"Sustainability and Building Codes"

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Editors' Introduction

Visionary ecological design principles are often confronted by the cold, hard reality of building codes and zoning regulations, which forbid many innovative design practices and materials. Most of these regulatory mechanisms didn't exist a century ago, but have become ever more complex and demanding in recent decades. They help ensure human health, safety, and welfare, to be sure, but also mandate particular modes of building that are now seen as unsustainable. For example, graywater systems (collecting sink or shower water for reuse in toilets or irrigation) and alternative building materials such as straw bale or rammed earth have been prohibited by codes in many locations until recently. Codes also often set minimum room sizes and require unnecessarily expensive construction materials and practices. Meanwhile, zoning regulations frequently require large amounts of parking, large lot sizes, substantial building setbacks from lot lines, and low building heights. All of these requirements constrain what ecological designers can do.

The following piece from the journal *Environmental Building News* (www.buildinggreen.com) addresses building codes specifically, tracing their development and some ways they might be changed to better promote sustainability. David Eisenberg is director of the Development Center for Appropriate Technology (DCAT) in Tucson, Arizona, and a member of the International Conference of Building Officials. His work has ranged from the steel and glass cover for Biosphere 2 to adobe, rammed-earth, and straw-bale structures. Co-author of *The Straw Bale House* (White River Junction, VT: Chelsea Green, 1994; with Athena Swentzell Steen, Bill Steen, and David Bainbridge), he helped write the first load-bearing straw-bale construction code for the City of Tucson and the County of Pima, Arizona, and led DCAT in a collaborative effort called "Building Sustainability into the Codes." Peter Yost is a former editor of *Environmental Building News* and a research associate with the Building Science Corporation, a Boston-based architecture and building science consulting firm. Further information on this subject is available from the Developmental Center for Appropriate Technology in Tuscon, Arizona, at www.dcat.net.

Shallow frost-protected foundation, straw-bale walls, composting toilet, graywater system, rainwater harvesting. . . . An impressive array of green building features! From the foundation to the roof, these are exemplary systems and materials. But there is another commonality to these features: each represents a potential – if not likely – regulatory challenge. It can be frustrating to have the knowledge

