th century has seen increasing concerns about both man's impact on the environment and the environment's impact on man. Human activity occurs for the most part in and around buildings. Although buildings are not isolated from the global environment and certainly have a significant impact on global conditions through energy consumption, resource depletion, and waste generation, by far the most important impact of buildings is on the well-being of the people who occupy them. In large part, occupant well-being is determined by the air quality and other environmental conditions of the indoor space. These conditions are provided by a variety of disciplines concerned with building design, construction, and operation that include engineers, architects, and building owners and managers. Specific impacts on human well-being, on the other hand, are defined by a host of other disciplines including doctors, toxicologists, hygienists, and epidemiologists. The impact of buildings on occupant well-being is of particular concern in cold and temperate regions, where it is not uncommon for inhabitants to spend 90% or more of their lives indoors. In these climatic regions, in which more than one-third of the world's population resides, the creation of comfortable indoor environments is heavily dependent upon the application of energy- and resource-intensive building and heating, ventilating, and air-conditioning (HVAC) system technologies. It is precisely in these regions that the need to conserve energy and resources has often been linked to widespread occupant dissatisfaction with indoor conditions.

ASHRAE INITIATIVES

The American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE) formed the Task Group on Cold Climate Design in 1987 to address the unique problems associated with heating, ventilating, air-conditioning, and refrigerating systems in cold climates. The scope of the committee includes human health and comfort as well as building performance. Early in its deliberations, due to the lack of a central source of information on cold climate issues, the committee identified the need for an international conference concerned with health, technology, and building design in cold and temperate climates. In collaboration with a number of international professional societies, a committee was formed to organize a conference to provide a forum for the exchange of new ideas, technology, and the results of scientific studies both within and across the many disciplines involved in creating quality buildings that promote human well-being. The conference was intended as a means to facilitate the cross-fertilization of ideas as a framework to improve the quality of buildings and building systems, as well as methods of assessing their impact on human health and well-being.

CONFERENCE ORGANIZATION

The conference "Building Design, Technology and Occupant Well-Being in Temperate Climates" was held in Brussels, Belgium, February 17-19, 1993, and attracted attendees from 25 countries representing a wide range of professions including architects, engineers, doctors, lawyers, toxicologists, government legislators and policy makers, and leading research scientists. The "Association Royale Belge Technique de l'Industrie du Chauffage, de la Ventilation et des Branches Connexes (ATIC) acted as conference host. ASHRAE was involved from the early planning stages of this conference through the Task Group on Cold Climate Design. Other sponsoring organizations included the

- International Institute of Refrigeration (IIR)
- Federation of European Heating and Air-Conditioning Associations (REHVA)
- Association Belge des Acousticiens (ABAV)—Belgium
- Association of Engineers for Heating Ventilation Air-Conditioning Heat Supply and Building Thermal Physics (ABOK)—C.I.S.

- Agence de l'Environnement et de la Maîtrise de l'Energie (ADEME)—France
- Air Infiltration and Ventilation Centre (AIVC)—U.K.
- Association pour la Prévention de la Pollution Atmosphérique (APPA)—France
- Building Owners and Managers Association of Canada (BOMA)—Canada
- Centre Scientifique et Technique de la Construction (CSTC-WTCB)—Belgium
- Intelligent Buildings Institute of North America (IBI)
- International Union of Air Pollution Prevention Associations (IUAPPA)
- Société Française d'Aérobiologie (SOFRAB)—France and
- Société Royale Belge des Ingénieurs et Industriels (SRBII)—Belgium.

The conference's International Advisory Committee consisted of representatives of each of these organizations. In addition, a special technical committee composed of scientists and technical experts was responsible for developing an interdisciplinary program that covered topics of particular concern in cold and temperate climates.

