Maintaining Elements that are Efficient by Design

What is already green about our Historic Buildings

Legacy Project Number: 09-456

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This pamphlet highlights the findings of a technical report prepared by Van Citters: Historic Preservation, LLC under the auspices of the DoD Legacy Resource Management Program. The technical report is designed to educate DoD cultural resources managers, planners, engineers, maintenance staff, and other facilities staff about the sustainabilityof historic buildings and the need for a thorough historic preservation and sustainability analysis prior to making energy efficiency or making energy efficiency or sustainability improvements.

In this era of energy conservation and sustainability requirements, historic preservationists are frequently asked: What is already "green" about historic buildings? Using a variety of assumptions (some substantiated—some not), answers have ranged from "everything" to "nothing." *Maintaining Elements that are Efficient by Design, or, What's Already Green About Our Historic Buildings* argues that historic buildings are better conceived of as being "shades" of green rather than as being green or not green. Key points from study point out that:

- Historic design concepts and contemporary notions of sustainability cannot be compared unequivocally;
- Historic buildings were designed as efficient operating "systems";
- These systemic functions should be carefully studied and understood before energy efficiency and other sustainability improvements are considered; and
- Once the historic building's original systems are understood, modern improvements *can* be made to improve energy efficiency and sustainability, and facilities managers can meet the requirements of **both** energy conservation and historic preservation policies. It has been pointed out that America's existing building inventory, including historic buildings, is much too large to rely solely on constructing new green buildings to significantly advance the cause of sustainability.

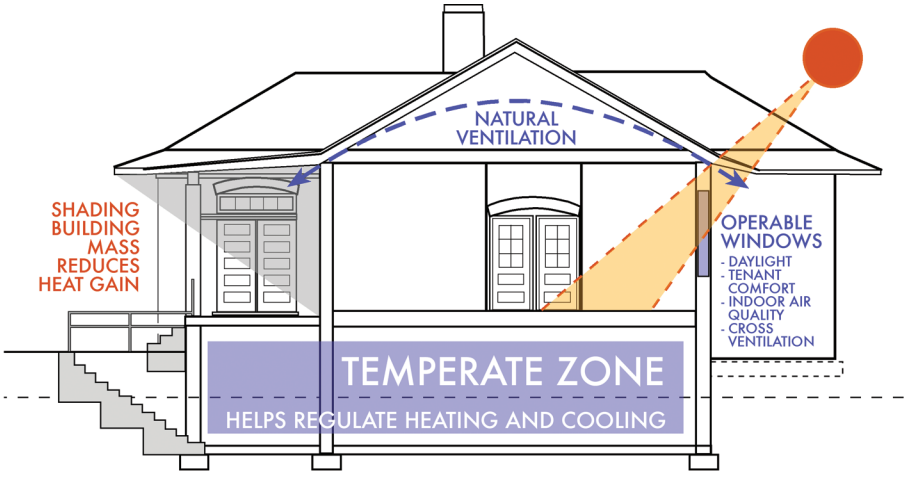
This premise is supported by DoD statistics that show the agency is responsible for over 250,000 buildings, of which as many as 62,500 may be historic. DoD's extensive inventory of historic buildings corresponds with the majority of advancements in building design and construction principles that have increased energy efficiency and indoor environmental quality. However, sometimes the new technologies that were meant to improve sustainability have disrupted those building design features that made the historic building "already green."

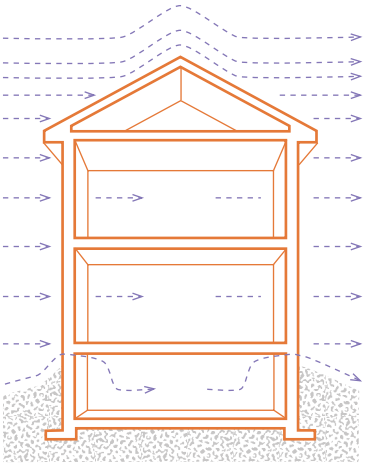
Historic Building Systems

There are many individual features of historic building that may be characterized today as "green" or sustainable by today's standards. Overall, however, historic buildings were designed to operate differently than modern buildings. Before the technological advances of electricity and mechanical systems and the development of modern architecture (structural systems that allowed curtain walls, etc.), it was necessary for buildings to have the ability to respond to changing environment factors in order to provide thermal comfort. The architectural design features worked together to provide ventilation, lighting, heating and cooling. The features worked together to provide thermal comfort.