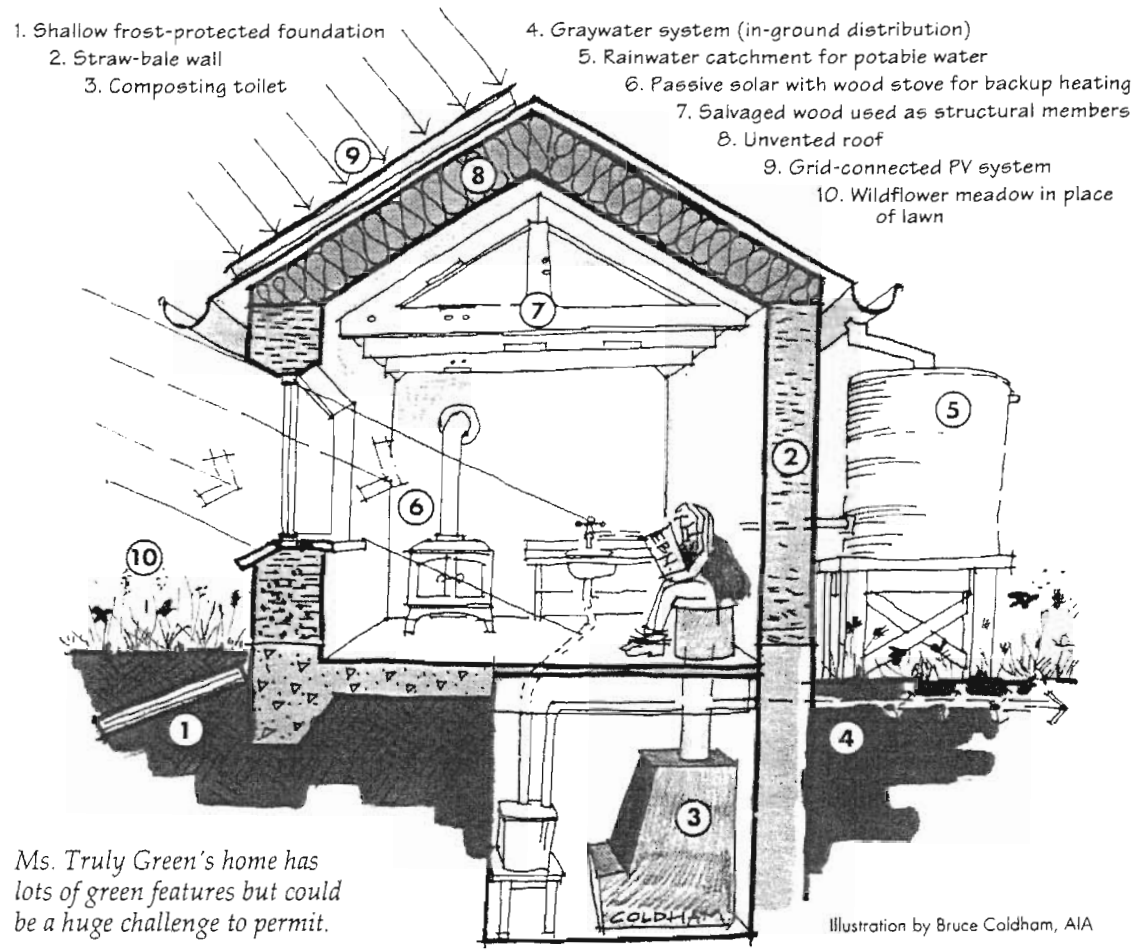

Figure 1. Code obstacles to green design.

and skills required for building green, yet lack the approvals to do it.

This article takes an in-depth look at the inherent but largely unrecognized relationship between sustainability and building codes, and efforts under way to change this relationship. It also presents a process for professionals to use in gaining approvals for alternative designs, systems, and materials within the existing regulatory framework. A sampling of code success stories demonstrates what is possible when this process is employed.

Though it is beyond the scope of this article, the issue of regulatory hurdles with green building is not restricted to buildings and building codes; a new approach is needed as well for the larger issues of land development, zoning, and planning.

A BRIEF HISTORY OF BUILDING CODES

Building codes have long been used by societies to protect individual and general welfare, and to hold practitioners accountable for their work. As long ago as 1750 BC, Hammurabi, the Babylonian king of Mesopotamia, created his famous Code of Laws covering a wide range of public and private matters. Number 229 of this Code states: "If a builder build a house for someone, and does not construct it properly, and the house which he built fall in and kill its owner, then that builder shall be put to death." This type of "performance" code must certainly have had an impact on quality of construction, but it very likely stifled innovation!

There were many intermediate steps on the way to our present codes. In 1189 AD, the city of London adopted regulations for the construction of common walls, rights to light access, drainage, and safe egress in case of fire. Historically, fire has been the most common concern driving interest in building regulations. Early in the Colonial period of the United States, concern about fire resulted in a ban on wood chimneys and thatch roofs. In 1860 the City of New York appointed a Superintendent of Building and provided staff for code enforcement. In 1867, the Tenement House Act was enacted to regulate conditions in existing buildings, covering such things as fire escapes, ventilation, water supply, toilets, and stair railings. In 1905, the National Board of Fire Underwriters, an insurance industry group, wrote the first National Building Code.

This code led to the formation of organizations for building code officials and the next stage of code development in the United States. By 1940, three model code organizations were established: the Building Officials and Code Administrators International, Inc. (BOCA) in the northeastern US, which produced the National Building Code; the International Conference of Building Officials (ICBO) covering the western half of the United States, which produced the Uniform Building Code; and the Southern Building Code Congress International (SBCCI) in the southeastern United States, which published the Standard Building Code. Reflecting regional differences and different code philosophies, the three model codes also embodied variations that have made code compliance difficult for designers, builders, and manufacturers working across different code-enforcement areas.

Efforts to harmonize the three codes, initially through the Council of American Building Officials (CABO) and more recently by its successor, the International Code Council (ICC), have now resulted in the creation of a single national building code – or family of codes. The ICC codes (including the International Building Code, International Residential Code, and "International" versions of the Mechanical, Plumbing, Fire, and Energy Conservation codes) are replacing the BOCA, SBCCI, ICBO, and CABO codes, which are no longer being maintained. Instead, these groups now support and maintain the ICC codes, the first full edition of which was published in 2000. (Recently, the NFPA dealt a blow to this consolidation effort when it split from the ICC process and began developing its own building code to compete with the International family of codes.)

