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Building Safety JOURNAL

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ICC INTERNATIONAL CODE COUNCIL®

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Departments

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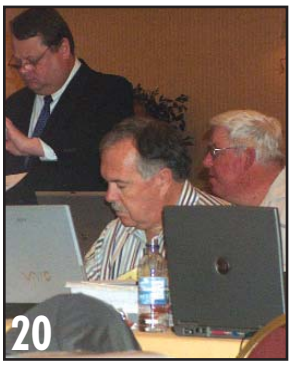
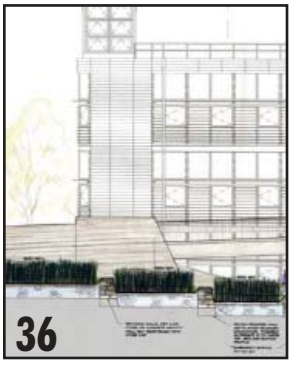
Features





Sustainability in the Twenty-First Century

With limited supplies of many traditional building materials and the increasing concern for preserving the Earth's delicate ecological balance, there is much to be said for the unique solutions offered by alternative materials and methods of construction. Environmental and economic concerns have caused wealthy, highly industrialized nations to begin taking lessons from successful building techniques employed by developing countries and past generations.

BY FRANK P. HODGE, JR.

Sustainable materials and methods of construction offer a variety of creative and practical alternatives to conventional methods of building, and *Building Safety Journal* tries to consistently present them in such a way that they will be seen by the general public as rational options.

In this issue you will find a progress report on new developments in green building certification programs from ICC staff architect Allan Bilka. In addition, you will find a series of articles profiling building departments that have developed and implemented green building programs.

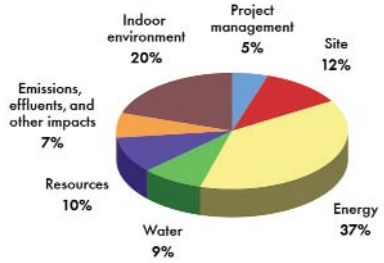
The growing public consciousness regarding the use of natural resources will pave the path for sustainable living in the new millennium. By meeting the needs of communities today without destroying resources that will be needed by future generations, we are ensuring the longevity of our built environment through long-range planning and respect for the planet we all share.

Frank P. Hodge, Jr.

2005 GREEN BUILDING UPDATE

by ICC Senior Staff Architect Allan Bilka, RA

Distribution of points in Green Globes.



The National Association of Home Builders (NAHB) held its annual Green Building Conference March 13–15 in Atlanta, Georgia. The ICC Industry Advisory Committee met in tandem with NAHB's conference to discuss green building programs and their relationships to the *International Codes*®.

In general, green building can be characterized as building with a conscious effort to minimize negative impacts and encourage positive impacts on both the indoor and outdoor environments. The number of green buildings being constructed in the U.S. has increased exponentially over the past several years. As a result, more and more green building programs are appearing in jurisdictions around the nation. The majority of these are voluntary, but an increasing number of jurisdictions are adopting mandatory green building programs. Although most of the latter only apply to government buildings, some mandate compliance for residential and commercial structures.

Many jurisdictions and designers look to the U.S. Green Building Council (USGBC) Leadership in Energy and Environmental Design (LEED) program to assess and certify green commercial structures. The USGBC rates buildings using a system that awards points for each environmentally friendly concept utilized. Although the LEED for New Construction and Major Renovation (LEED-NC) program is the most widely utilized green building rating system in the U.S. for commercial buildings and has proven effective, LEED evaluation can also be time-consuming and costly for some projects.

One alternative is Green Globes: a green building rating system which can be self-administered by a commercial designer or builder. Green Globes has been utilized primarily in Canada; however, the Green Building Initiative recently acquired the rights to Green Globes and is actively promoting the program in the U.S. with the support of NAHB. It is important to note that Green Globes is not intended to be utilized with mandatory green building programs. Other prominent green building programs include the U.K.'s Building Research Establishment Environmental Assessment Method and the International Initiative for a Sustainable Built Environment's Green Building Challenge.

On the residential front, as green building has gained more and more attention from the general public it has become a valuable marketing tool for home builders. One result is the recent publication of NAHB's *Green Home Building Guidelines*, which ICC contributed to as an invited member of the development program's stakeholder group. Seminars regarding the use and implementation of these guidelines were presented at the Green Building Conference. Like the LEED-NC program for commercial buildings, a point system is utilized to evaluate performance. Unlike USGBC, NAHB does not intend to have a system or staff in place to assess compliance with its residential guidelines. Instead, the program is to be self-administered or administered through local home builders associations (NAHB is not encouraging adoption or enforcement by local jurisdictions).

Meanwhile, some local jurisdictions have developed their own residential green building programs and the USGBC is at work on its own green building rating system for residential construction. According to LEED for Homes Program Manager James Hackler, the system will be much more user-friendly and streamlined as compared to LEED-NC, and the USGBC does not intend to check or certify plans for LEED for Homes compliance.

From a codes perspective, it is interesting to note that the mimimum standards set by most green building programs and rating systems are tied to the I-Codes®. For example, green buildings are typically required to fully comply with the energy code adopted by a jurisdiction—which can itself be a major step forward environmentally.

The ICC Industry Advisory Committee is currently studying the subject of green building on behalf of ICC members and stakeholders, and will present its recommendations to the ICC Board of Directors. ◆

The 80,000 square-foot Integrated Learning Centre at Queen's University in Kingston, Ontario, received a four-leaf rating through the Green Leaf program, which is now accessible online as Green Globes. Designed by B+H Architects of Toronto, the project was completed in 2004. The Ottawa-based firm Green & Gold, Inc., implemented the Green Leaf program and helped integrate the building analysis tool into the design process. The lighting, ventilation and water distribution systems, in particular, contributed to the building's high rating.

