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Valuing What We Have

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The rehabilitation of modern-era buildings presents new challenges to preservationists. In its proposed master plan for the existing headquarters (above left) of the American Institute of Architects in Washington, D.C., Quinn Evans | Architects illustrates an alternative preservation approach in which all existing facade elements are saved while performance is improved with visually apparent sunshades and light shelves (above).

Renewal of existing buildings is the key to reducing levels of air and water pollution, greenhouse gas emissions, and energy and material resource consumption in the building industry.

Flip through any magazine or newspaper, or skim through the stations on your television or radio, and you are likely to come across a great deal of talk about sustainability. The retooling of the carbon economy is underway, and the construction industry, land development, and urban infrastructure are central elements in the process. The environmental impacts of constructing and using buildings—the largest sector of the U.S. economy—are staggering, constituting 35 percent of the energy and 40 percent of the material resources consumed, 25 percent of the solid waste generated, and 35 percent of the greenhouse gases emitted.

Reduction and even reversal of the impacts of the built environment are the objectives of numerous initiatives recently undertaken at all levels of government and by development and construction industry organizations. Guiding principles and best practices are becoming well defined and broadly accepted, and information resources are proliferating. There is hardly a place in the United States where a property owner looking to do the right thing is not supported by readily available information, eager professionals, and public sector inducements.

Still, a fundamental truth of community sustainability is all too frequently overlooked: people must not only build their way to a sustainable future, but also conserve their way to it. Though changing the way new buildings are designed and constructed can reduce the rate of increase in environmental impacts, the only way to reduce the impact is to address the performance of existing structures.

An Avalanche of Existing Buildings

In the green building marketplace, by far the most attention goes to designing new buildings that are more efficient to build and operate. The same is true of the application of smart growth and other planning

The State of the Existing Building Stock

To better define the challenges presented by existing buildings to both preservationists and those interested in sustainability, it helps to look more closely at the types of structures that make up the stock.

About 20 percent of the existing building stock is historic or other traditionally constructed buildings dating from before World War II, according to figures for nonresidential buildings derived from the Commercial Building Energy Consumption Survey, compiled by the U.S. Department of Energy.

From a contemporary perspective, the prewar era was one when energy and material resources were comparatively scarce: few could afford the luxury of consuming large amounts of energy. It may seem to run counter to the faith people have in new technology, but buildings built before 1920 on average consume less energy per square foot than those built in any decade since. Only the best of today's generation of high-performing buildings can match their performance.

Nearly half the existing stock is made up of early modern-era buildings erected during the 1950s through 1970s, when a seemingly endless supply of cheap energy was taken for granted. Buildings from this period have the dubious distinction of being both the largest and least-energy-efficient segment of the building stock. Many early modern buildings were constructed of materials with poor performance and low durability characteristics. Because of their numbers and relatively low construction quality, contending with early modern-era buildings may represent the greatest challenge to people interested in preservation and sustainability.

Most buildings constructed since the 1980s are likely to incorporate at least some high-performance elements, such as insulated glass windows or energy-efficient heating and cooling systems. However, only about 5 percent of these buildings are certified green buildings under the Leadership in Energy and Environmental Design (LEED) or Green Globes ratings systems. Although construction practices are moving in the right direction, even the highest-performing buildings built in recent years cannot be said to be truly sustainable.—C.E.

and design strategies at the community scale. Projections are frequently cited estimating that the building stock will increase by more than 40 percent by 2030. But it also is predicted that over the same period, 85 percent of today's building stock will be substantially modernized. What strategies are being developed to transform the existing building stock and the communities where they are located?

Perhaps the deepest well of experience for maintaining and adapting existing buildings can be found in the field of historic preservation, codified in the National Historic Preservation Act of 1966. Since that act was signed into law, preservation professionals have been assessing the value of existing buildings and developing effective techniques to extend their useful service life—two important elements relevant to sustainability.

Preservation's fundamental purpose is to conserve the material value of existing buildings—to retain their physical "fabric." But sustainability considerations shift the focus somewhat to the environmental value of the energy and material resources embodied in existing buildings. Though embodied energy was studied in the 1960s and trumpeted in preservation circles during the energy crisis of the 1970s—perhaps most thoroughly in *New Energy from Old Buildings*, a National Trust for Historic Preservation publication—the topic has new relevance today.