An important new development in the ICC process is creation of the International Performance Code (IPC). This code differs from the other International codes in that it is based on stating what must be accomplished, rather than describing in detail what must be done and how to do it. While the more typical *prescriptive* approach is straightforward and relatively easy to implement for both builder and code official (because everyone knows what must be done), it can also be confining and thus limit innovation.

Though new to the US, the experience of other countries using performance codes has shown that they are viable. The greater flexibility provided by performance requirements is both liberating and problematic. The added freedom comes at a price because the performance approach requires that the proposed designs, materials, or methods be supported by calculation, test results, or other demonstrations of adequate performance. That often means more engineering services, testing, and time – both for designer and plan reviewer. It adds a burden for the building department because building officials must be able to analyze the project rather than just making sure it conforms to common practices with which they are familiar.

BUILDING CODES IN ACTION

One might assume that the creation of a single family of codes would bring about complete consolidation of building codes across the United States, but for several reasons this is not the case. First, unlike in many countries where code adoption takes place at the national level, in the United States it occurs at the local, county, or state level. Codes derive their legal authority from their enactment as laws, ordinances, or statutes. While it appears likely that most US jurisdictions will eventually employ the ICC system, in most cases each jurisdiction makes its own determination of which codes and which versions of those codes it will adopt. Some jurisdictions are still without any building codes.

Complicating the matter further, nearly all jurisdictions reserve – and often exercise – the right to add to or amend the codes they adopt. Local amendments may be in response to conditions such as high winds, wildfires, or earthquakes, and additions often include appendix chapters for traditional or regional building approaches – for example, adobe and rammed-earth in the southwestern United States.

At the other end of the spectrum, state or federal government can, as public policy, pass legislation or develop programs that either directly or indirectly supersede local codes. Two examples are the low-flow toilet requirements included in the 1992 Energy Policy Act[1] and the recent code requirement by the city of Frisco, Texas that all new homes be EPA ENERGY STAR-compliant.[2]

Just as important as the process by which codes are adopted is the process by which building codes are developed, changed, and enforced. Few people are aware that the building code development and code change processes are open to the public. Anyone – a business, interest group, or individual – can propose changes to the codes. On an annual basis, all filed proposals go through the same process – committee review, scheduled hearing, and voting. This process results in many changes to codes every year. Typically, supplements are published annually and then consolidated into a new edition of the code every three years.

At the other end of the process are local building officials who have the authority, granted by provisions in the codes, to approve alternative designs, materials, and methods of construction as long as they are deemed adequate to meet the intent of the building code. All codes have such provisions for dealing with building practices, materials, and systems not specifically addressed in the code. Understanding how to use this process can be of enormous benefit when proposing alternatives to standard practice.

THE CASE FOR INTEGRATING SUSTAINABILITY INTO THE CODES

A key to shifting the building regulatory system towards greater acceptance of more sustainable, alternative approaches is to create a context in which those alternatives can be seen both as positive and as representing a reduction of risk, rather than an increase in risk. That requires developing awareness of the inherent risk in the status quo: what is likely to happen or is already happening if we maintain our current practices. To see the risk requires shifting from the details of the codes to the larger context and intent of the codes – understanding how current practice jeopardizes the public welfare that the regulatory system was established to protect.

Historically, building codes were developed as a reaction to disasters and building failures. They derived their authority from a societal expectation that the public must be protected from these threats. This led to a focus on the protection of people in and around buildings and secondarily on protection of property. Over time, this focus has become ever more detailed and has expanded into nearly every aspect of buildings and their components and systems. It is no surprise that this focus, combined with our slow awakening to the scope and magnitude of the environmental impacts of the building industry, has resulted in a lack of concern for impacts that occur *away* from the actual building site, impacts that are cumulative or difficult to measure (such as climate impacts or the health effects of indoor air quality or toxicity of materials), or that extend into the future.