LEADING THE WAY:
BUILDING DEPARTMENTS AS COMMUNITY RESOURCES FOR BETTER BUILDING PRACTICES

by David Eisenberg, Director, Development Center for Appropriate Technology

Times are changing and many old stereotypes simply don't hold true anymore. In communities large and small across the country, it's becoming ever more common to find design professionals, builders, subcontractors, developers and building owners who are committed to environmental and social responsibility working together with their local planning and building departments.

This article spotlights two very different jurisdictions—Seattle, Washington, and Aspen, Colorado—that have demonstrated leadership in bringing their building and planning departments into real partnerships with the most forward-looking elements of their communities. Rather than just presenting the details of their different programs, I wish to impart an understanding of how such leadership emerges and what lessons are being learned that can be of use in similar efforts to create healthier, stronger, safer and more sustainable communities. This is important because although this leadership is often demonstrated first by elected officials, success in identifying and meeting specific objectives necessarily depends on commensurate leadership within planning and building departments.

Because the jurisdictions highlighted may seem to have more resources than many others, there may be a tendency to dismiss their accomplishments, thinking "Sure, you could do that in Seattle or Aspen, but not here." Keep in mind, however, that the funding and staff needed to implement their various programs and initiatives became available through civic, political and administrative leadership by choice, not chance. In both jurisdictions, leaders within the local planning and building departments—with committed support from both the public and private sectors—took the ball and ran with it. Also keep in mind that it invariably takes more time and money to do pioneering work, so the lessons learned from their examples may be of substantial help in compensating for limited resources within your own community.

The diversity of interests that have come together to make these programs work is inspirational, and perhaps the first and most important lesson to learn from each example is the "can-do" attitude that continues to drive this country's greatest achievements. With respect to the departments and personnel involved, this constitutes neither an abandonment of basic responsibilities nor an expansion of regulatory authority. Instead, it demonstrates a deeper and more mature understanding of what is truly required to safeguard public health, safety and welfare for current and future generations: looking beyond the limits of just keeping bad things from happening by enabling good things to happen.

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City of Seattle, Washington, Department of Planning and Development

Green building isn't new to Seattle. The Pacific Northwest region has undergone a long process of making tangible connections between development and building practices and the health of the natural environment, including watersheds and salmon populations. Those connections led to a high level of awareness and activism in local and regional politics. Organizations like Sustainable Seattle and other efforts to create and monitor sustainability indicators for the region gave rise to action plans and goals that gained community support, eventually translating into a strong commitment in local government for environmentally responsible building and development.

In 2000, as an outgrowth of its 1998 Sustainable Building Action Plan, Seattle became the first U.S. city to adopt a sustainable building policy, requiring municipal building projects over 5,000 square feet in area to achieve a Silver rating using the U.S. Green Building Council (USGBC) Leadership in Energy and Environmental Design (LEED) green building rating system. The adoption of this policy set in motion significant changes both internally and externally. The decision to merge the city's planning and building departments continues this process.

According to Seattle Department of Planning and Development (DPD) Director Diane Sugimura, "That consolidation brought into view critical relationships between the city's goals for sustainability and issues of building and development connected to the Growth Management Act; the Comprehensive Plan; water, energy and infrastructure; and the whole concept of concentrating people in thriving urban centers where they are no longer dependent on cars. As a planner for many years before coming over to the building regulatory department for the past decade, it's clear that having these departments together lets us develop more effective and integrated solutions. I find this pretty exciting."

"Seattle is fortunate to have a number of developers, designers, engineers and property owners who are totally committed to urban sustainability," Sugimura adds. "These are the leaders we work with in the field, the ones we depend on to do great sustainable private development. Without them it would be hard, if not impossible, to get the masses to follow suit. Early on they were willing to make LEED work, and they're working with us to look beyond LEED—that is beyond the individual building—to include the whole site and the right-of-way adjacent to the property, and even the neighborhood or district. We need to think more broadly than building-by-building. This is a way of life."

One of the catalysts for driving commitment to the city's sustainability goals all the way down to frontline staff was hiring Lynne Barker as DPD's Sustainable Development Planner. Having a full-time, highly knowledgeable green

building advocate within the department provided the capacity to support a transition in thinking, attitudes and day-to-day practice.

"The commitment to these larger goals didn't permeate the department until Lynne came on board," observes Sugimura. "Lynne started talking about green building and LEED, encouraged people to take workshops, and now the city has 22 LEED-accredited staff members, 12 of whom are at DPD, ranging from planners to plan reviewers to inspectors."

Seattle Public Utilities Sustainable Design and Construction Specialist Lucia Athens, chair of the city's Green Building Team, attributes the success of the city's efforts to the following. "Leadership from the top: vision, passion, inspiration, direction and clarity. Leadership from the bottom, the ranks, the staff level: hard work, openness, passion, vision, willingness to think about old things in new ways. Elected officials with a background or awareness of development and architecture issues. A building community that is willing to try new things. Communication—talking within the building department and with the building community about what works, what doesn't, what gaps exist. Awareness that we hold in our hands the possibility to create a new future if we work together."

The Green Building Team is working on a proposal to create greater coordination across all departments. Rather than working somewhat by themselves, the plan is to have part of the Green Building Team working in the Office of Sustainability and Environment on city projects while the rest would be in DPD helping private developers. This greater cross-disciplinary coordination will lead to stronger teamwork and better support for all green projects in the jurisdiction.