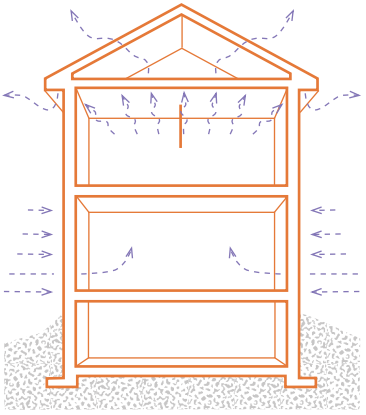
Historic builders did not think in terms of "green" or "sustainable" construction. They did, however, attempt to mitigate the effects of climate and create the best possible indoor environmental quality

HISTORIC SUSTAINABLE QUALITIES

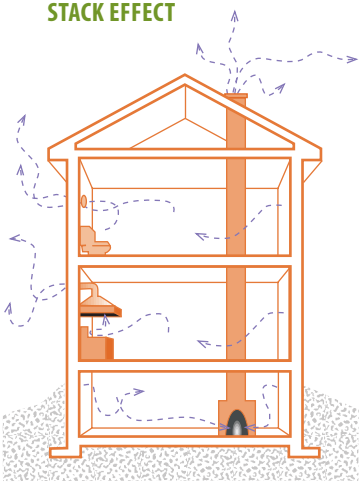




WIND EFFECT



STACK EFFECT



COMBUSTION & VENTILATION EFFECT

with the technologies available to them at the time. They did so by designing buildings that functioned as a system in which ventilation; conduction, convection, and radiation; daylighting; orientation; shape; building materials; and some architectural style elements worked in concert with each other to provide a comfortable building. When we make changes to one of these parts of a historic building system, we potentially alter the other pieces. Understanding how the pieces work together can prevent us from making changes that negatively affect the overall sustainability of the building, and at the same time can help prevent us from negatively affecting the historic character of the building.

With the introduction of air conditioning and new structural materials, architects were no longer constrained by local environmental conditions since they could create and control their own environments.

Because the large amounts of energy are needed to maintain these closed indoor environments, this approach worked as long as conventional energy sources were inexpensive and easily available.

Modern notions of "green" buildings and "sustainability" have a complicated interrelationships with historic building systems. For example, alterations that change a building's daylighting pattern can affect the HVAC system and energy efficiency. Creating privacy by erecting office partitions can affect ventilation and ambient air conditioning; and if computers, new lights, and more people are added they can affect energy and other operational aspects. Each building system element that is altered can potentially affect other system elements and inhibit the desired performance goals. Adding preservation to the mix can complicate the interrelationships, but may also simplify them. If a building's interior space is historically significant and the project design team cannot introduce partitions, or window openings cannot altered because it will adversely affect the building's architectural character, there are fewer architectural and engineering options available. So, it is important to define the project parameters from a preservation point of view, as well as outline the green architecture goals. If carefully thought out, the historic features can support both goals through using or restoring those original

building elements to achieve the same result. The challenge is to meet sustainability goals while preserving DoD history, which in turn can lead to unique and beneficial solutions.

Architectural Styles and Character-Defining Features

Specific building styles are in part identified by character-defining features; however, these features often have little to do with energy efficiency. For example, Victorian and Italianate styles are defined primarily by ornate bracketing, elaborate columns, and cast iron metalwork. These features are ornamental and have nothing to do with "green" building techniques. But this is not to say that character-defining features cannot be green and at the same time

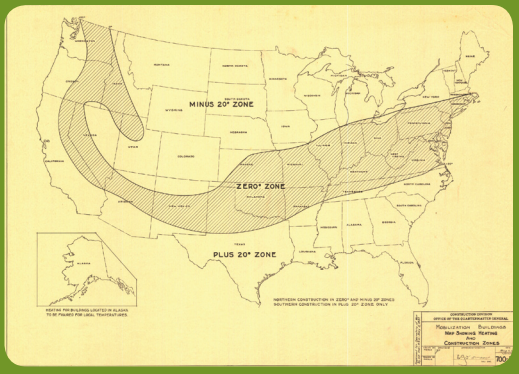
		Shape*		Massing				Wall Material				Fenestration				
	Architectural Style	Externally Loaded	Internally Loaded	Flat Root	Pitched Roof	Eaves & Porches	Basements	Solid Masonry	Aerated Masonry	Steel Fram	Wood Frame	16.25%	26.50%	51.00%	Operable Windows	Non-Mechanical Vents
Group A	QUEEN ANNE	o			o	o	o	o			o		o		o	o
Group A	ITALIANATE	o		o	o	o	o	o			o		o		o	o
Group A	RICHARDSONIAN ROMAN	o			o		o	o					o		o	o
Group A	PRAIRIE	o		o	o	o	o	o			o		o	o	o	o
Group A	BUNGALOW/CRAFTSMAN	o			o	o	o	o			o		o		o	o
Group A	CLASSICAL REVIVAL	o		o	o	o	o	o			o		o		o	o
Group A	MISSION REVIVAL	o		o	o	o	o		o		o		o		o	o
Group B	ART DECO/MODERNE		o	o			o	o	o				o		o	
Group B	INTERNATIONAL		o	o			o	o	o	o				o		
Group B	BRUTALISM		o	o			o	o				o	o			
Group B	FORMALISM		o	o			o	o		o				o		
Group B	POST MODERNISM		o		o	o	o			o	o		o			
C	MILITARY VERNACULAR	o		o	o	o		o	o		o		o		o	o

* Externally loaded buildings are generally narrow and internally loaded are generally deeper, square buildings.

function as important style markers. These markers include features such as the tall, multi-light windows and deep porches typical of Victorian era architecture (e.g., Queen Anne, and Italianate) and the long, overhanging rooflines and eaves so characteristic of the Prairie and Bungalow styles.