The idea of addressing such aggregated impacts through codes, though relatively new, has precedents in such areas as sewage systems, building energy codes, and water-efficiency requirements. Building energy codes provide a valuable, though still somewhat controversial, precedent for incorporating into building codes the larger, more distant, and cumulative consequences of buildings. It has been argued that energy-efficiency is not a safety issue and therefore has no place in the building codes. "I thought that [insulation requirements in building codes] was the dumbest idea I'd ever heard and that it had no place in the codes," admitted Bob Fowler in an interview in *Building Standards*. Good arguments were made for minimum insulation requirements for buildings exposed to extreme temperatures as part of the concern for health and safety of the occupants or users of buildings, and thus they were developed. But it took a combination of economic, environmental, health, and even

national security issues to finally propel building energy codes into existence and widespread adoption. "Looking back," reflected Fowler in the same interview, "I see that the energy-efficiency requirements set a very important precedent for our learning to take responsibility for the full range of the consequences of our buildings. We now need to continue that learning process and open our eyes and our minds to the work of creating sustainable buildings."

The larger, ecologically based risks to public welfare must eventually be seen as risks that demand responsibility for protecting public welfare as much as structural integrity, fire safety, or means of egress. The current regulatory system requires a high degree of safety and certainty in each building project, while ignoring the unintended role it plays in encouraging the depletion of natural resources and the demise of the natural systems upon which everyone's health, safety, and survival ultimately depend.

It is not difficult to find evidence to support concerns about the environmental impacts of the built environment:[3]

- Over 40 per cent of the material resources entering the global economy today are related to the building industry.
- Modern buildings use tremendous quantities of energy – in the United States (with less than 5 per cent of the world's population) buildings alone account for a staggering 10 per cent of *global* energy use.

Such statistics are all the more remarkable when one realizes that only about two billion of the world's more than six billion people live and work in resource-consumptive buildings – the sort of buildings described by modern building codes. The rest of the world's people today live in earthen buildings (adobe, rammed- or puddled-earth, cob, wattle-and-daub) or other types of indigenous buildings, shelters made of scavenged materials, or no buildings at all. Yet all over the world modern building methods, with their greater impacts and resource consumption, are replacing traditional – and often far more sustainable – ways of building. It is important not to romanticize indigenous buildings or dismiss the very real problems that are often associated with them (poor earthquake resistance, lack of insulation, etc.), but to recognize the value and viability of simple, low-tech materials and building methods when used wisely. At the same time, modern materials and building systems must be viewed with the same critical eye, acknowledging their real costs and impacts, not just their benefits. With projections of the world's population reaching at least eight or nine billion this century and with the needed development and construction that must accompany such growth, these issues cannot be ignored much longer. . . .

Relationships with leaders in the building codes community are important, but creating similar relationships locally and regionally is required in order to achieve the needed changes. That can only happen through the engagement of the environmental design and building community in a proactive, constructive partnership with their building code officials, based on a very real, mutual interest in creating safe buildings. Then the definition of public health, safety, and welfare related to buildings can be expanded to include this larger set of responsibilities. . . .

The environmental design and construction community must become actively engaged in writing code change proposals and encouraging funding, research, and testing to support those changes. Additionally, standards-development activities, such as those in ASTM and ASHRAE, often result in requirements less than satisfactory in terms of the environment. The green building community needs to share their direct experience in contending with the realities of those standards by participating more fully in the standards-development process.

It is also time for the environmental design and construction community to seek representation on relevant building code development committees. The ICC code development process is now opening up representation on their committees to the public and industry. Organizations such as The American Institute of Architects Committee on the Environment (AIA-COTE), US Green Building Council (USGBC), Sustainable Building Industry Council (SBIC), Energy and Environmental Building Association (EEBA), and New Buildings Institute need to come together and focus on how to gain such representation. Other interest groups are well organized and funded to represent their interests;

the green building community needs to take responsibility for bringing about changes, rather than simply lamenting the status quo.

Finally, local green building programs provide an ideal forum for education and exchange about alternative designs, materials, and methods and the building codes. Local code officials could be brought into these programs to share their existing skills and experience as well as for their education and enlightenment. Everyone would benefit from such an exchange.

NOTES

1 See *Environmental Building News*, 2(1).
2 See *Environmental Building News*, 10(6).
3 See *Environmental Building News* feature, 10(5).