Seattle's multipronged approach for change includes both internal and external educational programs and partnerships. The Urban Sustainability Forum speaker series

created by DPD has been extraordinarily successful, with the first speakers drawing audiences of around 300 and a recent forum featuring Svend Auken—the former Danish Minister for Energy and Environment and member of the Danish Parliament largely responsible for the policies that made Denmark the world leader in renewable energy—welcoming a whopping 900 attendees. It wasn't only the public who were motivated by what they heard. Sugimura reports that following Auken's talk she had several e-mail messages from staff members suggesting how they could implement similar programs at DPD. This is an example of how Seattle seeks world-class examples of what works and then explores how to appropriately adapt them for local use.

Internally, continuing education for staff is key. Taking advantage of the proximity of USGBC's 2005 International Greenbuild Conference and Expo—which drew 8,000 attendees to Portland, Oregon, in November—DPD sent 11 staffers to learn as much as they could from the educational programs offered. Among them was DPD Senior Civil Engineer Rick Johnson, the project manager for developing a stormwater code for projects within Seattle.

An enthusiastic supporter of the city's sustainability goals, Johnson has been involved in researching and implementing low-impact development guidelines and best management practices for roadways, parking lots and stormwater management. This led to his interest in green roofs, pervious pavement, alternative strategies to deal with nonpoint source pollution from roadways, runoff from construction sites, impacts on salmon habitat, and the health of watersheds and the Puget Sound.

"Codes are an integral part of the solution that people often overlook," he points out. "Change can be slow, but we're steadily moving in the right direction. A big piece of that now is that builders and developers are starting to see that it's economical to do these things, and that's when things really start to change."

Another DPD staffer who attended the 2005 Greenbuild Conference was Senior Building Inspector Warren Parker. He found the conference especially useful in learning not just about new materials and systems and how to build greener buildings, but also how to properly deconstruct existing buildings to better salvage and reuse or recycle the materials in them.

"It's great to see a lot of materials being diverted from the landfill," says Parker. "Now there are places that sell salvaged materials in Seattle and we can tell people where to find them. We're also seeing a lot of water harvesting and storage for irrigation and many other good ideas."

Like many of his colleagues in the department, Parker has had a lifelong interest in preserving the natural environment so green building goals make sense to him. The increasing number of builders adopting green concepts is also making his job easier. "Those jobsites tend to be much better organized and well run. They're more efficient and there are fewer problems. Not only do these people tend to build a better product, the more conscientious mindset definitely makes it easier to inspect their projects."

In the end, according to Parker, it all comes down to quality of life. "These end up being better, more economical, healthier buildings for their occupants. With the tight construction that we're seeing, you can now have a heat recovery ventilation system installed that gives you the right amount of filtered outside air required by code with energy efficiency that gives a payback of five years or less."

Parker acknowledges that not everyone has bought into the program but believes that awareness is growing. His advice to other building officials? "Try to have an open mind. Sometimes it seems like it might take a little extra time to learn about some of this stuff but it's well worth it. So skip that latte and read something about green building!"

A green roof installed atop Seattle's City Hall in 2003 significantly lowers heat generation and serves as an important component of a rainwater harvesteing system that reduces the burden on the municipial water supply and wastewater systems.

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City of Aspen/Pitkin County, Colorado, Building Department

A typical home in this country requires about one acre of forest to build and generates roughly 4 pounds of waste per square foot. Manufacturing the cement for the 55 yards of concrete in the foundation generates over 20,000 pounds of CO_2 emissions. In 1990, American households consumed $110 billion worth of energy alone. Buildings consume vast amounts of our resources and threaten the ecological systems that support life, from the ozone layer to the world's forests. Changing the way we build has become imperative. Environmental efficiency will no longer be an option in our future.

That is the opening paragraph of the 45-page City of Aspen/Pitkin County Efficient Building (APEB) Program Resource Guide. Unlike most other such programs the APEB is not optional, and the *Aspen/Pitkin Energy Conservation Code* differs from most energy codes in that it applies to more than the building itself. Rather, the code—which has been enforced since 1996—establishes a point-based energy "budget" that applies to the building envelope, space conditioning systems, water heating systems, snowmelt systems, and private pool and spa heating systems of all new or remodeled buildings.

For homeowners wishing to build homes that consume more energy than the budget allows because of building size or the existence of a pool or a snowmelt system, there is the option of installing an onsite renewable energy system or paying a renewable energy mitigation fee. Fees collected go into the jurisdiction's Renewable Energy Mitigation Program (REMP), the first of its kind in the world. The REMP funds are dedicated to energy efficiency and renewable energy projects for public benefit in the Roaring Fork Valley. The program has generated almost $3 million since its launch in 2000 and a wide variety of creative and effective projects have resulted, all of which are designed to offset greenhouse gas emissions and reduce air pollution. For example, it is estimated that REMP-funded projects will keep 42 million pounds of greenhouse gases out of the atmosphere over the next decade.

How did these policies come into existence and find support both within and outside local government? Now that they have been in place for a while, are they receiving community support and are they achieving their goals? What are the factors that enable such innovative leadership to develop?

To begin with, Aspen isn't an average city. The combination of the spectacular beauty of the region, the community's connection—economically and in spirit—to the natural environment, and the wealth of many of the residents brought about an unusual coalition of interests. Although not universal, the high level of environmental awareness and commitment has enabled the city to accomplish things few others would even attempt.

Mayor Helen Klanderud sees these programs as consistent with maintaining what Aspen residents care about. "We're committed to excellence and place a high value on a healthy environment. It's essential to why people love to come here. We're willing to be responsible for doing the right thing locally to preserve it."

Aspen City Council member Tim Semrau is also a designer/builder, giving him the ability to view the range of related issues from both private and public-sector viewpoints. "The key to getting the private sector behind public sector 'feel good' initiatives is to leave room for the creativity of capitalistic 'doers,'" he says. "The green program in Aspen provides an extensive menu of options and lets builders decide what best fits their projects. Since they're not forced to follow bureaucratic methodology per se, they're much more inclined to apply their creativity to making the program work rather than fighting its adoption. In other words, if the public sector can mandate goals and not methods, the private sector adapts very quickly to reach those goals."