The investment of material and energy resources in buildings is considerable. On average, a traditional brick building embodies the energy equivalent of about five gallons of gasoline per square foot (205 liters per sq m). As an equivalent for operational energy, this same amount of energy would operate a typical modern building on a per-square-foot basis for more than ten years, or a high-performance building for more than 20.

For the true value of these embodied energy and material investments to be appreciated, they must be understood over their full life cycle. Preservation teaches that buildings are assemblages of many components, each with its own life cycle. Life cycle assessment (LCA) addresses not only those materials incorporated directly into a building and the energy used to operate the structure, but also the materials and energy used to extract, manufacture, transport,

VISUALIZATION BY FOX ARCHITECTS

Transfer development rights (TDR) fuel incremental growth and once-in-a-generation revitalization that captures the value of existing resources while creating high-performance buildings. Taking advantage of Washington, D.C.'s TDR regulations, Liberty Property Trust is adding two floors to its eight-story structure at 1129 20th Street, N.W. (right), which was built in 1968. In addition, they are filling in the open courts at three corners of the existing floor plates. All together, this will increase the existing gross square footage by more than 45,000 square feet (4,180 sq m). The new façade (above) will be a unitized glass and metal curtain wall system. The renovation, designed by local firm Fox Architects, will be completed this year.

and install each component. LCA also extends to the removal and disposal of components at the end of their service life.

LCA tools are beginning to define environmental impacts with a degree of authority that contributes to informed decision making. The U.S. Environmental Protection Agency (EPA), in partnership with the National Institute of Standards and Technology (NIST), has developed an LCA protocol, Building for Environmental and Economic Sustainability (BEES), which assesses 16 categories of environmental impact. Developed to evaluate the environmental effects of manufacturing products, BEES is the methodology required in order for products to qualify for EPA's Environmentally Preferable Purchasing (EPP) list.

But it can be much more complex to assess an entire building project, so other LCA tools are needed. The Athena Institute, a Canadian nonprofit organization, has developed an LCA protocol, called the Environmental Impact Estimator (EIE), to assess full building projects. EIE groups environmental impacts under six headings: water pollution, air pollution, climate change contribution, material resource expenditure, energy resource expenditure, and installed performance. Through the use of EIE, design choices can be assessed in terms of their effect on these six measures. Athena has also developed an LCA tool, called the EcoCalculator—available for download at no cost at www.athenasmi.ca/tools/impactEstimator—which estimates the environmental impacts of commonly used building component assemblies.

With existing buildings, the investment of energy and material resources has already occurred and the associated environmental impacts already felt. Retention of existing structures rather than their replacement with new construction allows additional environmental impacts to be avoided—not only those involved with new construction, but also those associated with demolition and disposal of the existing building. Avoided impacts can be measured and used to inform future actions.

Factoring Existing Buildings into the Sustainability Equation

Plans and programs are needed that both embrace the value of the existing building stock and contribute to both its preservation and transformation. Approaches must take advantage of the material and energy investments already expended in constructing these buildings, as well as encourage effective methods of improving their performance. It is the existing building stock that holds the key to reduction of current pollution and emissions levels from the built environment.

Unfortunately, despite the importance of life cycle assessment within the sustainability framework and the growing availability and sophistication of LCA

Challenges of the Modern-Era Building

The rebuilding of K Street in Washington, D.C., does not fit conventional definitions of preservation. Many preservationists view such aggressive intervention and transformation as anything but preservation. However, even the most hard-core preservation advocates recognize that the modern-era building stock poses new and more perplexing problems.

Though there are many modern buildings that merit preservation as already codified, a different approach is needed to deal with the vast majority of them—an approach focused on alteration, improvement, and transformation rather than preservation's traditional goal of saving structures as historical records of their time.

There are three issues that generally tilt the balance toward transformation and renewal of the modern building stock rather than preservation and restoration.

▷ Many principles of modernism grew out of disdain for traditional architecture and cities. Modernism brought the built environment sprawl and self-conscious architecture that ignores its context. Cobbling together sustainable communities from modern-era buildings that make great places for people will require creativity.

▷ Many modern-era buildings were poorly made with materials that emphasized economy over durability. Conservation of a well-maintained stone facade sometimes requires only a good cleaning and the painting of windows and trim, while treatment for modern buildings typically must be much more aggressive.