COMMUNICATION BETWEEN DISCIPLINES

Communication between disciplines is the key to the creation of building environments that promote the well-being of their occupants. Therefore, a vital objective of the conference was to facilitate the exchange of information between disciplines. To achieve this goal, health, technology, and design topics were integrated into each technical session, rather than dividing the conference into a series of separate sessions, each focusing on subjects of primary interest to individual disciplines. The integrated organization provided a forum that allowed experts from different fields to listen to, and communicate with, one another. However, such organization is not appropriate for a printed proceedings.

The conference proceedings is therefore organized into the seven broad topic areas that were integrated into each session of the conference:

- Design, operation, and maintenance
- Energy management
- Environmental management
- Building performance and thermal comfort assessment
- Indoor environmental quality
- Occupant health and well-being
- Legislation, standards, and litigation

Design, Operation, and Maintenance

Research has shown that inadequate design, operation, and maintenance of building systems are primary causes of occupant complaints of poor indoor environmental conditions. The first section of the proceedings focuses on this

issue and includes a wide range of papers devoted to achieving acceptable indoor environmental conditions in commercial, institutional, and residential buildings. Topics include development of computer simulation software for building design, a description of frameworks for integration of building operational and maintenance procedures early in design, results of simulation models and field tests of new thermal and controls technologies, and an overview of the impact of buildings or building design on both the local indoor environment and the global environment.

Energy Management

Experience gained implementing building energy management strategies over the past 20 years has identified a need to balance energy efficiency with environmental comfort and that this balance can be achieved. The papers in this section describe the energy impacts and potential for energy savings of a wide range of technologies and operational characteristics. The papers include field research, mathematical models, and simulation studies. In addition, a paper describes the major initiatives within the European Community in the field of energy engineering.

Environmental Management

Both the indoor and outdoor environments have suffered as a direct result of building technology. Much research has been devoted to understanding these impacts and developing effective management strategies and control technologies. The papers in this section focus on control and management of buildings to improve environmental quality. The two major issues of concern are indoor air quality (IAQ) and ozone-depleting substances. IAQ-related management strategies are described for both new and existing buildings, including discussion of relevant ASHRAE standards. A review of concerns regarding the effect of refrigerants on the global environment and a discussion of the effectiveness of alternative refrigerants are presented.

Building Performance and Thermal Comfort Assessment

The building industry has devoted substantial research efforts to assessing the ability of new building technologies to improve thermal comfort and occupant well-being. This section includes papers on topics concerned with the development of test facilities for building performance analysis, experimental studies, and field validation of thermal comfort models.

Indoor Environmental Quality

The quality of the indoor environment is a complex issue that may be best understood by applying an integrated, multidisciplinary research approach. A thorough under-

standing of factors affecting the quality of the indoor environment is a prerequisite to improving occupant health and well-being. The papers in this section examine a wide range of issues related to indoor environmental quality. Topics include emissions from building products, occupant activities, and building systems; methods of sampling indoor pollutants; case studies of radon mitigation; and a field survey of lighting quality.

Occupant Health and Well-Being

The effect of buildings on occupant health and well-being is a central theme of these proceedings. This section includes papers describing possible health effects associated with exposure to asbestos, man-made mineral fibers, volatile organic compounds, and microbial contaminants. One paper critically evaluates established methods used to assess the health risks of indoor exposure to environmental substances.

Legislation, Standards, and Litigation

Building design is traditionally regulated by legislation and standards of professional practice. However, today, due

to environmental health concerns, prudent building designers and operators must be aware of the potential for litigation resulting from poor indoor environmental conditions. This section includes case studies of indoor air quality litigation; a strategy for solving disputes without litigation; and a review of European and North American ventilation, thermal, and lighting standards as well as actions toward international standardization.

CONFERENCE CONCLUSIONS

A summary discussion session concluded the conference. The participants agreed that the integrated organization of the technical sessions had enhanced their awareness of the research and skills provided by other professionals that could be relevant to their own practices. Further, as communication between disciplines is vital for the development of building environments that promote and enhance the well-being of their occupants, integration of professions not traditionally involved in the building design, construction, and operation process is crucial. There was general agreement that the conference had identified a need for further communication between professions and that a conference series should be considered to fulfill this need.