Chief Building Official Stephen Kanipe plays an active role in the administration and enforcement of Aspen's sustainable building programs. "We've used 'tough love' with those who were reluctant to go along with these programs at the start, and we've been able to bring just about everyone on board with these goals," he explains. "We worked with them to demonstrate that 80 percent of the designs they were already submitting would meet the efficient building code requirements, and that if they started with these goals in place at the beginning of the design process they could accomplish this with little or no additional cost and have a much better, more durable and efficient house to sell."

It is no surprise that Kanipe, who also serves as Chairman of the ICC Energy Conservation Code Committee, is among the many who see ongoing dividends to the community.

"The biggest benefit is education. The designers and contractors have to learn about things they never considered before. We provide them with a lot of information and help, and

(continued on page 32)

Aspen/Pitkin Renewable Energy Mitigation Program

In 2000, The City of Aspen and Pitkin County, Colorado, launched the Renewable Energy Mitigation Program (REMP). Designed to promote renewable energy and energy efficiency, REMP is the first program of its kind in the world. By requiring new homes to mitigate their environmental impacts, REMP has raised close to $3 million for energy efficiency and renewable energy projects.

The *Aspen/Pritiken Energy Conservation Code* requires new homes to meet a strict energy "budget." Homeowners who wish to consume additional energy to snowmelt a driveway or heat a pool can either install a renewable energy system or pay a renewable energy mitigation fee. The fees are justified because a heated driveway, for example, can use as much energy as a typical house.

The fees collected are dedicated to energy efficiency and renewable energy projects in the Roaring Fork Valley. Funding proposals are developed and reviewed by the Community Office for Resource Efficiency—a nonprofit organization that promotes renewable energy and energy efficiency in western Colorado—then approved by the Pitkin County Commissioners and Aspen City Council. REMP-funded projects include the following.

- **ARC Pool and Ice Rink.** Aspen's newest pool and rink facility includes efficient boilers, pumps and motors, and will also use a microturbine to generate electricity and a solar hot water system.
- **Affordable Housing.** REMP funds are supporting solar hot water systems at two local affordable housing developments.
- **Wagner Park Facilities.** A contemporary glass laminate solar electric system was installed at Wagner Park.
- **Wind Power.** The REMP fund purchases two million kilowatt-hours of wind energy each year.
- **Aspen High School.** The new Aspen High School incorporates daylighting features designed with REMP support.
- **Ruedi Creek Hydro.** REMP provided an incentive or this grid-tied hydro system that produces 140,000 kilowatt-hours per year, eliminating 280,000 pounds of greenhouse gases.
- **Green Design.** REMP funds are used to incorporate sustainable design principles into public buildings. They were also used to underwrite development of the Aspen and Pitkin County Efficient Building Program.
- **Solar Incentives.** REMP supports a zero-interest loan program for solar installations.
- **Washer Rebates.** Residents are offered $100 incentives for purchasing energy- and water-saving clothes washers.
- **Efficient Lighting.** The REMP program helps retrofit lights in area buildings. A project to retrofit the Aspen Skiing Company's Little Nell garage will eliminate 5 million pounds of greenhouse gases.

In addition, grants are available to nonprofit groups and schools working on energy and environmental issues. For example, REMP recently helped Basalt Elementary School students preserve 50 acres of Brazilian rainforest. Other recipients have included the Science Outreach Center, Yampa Mountain High School, Solar Energy International and the winning 2002 Colorado University at Boulder Solar Decathlon team. ◆

they learn that these things just make sense. It's good business and better building, and there is virtually no push-back anymore."

General contractor Red Rienks, who builds light commercial and custom home projects, has nothing but praise for the Aspen/Pitkin Building Department and its programs. "Sure, we were all concerned at the start that this would be too burdensome and cost us money," he recalls, "but once we started doing it we found it made good sense. Our owners are now more conscious of the costs and impacts of inefficient systems and they want these better homes. The building department staff is very helpful and although the codes are strict, they're very flexible and the staff problem-solves with us. The inspectors are very knowledgeable. It's great."

Local contractor Pat Fenton, who has built everything from a 13-unit affordable housing project to extremely large custom homes in the area as well as two demonstration Next Generation affordable research houses in conjunction with the U.S. Department of Energy's Building America program, has had similar experiences. "With most of these homeowners building these large expensive homes, there is no opposition at all. Once we educate our clients and they understand what is required and why, they're happy to comply. The fact that we've been able to build highly energy-efficient affordable housing dispels the idea that this costs too much. Lower utility bills are a big part of affordability. It's working extremely well."

As in Seattle, Aspen's commitment to a solid process and an adequate transition period were essential to the success of its efficient building and energy mitigation programs. So were partnerships with external organizations able to provide needed technical expertise, resources and educational support to designers, builders, developers and building owners. For example, the Community Office for Resource Efficiency (CORE), a nonprofit organization promoting energy efficiency and renewable energy, worked closely with Kanipe and other city staff to establish both the *Aspen/Pitkin Energy Conservation Code* and REMP, which in turn eventually provided a grant to the city to help support the development of the APEB.

