



Building environment design: energy conservation and efficiency

by Stephen Turner, Chair of ISO/TC 205, Building environment design

The scope of ISO technical committee ISO/TC 205 is standardization in the design of new buildings and retrofit of existing buildings for acceptable thermal and visual comfort, indoor air quality, and energy conservation. Because of this scope, the committee treats the employment of materials and techniques in their optimal way in the design of buildings, which is intricately related to overall sustainability in building design. The unique opportunity afforded ISO/TC 205 is the holistic treatment of the many aspects of building environment design, that ultimately helps to determine the indoor environment. Since these aspects are often standardized at the national level in disparate technical committees and standards, TC 205 has the opportunity of

delivering standards in several closely related sub disciplines. If these standards respect and explore the interrelatedness of these sub-disciplines, better buildings will result.

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Furthermore, the work of ISO/TC 205 recognizes that architectural engineering – the design of building systems – can no longer be undertaken separately from the overall design of buildings. The system of standards under development is intended to integrate both across engineering sub disciplines, and to vertically integrate archi-

tectural engineering with the entire building design process. With the standards developed by ISO/TC 205 providing the proper framework, the results of this integration can be buildings that respect the greater environment and provide safe and comfortable indoor environments.

The activities of ISO/TC 205 recently led to the discovery of a remarkable coincidence. Mr. Kisung Cho, Director General of the Department of Safety and Service Standards, Korean Agency for Technology and Standards, hosted our recent meetings in November 2005, in Seoul, Korea, together with the country’s Ministry of Commerce, Industry & Energy. In his warm greeting welcoming us to Seoul, he told the story of restoring the Cheonggyecheon, a river in downtown Seoul, after decades of being covered by urban streets. In my response, I was moved to talk also of a recently uncovered urban river in Providence, Rhode Island, USA, the

birthplace of the American industrial revolution and my home today.

Having realized the consequences of inattention to nature, two cities on opposite sides of the world have recently undertaken redress. Similarly, the mistakes of the past in building design cannot be sustained into the future. The mistakes of the 1970's can inform us today. Energy efficiency alone is not a worthy goal, if it results

Instead of buildings that attempt to suppress and overcome nature, why not design buildings that integrate with the environment, on every possible level? The international standardization work which ISO/TC 205 performs seeks, in addition to lowering trade barriers for engineering design, to promote and facilitate the design of high performance buildings: higher performing as economic assets for their owners, high-



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in dissatisfied and unproductive occupants. To ensure the future, buildings must respect the environment by minimizing their impact on the external environment whilst providing safe and comfortable indoor environments. The restored rivers ran through our conversation as poignant examples of right action with respect to the environment. What a powerful metaphor for architectural engineering, where sustainability is an essential goal!

er performing as buildings that provide amenable indoor environment for their occupants, and higher performing with respect to resource utilization and environmental impact.

ISO/TC 205 is organized into six active working groups, with two additional task groups currently evaluating future work items. Truly an international effort, the convenorships are distributed amongst Australia, Egypt, Republic of Korea, the United Kingdom, and the USA.

The three I's in sustainability

The Brundtland Commission¹⁾ of the United Nations stated that development is sustainable "...if it meets the needs of the present without compromising the ability of future generations to meet their own needs."²⁾ ISO/TC 205 is seeking to standardize building environment design, including several aspects of sustainability and environmental responsibility. Its working group WG 1, *General Principles*, has developed a design process standard that was approved for final draft (FDIS) stage at our plenary session in Seoul. This process standard defines interactive, iterative design stages to target and achieve integrated performance targets. The process is inter-

1) In 1987, the World Commission on Environment and Development published a report, which came to be known as the "Brundland Report". It presented the concept of global sustainable development, with guiding principles for sustainable development as it is known today.

2) ASHRAE. 2003. ASHRAE GreenGuide. Atlanta: American Society of Heating Refrigeration and Air-Conditioning Engineers, Inc.

3) ASHRAE 2004. Advanced Energy Design Guide For Small Office Buildings. Atlanta: American Society of Heating Refrigeration and Air-Conditioning Engineers, Inc.