Rehabilitation Tips

When planning a rehabilitation project for an historic building, the architect/designer should consider elements of the building system such as, the local climate, orientation of the building, use, structural components, and specific architectural features such as windows, eaves, or porches. The following tips, though not comprehensive, provide a preliminary guide for planning rehabilitation projects that respect and optimally use what is already green in historic buildings.

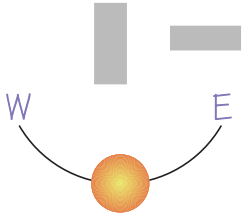


Tip 1: Climate.

Conduct a thorough analysis of how building components and characterdefining features mitigated the effects of the local climate. This analysis can suggest avenues for more cost-effective and preservation-sensitive rehabilitations, and may also indicate how original architectural features may be restored in order to support sustainability.

Tip 2: Orientation.

Analyze how the building's orientation affects energy use and whether it can be used to support natural ventilation, and daylighting.

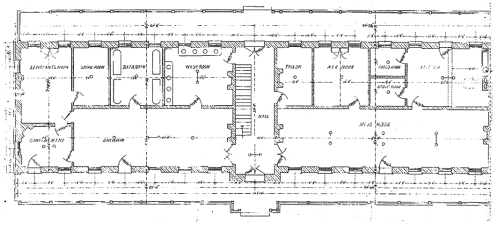


Tip 3: Use.

Few historic, non-residential buildings continue to be used as originally intended. Adaptive reuse often necessitates altering some of the very elements of a building that were originally intended to provide for user comfort. While sometimes these alterations can be restored to improve sustainability, more often than not, restoring these elements are impractical. Understanding how a building was originally used and how the space was configured to facilitate those original uses can help us to make better decisions about adaptive reuse and rehabilitation projects.

Tip 4: Structural Components.

The roof, walls, foundation, and building shape all affect the ventilation and thermal comfort of a building. The shape defines whether a building is internally or externally loaded, that is, whether it is heated primarily by its activities and occupants or by the outdoor environment. This is a critical factor in understanding how to add a new HVAC system. In addition, the roof, walls and foundation all contribute, as a system, to how air and



moisture move through a building and whether ventilation and thermal comfort can be achieved effectively. It is important to analyze not only how the building is functioning today (which likely includes a number or retrofits since its original construction), but how it originally was intended to function. Alterations can be made to the roof, walls and foundation to upgrade the energy efficiency; however, it is important to ask questions and conduct a use analysis to ensure that the addition of insulation will not reduce ventilation or cause moisture problems. In addition, it is necessary to understand whether the alterations can enhance the energy efficiency and maintain the historic character.

Tip 5: Daylighting and Windows.

Because historic buildings relied onnatural light to help illuminate the building's interior space, there is typically enough fenestration to provide good baseline lighting. If modern use necessitates the enhancement of light quality, there are daylighting methods that reduce the risk of having a negative impact on the building's historic architectural character. These methods include: devices to bounce light or allow more light to penetrate the center of the building, painting walls a light color for better reflectivity, and energy efficient electrical fixtures. Fenestration patterns and the window units can also impact the energy efficiency of the structure. In most cases, historic preservation necessitates the preservation of the window's style and spacing (replacing a historic window should be the last option). Thus, it is important to conduct a thorough energy analysis to understand the structure's heat gain/loss. Once completed, the project team should look at the full spectrum of alternatives that meet the goal of increasing energy efficiency while at the same time maintaining the building's historic character.

Other Tips: Window coverings, eaves, porches, and landscaping all contribute to tempering the effects of daylighting and heat absorption within a historic building. In general, such features typically provide the necessary shading to keep unwanted direct light from the interior. It is often useful for a green retrofit project to analyze the sunlight and how it hits a building. This can aid in design decisions about daylighting and landscaping and thus better understand how such improvements can the building's energy efficiency while maintaining its historic character.

Summary

While the obvious green characteristic of historic buildings is their embodied energy, there are other ways in which these buildings can contribute to the green building movement for DoD facilities. The best way to ensure that the requirements to meet federal laws for energy efficiency, sustainability, and the preservation of historic resources are met is to understand the existing sustainable elements of historic buildings by conducting a thorough historic preservation and sustainability analysis prior to making alterations. Only by understanding the historic use, systems, and character-defining features of historic buildings can we be truly identify their "shades of green."

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