"I think REMP is an early demonstration of what will become common in the coming decades when, out of necessity, buildings will be required to not just be energy efficient, but to harvest sunlight and rainwater and generate power—much more than just provide shelter," says CORE Director Randy Udall. "It's time we take the hundred million buildings in this country off life-support and have them start making it on their own." Udall attributes much of the success of Aspen's efforts to date to Chief Building Official Kanipe. "These programs would not have come into being without Stephen's thoughtfulness, knowledge and deep commitment to doing the right thing locally in a global context, providing real leadership from within the building department." ◆

David Eisenberg *is the Director of the nonprofit Development Center for Appropriate Technology; serves on the City of Tucson/Pima County, Arizona, Joint Building Code Committee; and is a member of the Board of Directors of the U.S. Green Building Council, for which he chairs the Greening the Codes Committee. He can be contacted by phone at (520) 624-6628 or via e-mail at* strawnet@aol.com. *For more information about DCAT, visit* www.dcat.net.

Resources

General

U.S. Department of Energy Building America Program: *www.eere.energy.gov/buildings/building_america*

U.S. Green Building Council: *www.usgbc.org*

U.S. Green Building Council Leadership in Energy and Environmental Design Program: *www.usgbc.org/LEED*

City of Seattle

City of Seattle homepage: *www.seattle.gov*

City of Seattle Department of Planning and Development: *www.ci.seattle.wa.us/dpd*

City of Seattle Sustainable Building Program: *www.seattle.gov/dpd/Sustainable_Building/index.asp*

City of Seattle Green Building Team: *www.seattle.gov/sustainablebuilding/greenteam.htm*

City of Seattle Sustainable Building Policy: *www.seattle.gov/sustainablebuilding/policy.htm*

City of Aspen/Pitkin County

City of Aspen/Pitkin County homepage: *www.aspenpitkin.com/*

Links to City of Aspen/Pitkin County Efficient Building Program Resource Guide and *City of Aspen/Pitkin County Energy Conservation Code: www.aspenpitkin.com/depts/41/bldg_efficient.cfm*

Community Office for Resource Efficiency: *www.aspencore.org/index.htm*

City of Aspen/Pitkin County Renewable Energy Mitigation Program: *www.aspencore.org/NEW_FORMAT/REMP_new_format.htm*

Evolving Codes in Chicago

by Kelly Jon Andereck, LEED AP

Beginning in 2000, efforts were initiated to transform building codes and regulations in the Midwest's largest city. The following year, the *Chicago Energy Conservation Code* began being used to tear down previous code barriers and rebuild with "green" practices.

"In 2004 Mayor Richard M. Daley created a policy requiring all new city buildings to meet the Chicago standard, which includes achieving LEED certification," says Assistant to the Mayor for Green Initiatives Sadhu Johnston. "In leading by example, Chicago aims to build expertise in Chicago's construction industry as well as demonstrate the costs and benefits of green building. We're now developing strategies to further encourage the private sector to join us in building green in Chicago."

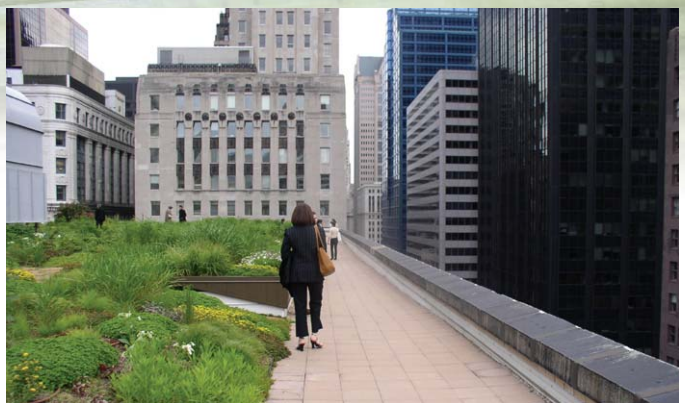
The process actually started in December 2003 with a full-day workshop on sustainable building processes attended by approximately 60 members of the Chicago-area design and building community. Led by Johnston and Development Center for Appropriate Technology Director David Eisenberg, the workshop specifically focused on identifying barriers to green design technologies and strategies. The U.S. Green Building Council's LEED rating system categories were used as a basic framework to group and identify these barriers and assist in ascertaining conflicts between recognized green building practices and Chicago's codes. For example, the existing codes prohibited the use of waterless urinals and gray water reuse for such purposes as toilet flushing or irrigation.

The information gathered at the workshop was evaluated and prioritized, and barriers were associated to actual code sections and citations. This extensive procedure led to a number of recommendations for changing the codes. Review by various city departments is ongoing, with completion expected in the near future.

The city is expected to provide additional programs to support green building and create building community motivation. According to Department of Construction and Permits First Deputy Commissioner Chris Bushel, "The City of Chicago is looking to provide tangible incentives to building green." For example, the department is looking at a permitting option that would include an alternative green building code and fast-track permitting.

"The new code efforts won't require that you adopt green strategies," explains Department of Construction and Permits Green Projects Administrator Erik Olsen, "but there will be incentives to do so."

Because energy efficient building envelopes, mechanical systems and lighting; daylighting; and other conservation measures can reduce annual electrical usage by 30 percent or more, reducing energy consumption is often an advantageous capital investment for building owners. Combine this economic incentive with expedited permitting and easier approval of effective alternative designs and there are a plethora of opportunities in Chicago. Clearly, the city—already widely known for its architecture—is now laying the foundation for a future of high-performance, environmentally responsible buildings. ◆



The Chicago City Hall Green Roof Project, which was completed in 2001, serves to facilitate research and educational outreach within the context of a midwestern climate.

The Chicago Center for Green Technology is the only LEED Platinum municipal building in the country and the first renovated building to be designated Platinum.