About the author



Stephen Turner is the Chair of ISO/TC 205, *Building environment design*, serving from 2005 to 2007. In the USA, he chairs the committee for the American National Stand-

ards Institute and the American Society of Heating, Refrigerating and Air-Conditioning Engineers (ANSI/ASHRAE) Standard 55: 2004, *Thermal environmental conditions for human occupancy*, and sits on the Rhode Island Building code commission. He specializes in building commissioning, campus utility systems and construction standards as mechanical engineer at Brown University.

active to allow the many design goals, constraints, and factors to come together at the appropriate balance point for each project. Each stage of the design process is iterative. The check step called for at the end of each design stage ensures that all design targets are met. Failure to achieve targets – whether energy efficiency, resource use, controllability, or indoor environmental metrics – prevents the project design team from proceeding to the next design stage, or construction, until all targets are met. And the process integrates the many facets of indoor environment design to ensure that, for example, good energy performance is not achieved at the expense of comfortable and productive indoor environment for building occupants.

Energy use in buildings

Working group WG 2, *Design of energy-efficient buildings*, forwarded a terminology standard to draft (DIS) stage this month and will now further develop the guideline for energy-efficient design of new buildings currently at committee draft stage. WG 2 is establishing a subsequent work item, minimum energy efficiency requirements for heating, ventilating, and air conditioning equipment. This significant and growing group of standards is intended to build on the important work done worldwide, including the USA on national energy standards mandated by the Energy Policy Act amendments of 1990, and in Europe by the European Performance of Buildings Mandate pursuant to the Kyoto Protocol. For example, buildings in the USA consume one-third of the energy and two-thirds of the electricity produced annually. Thus WG 2 is squarely addressing this significant aspect of buildings' impact on the environment. Recent progress in member countries shows that reductions of one-third in energy intensity are achievable today with readily available technology and without undue capital investment³. Using the WG 1 framework, TC 205 provides standards that allow such achievements whilst still allowing acceptable indoor environment for building occupants, results which are not ensured when energy efficiency alone is pursued in isolation.

There are 22 participating countries and 24 observing countries in ISO/TC 205. The Secretariat is held by the American Society of Heating Refrigeration and Air-Conditioning Engineers, Inc. on behalf of the American National Standards Institute (ANSI). International liaisons are established with the International Commission on Illumination (CIE), the European Insulation Manufacturers Association (EURIMA), and the World Health Organization (WHO), as well as numerous ISO and CEN technical committees. The Chair can be reached at stephen_turner@brown.edu or sturnerpe@cox.net, the Secretary, Mr. Douglas Tucker at dtucker@ashrae.org.

Intelligent buildings

Working group WG 3, *Building control system design*, has published to date three parts of seven planned ISO 16484 series standards on building automation and control systems: ISO 16484-2:2004, *Hardware*, ISO 16484-3:2005, *Functions*, and ISO 16484-5:2003, *Data communication protocol*. Forthcoming are ISO/DIS 16484-1 *Overview and vocabulary*, the new proposal ISO/NP 16484-4 *Applications*, ISO/FDIS 16484-6 *Data communication – Conformance testing*, and ISO/NP 16484-7 *Project implementation*. Together these standards provide an important unified framework for interoperable controls in buildings. Such systems are credited with the ability to deliver 15% savings in energy consumption in buildings, independent of individual component efficiency.

Indoor air quality

Working group WG 4, *Indoor air quality*, has approved its committee draft standard on designing for indoor air quality for registration as a DIS, which is about to be circulated by ISO for comment. This work represents a monumental effort by participating experts to create a meaningful framework to address indoor air quality. By assimilating the leading standards from around the world, this standard will allow universal application whilst respecting a wide range of local practice and societal norms. Recent liaison established



with the World Health Organization (WHO) is intended to assure that this working group addresses the profound implications of indoor air quality on the well-being of building occupants. In conjunction with the general principles process, this document will help building designers ensure that energy and resource efficiency measures do not preclude occupant comfort and productivity.

Thermal environment

Working group WG 5 works in the area of design of the indoor thermal environment. ISO/TC 159, *Ergonomics*, has defined the conditions for thermal comfort. WG 5 seeks to standardize the proper design methods for translating these criteria into building systems. This work takes particular advantage of the interrelatedness of the sub disciplines treated in the various working groups of TC 205.

Future work

Acoustic and visual indoor environment design criteria are under consideration for treatment, with work items being carefully considered in close liaison with ISO/TC 43, *Acoustics*, and the International Commission on Illumination.

As the family of standards developed in ISO/TC 205 grows, the tools available to designers improve. For countries wishing to adopt international standards that build on the extensive available national and regional standards, this growing kit of building environment design standards is a valuable resource, which promotes optimal indoor environments whilst respecting the greater environment. To safeguard a sustainable future, international collaboration is essential. Hence, ISO/TC 205 welcomes increased participation, and encourages countries not yet involved to contact the chair or secretary for more information. ■