▷ Most modern buildings, built in a period of plentiful and cheap energy supplies, are entirely dependent on systems requiring the consumption of fossil fuels—a fact that has had a profound effect on the shape of modern buildings. For example, massive floor plates—50,000 square feet (4,650 sq m) per floor has been the Holy Grail in commercial markets for many years—with low ceilings that require the constant use of energy-consuming lighting and air conditioning no matter how sunny or temperate the weather outside.

An avalanche of modern buildings is nearing the threshold at which it will need substantial refurbishment—either to address concerns about aging, or issues involving energy efficiency and climate change. For communities seeking to retool to achieve sustainability, the transformation of the modern building stock represents the most daunting challenge.—C.E.

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Another renovation project benefiting from TDR regulations and designed by Fox Architects is 2175 K Street, N.W., in Washington, D.C. Marshall Stewart Properties is adding three floors to the 1981 original (thereby increasing existing gross square footage by 37,500 square feet/3,483 sq m), recladding its facade, and upgrading mechanical and electrical systems. Project completion is expected in 2009.

tools, the policies and programs intended to promote and facilitate green building, smart growth, sustainable communities, and response to climate change pay far too little attention to existing buildings.

An example of this oversight can be found in one of the country's most ambitious and visionary plans. In an effort to exhibit progressive leadership on climate change, New York City recently initiated PlaNYC 2030, an extensive and multifaceted agenda to reduce greenhouse gas emissions from the nation's largest city and prepare it for potential impacts of rising seas and temperatures. But among the dozens of specific programs in the plan, only a few have any direct application to the existing building stock. And nearly all the development models referred to in PlaNYC 2030 consist of large-scale urban renewal, sweeping away existing industrial loft buildings to make way for new high-rise and mid-rise towers.

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Studios Architecture of Washington, D.C., took a "surgical" approach in 2007 to modifying the facade at 1110 Vermont Avenue, N.W. (above left). The designers inserted new glass elements into the original precast-concrete-panel facade to improve both insulation and heat-reflection and to add visual life. By retaining durable elements, the renewed building expresses the "continuum" of modern architecture while entering a new chapter in its life cycle. An interactive sound and light sculpture (above right) by MIT professors Eric Howeler and J. Meejin Yoon at grade confirms that this is no longer a mundane building from the 1980s.

In Washington, D.C., a different revitalization model is gaining traction. While it is no substitute for the broad scope of New York City's climate change response, it demonstrates a practical, market-driven approach to both conserving the existing building stock and creating an economic engine to help fund its transformation.

About 20 years ago, Washington adopted its first transfer development rights (TDR) overlay zone, called the Downtown Development Overlay District (DDOD), under a program with its origins in historic preservation and favoring incremental growth. The ordinance creating the DDOD allows for the transfer of development rights from historic properties to designated receiving zones, with the intent of preventing the loss of historic buildings to the pressures of rising property values while also providing economic resources to maintain and restore them.

Although it was not a primary objective of the ordinance, the TDR program is having a significant impact on the building stock in the central business district. As a receiving zone, Washington's K Street—a canyon of mostly modern office buildings famous for housing power brokers and lobbyists—is undergoing a once-in-a-generation transformation. Though there have been a number of teardowns and more will certainly occur, in most cases redevelopment in the corridor has involved the addition of two or three stories to an existing structural frame, expanding rentable floor area, increasing density incrementally, and creating an economic engine that drives renovation of the entire structure.

The exterior envelope is sometimes entirely replaced, but many architects have approached the renovation of building facades with a lighter touch by saving it, adding new elements or incorporating elements of the existing facade into the design, such as stone-clad spandrels or columns.

With every project, mechanical and electrical systems that were energy hogs have been replaced with high-performance systems. Responding to Washington's heightened awareness of issues involving energy efficiency and the environment, many builders are seeking certification of their projects under the Leadership in Energy and Environmental Design (LEED) green building program. The additional financial engine created by transfer development rights improves the quality of renovation work, bringing green building practices and high-performance systems well within economic reach.

Washington's TDR ordinance offers a genuine win-win scenario—establishing a protocol for preserving the value of the existing building stock while substantially reducing its environmental impacts. More solutions like it must be forged and their goals intensified. By definition, reducing the environmental footprint of cities requires that the existing building stock be addressed effectively in life cycle terms. As the best practices of preservation have illustrated for decades, modest intervention is often the most desirable approach, yielding the greatest benefit with the least investment of new material and energy resources. It is time to find affordable and effective ways to transform the stock of existing building while revitalizing the communities they occupy and define. **ULG**

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