***Kelly Jon Andereck, LEED AP**, has over 20 years of experience in environmental leadership and is a Principal of A Design Consulting, a full-service energy and environmental design firm committed to providing the development and design communities with specialized technical analysis, marketing, design assistance, financial strategy, environmental benchmarking and documentation.*

Scottsdale's Progress in Integrating Green Building into the Building Regulatory Process

by Anthony Floyd, AIA

In 1998, the City of Scottsdale, Arizona, established a voluntary Green Building Program to encourage environmentally responsible home building in the context of the Sonoran Desert. Incentives include pre-review project qualification, expedited plan review, jobsite signage and architect/builder participation listing on the city's web site.

By the fall of 2002, Scottsdale began reviewing and inspecting projects for conformance to the city's Green Building Program criteria. In the fall of 2003, Scottsdale adopted the 2003 *International Building Code*® (IBC®), *International Residential Code*® and *International Energy Conservation Code*® with amendments to create consistency with its green building energy provisions. Since then, what was once only a part of the green building criteria has become required for all projects.

Following are some of the continuing challenges Scottsdale faces with the integration of green building into the city's building regulatory process.

Staff Green Building Specialist

The intended effects of any prescriptive approach can be compromised if careful consideration is not given to the whole: one component can either positively or negatively affect another. Prescriptive energy codes, for example, provide an easy method to account for the pieces but do a poor job in accounting for the integrated performance of the whole. Performance-based standards are a superior approach but require more thorough analysis on the parts of both designers and building department staff (fortunately, an increasing number of software tools are becoming available to simplify this task). In addition, maintaining a proactive attitude toward the acceptance of alternative building materials and methods requires a thorough understanding of the intents of the building code and green building guidelines in order to minimize conflicts. As such, having a green building and/or energy specialist on staff would be of significant value to the city.

Inspections

Green building and energy code training is a continual process and should be done more regularly as part of the inspectors' weekly meetings. In addition, we have found that having at least one inspector with prior green building knowledge and experience contributes to the education of the others as a result of their daily interactions. In terms of testing and submittals (i.e., energy performance, recycled content, volatile organic compounds), a qualified third-party inspector or special inspection certification will be considered as an alternative to city inspection.

Scottsdale's green building inspections have been integrated into its existing inspection request process—builders must call designated inspection request numbers for their green building inspections. There are currently 14 categories of green building inspections along with 26 mandatory items (prerequisites). Besides the mandatory items, the total number of required green building inspections depends on the rating level approved during plan review. We will continue to refine this process by looking to reduce the number of designated green building inspections.

National Versus Local Standards

A locally derived green building rating checklist is sensitive to regional environmental conditions and related issues, but keeping such checklists relevant, accurate and up-to-date requires significant time and professional resources. Along with being able to draw from a much larger pool of expertise, research and experience, a green building rating checklist developed and maintained by a national body facilitates consistency, measurability and compatibility, but is not always in tune with regional environmental conditions.

With the recent release of the National Association of Home Builders *Green Home Building Guidelines*, the development by the U.S. Green Building Council (USGBC) of a LEED for Homes rating system and other national efforts, there will soon be a much greater range

of options for local jurisdictions to evaluate with respect to residential construction. Scottsdale's program will continue to grow, learn and adapt to both local conditions and evolving national green building models and standards. Our residential green building checklist is currently in the process of being reviewed and updated by the Scottsdale Green Building Advisory Committee, which serves under the City Council-appointed Environmental Quality Advisory Board.

Adoption of Green Building Standard for City Facilities

On March 22, the Scottsdale City Council passed a resolution requiring all new, occupied (as defined by the IBC) city buildings to be designed, contracted and built to achieve the LEED Gold certification. This action makes Scottsdale the first city in the nation to adopt a LEED Gold policy and will serve as a model for the regional development community. There will be an emphasis on water efficiency and renewable energy in response to the context of Scottsdale's Sonoran Desert environment. USGBC will serve as the certification agency with support material provided by the project design professionals and third-party inspectors.

The new Scottsdale Senior Center will be the city's first LEED Gold project, with at least three more projects coming on-line over the next year. The greatest challenges foreseen will be coordination and collaboration within the city capital project and facility operation/maintenance process. Training has begun and will continue in the years ahead. The ultimate goal is to institutionalize green building within the culture and operation of the city. ◆

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STORMWATER AND WASTEWATER TREATMENT AND REUSE

by Michael Ogden, P.E.

The significant problems we face cannot be solved at the same level of thinking we were at when we created them.—Albert Einstein

Most people would not object to using rainwater or treated wastewater to flush toilets or treated effluent for irrigation. Yet actually putting these water-conserving practices into effect often proves extremely difficult. Why is this so?

We typically look to science for solutions to major economic and social problems. However, because technology rests on complicated, interlocking systems of supply, materials and subsidiary technologies, rapid changes of course are difficult to accommodate. This is a major factor, for example, in the evolutionary character of the development of standard engineering practices. What is considered acceptable today is based on things that were found to have worked in the past. The problem is that, like our predecessors, we seldom consider the unintended consequences of these practices.

The job of engineers is to solve specific problems such as increasing the water supply or improving the water quality of sewer plant discharges, but the resulting solutions are generally crafted without looking at the entire context of the problem. Sustainable solutions require that issues such as wastewater or stormwater reuse be dealt with as part of a whole system including economics, sociology, technology, materials, energy and ecology. Most engineers do not have the expertise or time to deal with this range of issues. The result is solutions that frequently create problems beyond the immediate scope of concern.

Stormwater Management

Most stormwater systems in the eastern U.S. are connected to the wastewater sewer system. Rain, melting snow and ice drain into the sewer system. Nonpervious surfaces such as pavement and roofs dramatically increase the flow of water—peak stormwater flows may increase the discharge by a factor of 6 compared to farmland or woodland run-off. Because of this, it is not unusual for a storm event to overwhelm a wastewater treatment plant's flow capacity. When this occurs, mixed stormwater and wastewater bypass the treatment system and untreated sewage is sent to rivers, lakes and the ocean.

Primarily because they are newer, western cities usually have separate sewer and stormwater systems. Due to the enormous cost of updating their infrastructures to handle the run-off from a typical storm event, older cities like Portland and Seattle began to manage the on-lot stormwater while some communities in Southern California and California's Central Valley, such as Fresno, have been using it to recharge the aquifers which supply their drinking water.

Looking at the possibilities for stormwater reuse, some solutions are obvious: collect the water from roofs and reuse it outside for irrigation and inside for flushing toilets and urinals, follow Fresno's example and divert stormwater into recharge basins for subsequent withdrawal, or capture rainwater in water gardens as landscape features. In the West, water shortages have prompted some cities to require the installation of cisterns for the capture and reuse of rainwater. Obvious uses include supplemental irrigation and as a water supply for flushing toilets. East or West, every gallon of water collected on a building roof and used to flush toilets is one less gallon required from the municipal water supply system and one less gallon that runs off into city streets and storm drains.

While there is no question that reuse offers significant

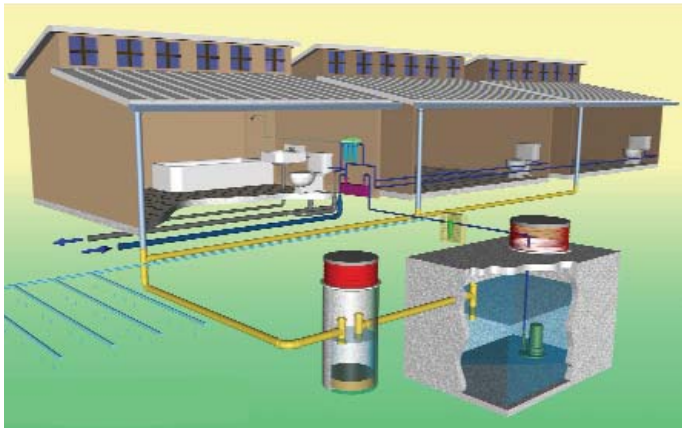


Illustration of a rainwater reuse system.

potential savings, potable water use, wastewater discharge and stormwater run-off reductions are dependent on the ratio of collection area to the number of building occupants. A total rainwater collection, treatment and reuse system for a typical office in the eastern U.S. requires about 30 square feet of roof collection area for each occupant. Therefore, up to the limitations dictated by the number of stories, each 30 square feet of roof area represents a substantial potential reduction of the potable water use, wastewater discharge and stormwater run-off for each building occupant.

Wastewater Management

Activated sludge, the primary technology used for wastewater treatment, was developed in the 1920s. Combined with membrane technology, it is capable of producing high quality water. Carbon in the wastewater (primarily cellular materials) is settled out as sludge for subsequent treatment. However, this approach is a costly solution that in the larger perspective does not make sense. It requires so much energy to run the necessary pumps and aeration devices that for every pound of carbon removed from the wastewater, we put 4 pounds of carbon into the atmosphere.

The treated effluent is generally discharged into waterways. Many are the source of drinking water for downstream users. Thus, for example, by the time the Ohio River reaches Cairo, Illinois, the water has been in and out of water and wastewater treatment plants eight times. Because of all of the chemicals that end up in wastewater, legitimate concerns have been raised about our current treatment practices. The U.S. Environmental Protection Agency has suggested some alternatives, including low energy passive technologies using natural systems. The extended treatment cycle of such systems (days instead of hours) is particularly effective in treating antibiotics and pharmaceuticals. Other obvious solutions include reusing wastewater for irrigation to supply water closets and urinals and in cooling towers.

Reuse of treated effluent provides some relief to downstream users. Applying it to the landscape allows plants and soil microorganisms to provide additional treatment, and using it to flush toilets can reduce consumptive use of water in the home by 24 percent and in offices by 70 percent. Reuse is easier to accomplish in new communities because decentralized wastewater treatment systems can be designed and built to allow passive treatment technologies, water reuse and sludge management techniques including composting with green waste from the community. Educating the public about the importance of water issues and available options is key. When well informed, communities often can reach agreement on acceptable practices.

The best solutions emerge from an integrated design approach in which all of the complex issues associated with water, stormwater, wastewater, energy, land use, buildings, materials and transportation are considered from the beginning. When the entire design team approaches the full set of problems associated with development and renewal, carbon and water cycles can be addressed as part of the design process. Buildings and communities can then be designed using only the water that falls on the land associated with the development.

Code and Regulatory Challenges

As noted, building codes and environmental regulations are often prescriptive and define materials and methods based on existing practices. They consequently tend to be restrictive, and the men and women whose responsibility it is to enforce them may not recognize the potential benefits of allowing something new or unfamiliar. The same holds true for many engineers involved in the building industry, who regularly rely on standard details and specifications developed over many years.

Unfortunately, disasters are often the triggers for change. As we know all too well, the results can be extremely costly in terms of human lives as well as property loss. It is also important to bear in mind that many environmental disasters occur so gradually that the significance of the threats are easily overlooked, often until it is too late. This is why we must seek out and implement solutions now rather than leaving the full weight of the task to future generations. One place to start is by developing appropriate performance-based regulations.

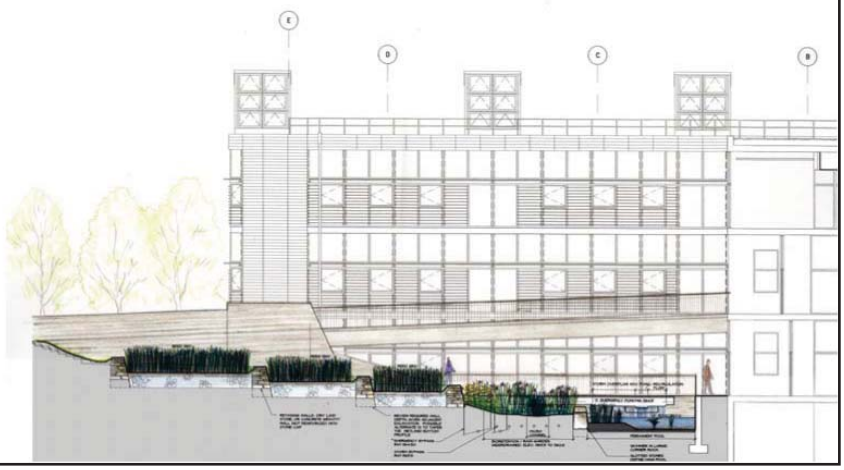
Irrigation

Public perception regarding the reuse of treated effluent for irrigation may be negative because mechanical treatment systems occasionally fail and the residual chlorine in the water can affect grass and other plants. In addition, many of us have experienced foul odors on golf courses or seen news reports of raw sewage discharged into rivers. The consequence is a reluctance to reuse treated effluent for irrigation.

One intelligent solution is subsurface drip irrigation. Developed in Israel, this method conserves water and

SIDWELL FRIENDS MIDDLE SCHOOL
WASHINGTON D.C.

The wastewater and stormwater treatment systems designed for the 355-student Sidwell Friends Middle School are incorporated directly within the schoolyard entrance. A LEED-certified building, the school incorporates features such as a green roof, rainwater harvesting and reuse of treated effluent for toilet flushing. The design flow of 3,000 gallons per day is treated in a series of terraced constructed wetland cells, a sand filter and a trickling filter, all tightly integrated with the landscape.



Drawing & architecture and landscape: Andropogon Associates and Kieran Timberlake Associates.

efficiently delivers treated effluent to the roots of plants. Despite the successful history of this technology, however, many U.S. jurisdictions refuse to permit it because there is no comparable working system in their state. Until recently, Massachusetts served as a classic example of this Catch-22 regulatory situation by preventing the use of any technology not already in use there. Imagine where we would be if this type of regulatory logic was applied to computers!

As with most public-perception and regulatory issues, overcoming this type of resistance requires perseverance, patience and leadership. Referring to regulations in other jurisdictions often helps, as does involving code and regulatory officials early in the design process. Even simple solutions like adding a biodegradable colorant and posting signs reading "Don't drink the blue water" can be enough to quell concerns about public health and safety.

Water Closets and Urinals

The reuse of treated effluent to flush water closets and urinals poses an even more difficult challenge. When flush toilets were invented by John Crapper in the Victorian era, the potable water lines to bathrooms provided a convenient source of water. Today, although most regulators readily acknowledge that there is no real reason to continue this practice, efforts to suggest other options are typically met with resistance. Most contemporary plumbing codes require a separate supply pipe (typically identified as a "purple pipe" with the printed legend: "nonpotable supply"). Yet some code officials still invoke the 10-foot horizontal separation rule for potable and nonpotable supplies . . . even though the supply to a water closet is typically within 12 inches of the sewer discharge line.

Other Considerations

There are instances in which state environmental regulations do not address a reuse option at all. For example, there are typically no regulations regarding the use of rainwater to supply water closets and urinals. This might seem to be a blessing, but in reality there is nothing to prevent code officials from interpreting the absence of guidance as a basis for prohibition. In all fairness, this is not so difficult to understand because codes and regulations are frequently viewed as affirmations of what is acceptable. Again seeking to take in the "big picture," however, we should not overlook the fact that every innovation and advance must be accepted by code and other regulatory organizations prior to being made available for adoption by local jurisdictions. This in itself can take anywhere from months to years, and the state of affairs is exacerbated by the fact that it is not uncommon for jurisdictions to be enforcing codes that are a decade or more out-of-date.

As mentioned previously, performance-based regulations are an attractive alternative because they encourage innovation by being much more adaptable to technological changes—but they must be written carefully. For example, California's current Title 22 regulations allow the reuse of treated effluent in water closets with the requirement that it be tested every day for fecal coliform bacteria. This may sound reasonable, but take a moment to consider the full implications.

First, it takes more than 24 hours to receive the results from the standard fecal coliform test, meaning that we do not know if the effluent is contaminated until at least a full day after the fact. Second, the cost of testing effectively prohibits reusing treated effluent in smaller communities and subdivisions. Finally, this requirement ignores the potential offered by "new" technologies available today. Ozone, for example, is not only an effective disinfectant but the presence of residual ozone in treated effluent provides immediate assurance that there are no live bacteria. Alternatively, ultraviolet disinfection followed by filtration results in the elimination of the dead bacteria and anything else larger than the filter pores. If the disinfection system fails to operate as specified, control systems like those now routinely installed to manage heating and cooling, water heating, and refrigeration could be used to automatically shut off the supply of reuse effluent.

Conclusion

Like all innovative solutions to problems caused by existing building practices, the development of stormwater and wastewater reuse programs requires that designers work with building code and regulatory officials who are willing to making positive changes in their communities' building practices. First-hand experience with the application of these solutions is often critical to gaining such support. This makes demonstration projects worthy of careful consideration: not only do they aid in training local officials (along with educating regulators and the public), but they are often easier to get approved.

In any case, if we agree that the fundamental responsibility of designers, building code officials and regulators is to safeguard the public's safety and welfare, we must actively seek to recognize the risks inherent in current practices and balance them against the potential risks posed by alternative approaches. The inclination to yield in the face of bureaucratic red tape or public resistance (not to mention possible gaps in our own experience) is understandable, but a committed leadership supported by a network of diverse professional partnerships can, and eventually will, prevail. ◆

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