Emerging Trends in Historic Preservation

Preservation and Sustainability
Historic Preservation is Sustainable

- Preserving Cultural Heritage
- Sustainable by Design
- Life Cycle Durability
- Embodied Energy and Energy Efficiency
Cultural Sustainability

- The cultural values associated with the stewardship of our environment are central to the concept of sustainability.

Preserving historic structures and neighborhoods is integral to the social equity pillar of sustainability.
Energy Efficiency and Green Design

- Historic buildings were often built more sustainably than more recent construction
  - Historic Materials
    - More durable/longer life cycle
    - Local and Non-toxic
  - Inhabitability
    - Adaptable to new uses
    - Designed for local climate
    - User-controlled operable systems (Day-lighting and natural ventilation)
  - Energy Efficiency
    - DOE study shows commercial buildings built prior to 1920 are as efficient as most building constructed after 2000
Embodied Energy

The embodied energy of a historic structure is the irrecoverable energy which has already been expended to bring the structure to the state it currently exists in.

- Embodied energy includes:
  - Construction
  - Materials extraction, processing, manufacture and transportation
  - Repair and maintenance (ongoing)
Most sustainable technologies can be applied to historic structures without reducing their integrity

- This includes passive and active techniques, as well as high- and low-tech strategies
- Such strategies have considerable potential to reduce the buildings environmental footprint
Historic building materials often are more sustainable than new technologies

- Historic materials
  - Selected for durability
  - Energy efficient: Thermal mass and insulation values
  - Repair is more efficient than replacement

- “New” technologies
  - Many have been found to be not as effective as intended
  - May require secondary insulation systems where traditional material do not
  - Potential for high VOCs and other contaminants
Building Operation

- Effective energy management includes strategies for conservation, collection, circulation, and generation
- Passive and low-tech strategies exist on many historic buildings
  - Make maximum use of day-lighting and natural ventilation
  - Include thermal conditioning features such as blinds, awnings, shutters, porches and thermal mass
  - User-operable features increase control of passive systems
Respectful Retrofitting

• Many energy-efficiency retrofits can be achieved with minimal impacts to the appearance of a historic structure
  – Additional insulation
  – Ceiling and porch fans
  – Ground source heat pumps
  – Skylights on less-significant facades for natural light and ventilation
  – Simple conservation measures such as replacement light bulbs
Windows

- Repair of a historic widow is most often more efficient
  - Heat loss is primarily through the frame not the glass, and can be drastically reduced with just proper sealing
  - Early wood frames more durable than manufactured or synthetic alternatives, and without pollution issues
Windows

– Storm windows are more efficient and less costly than replacement windows
– Little information exists on the life-cycle performance of new windows
– New double- and triple-glazed window frames have shorter life cycles, often with built-in obsolescence and toxicity concerns
Landscaping

- Landscape design can provide low-tech solutions, many of which are often already incorporated in historic landscapes.
  - Use trees and shrubs to provide wind and rain protection and seasonal shading.
  - Also a measure for carbon-offsetting
Galveston, Texas
Key Design Considerations
Building Orientation Requirement

Must orient to maximize views, breezes & solar access
Key Design Considerations

View Corridors and Breezeways
Energy Distribution and Generation Technologies

Technologies include:
- Under-floor radiant systems
- Heat recovery systems that collect ambient heat
- Biomass-based energy
- Wind turbines*
- Solar panels*
- Micro hyrdo-electric turbines

*Proper placement and integration of these systems should not adversely effect the character or integrity of a historic structure.
Key Principles for Sustainable Technology and Preservation

• Think Holistically
  – Consider all factors; entire life-cycle costs, manufacture, energy consumption, mining waste, original and waste toxicity, transportation costs, reuse or disposal etc.

• Use Technology Creatively
  – Retrofit with technologies which maximize efficiency and utilize existing systems and take advantage of inherent sustainable building qualities/features

• Seek Common Design Solutions
  – Respect the integrity of the historic structure while adapting for sustainability and other community goals
Preservation Regulations and Sustainability
Incorporating Sustainability in Preservation Standards and Guidelines

Key Regulatory Elements:
• Building Energy Codes
• Codifying Green Buildings
• Design-based zoning standards
• Design Guidelines
Energy consumption in buildings accounts for approximately one third of all energy used in the United States, and two thirds of the total electricity demand.

- Current focus on new construction and major renovations leads to a technology and product driven market
  - Creates a bias against replacement and tear-downs in the scoring systems
Building Energy Codes

Acknowledge that historic buildings can be efficient:

– Discourage tear-downs
  • They waste embodied energy
  • Create waste problems for local landfills
  • Replacement may take more energy than repair and maintenance

– Address practical standards for the existing buildings
  • Techniques for improving efficiency that preserve integrity of the structure
Energy Conservation Standards  
Crested Butte

Avoid locating skylights on front roofs.

Minimize the visual impact of solar collectors and skylights by not placing them on roof slopes that are visible from public ways.

ENERGY CONSERVATION

Crested Butte experiences an extreme winter climate. The burden of the cost of heating can be lessened through good design that takes into account energy conservation measures and alternative sources of energy. Additional information and suggestions can be found in the Appendix to this document.

9. The use of energy conservation methods is encouraged.
   a. Techniques used must be compatible with the historic core of the town.
   b. Solar collection devices should not alter simple roof lines.

10. Minimize the visual impacts of solar collectors and skylights.
    a. Solar collectors and skylights should be parallel with the angle of the roof.
    b. Limit the size of skylights and the amount of roof glass.
    c. Locate them away from the street facade when feasible.
    d. Bubble skylights are inappropriate.

11. Minimize the visual impacts of expansive areas of glass that may be associated with sun spaces.
    a. In Crested Butte, the amount of glass needed for solar gain is less than some people may assume. It is important to follow the guidelines for solid to void ratio. See also guideline 122.
    b. Design fenestration patterns to be similar to those of traditional windows.
    c. Use smaller glass panes, in frames, rather than a large plate of glass.
    d. Large expanses of glass are inappropriate, except on first floor storefronts.
    e. The construction of a sun space should not alter the character of an historic building.
    f. Glass should not continue to the edge of a wall. Corners of buildings should be solid materials, not glass.
The USGBC LEED rating system is the most common “yardstick” for green construction.

Many communities are codifying LEED, which may lead to many issues;
- Does not properly credit Historic Structures
- Does not recognize the concept of embodied energy
- No qualitative comparison for existing materials vs. replacement

Other green building rating systems should be considered, such as those in Canada, Europe, the UK and Australia.
Codifying Green Buildings

- Historic Buildings should be properly credited in any Green Building Code
- Key principles for green building codes include:
  - Does the system allow for flexibility?
  - Does it give proper credit to preservation and existing building?
  - How enforceable is it?
  - Will it be effective?
Sustainability in Design Guidelines

• Design guidelines for preservation offer:
  – More flexible to local climates, governments, community goals and sustainable design innovations than prescriptive standards
  – Easy integration with existing guidelines
  – Guidelines also serve as an education tool
Sustainability in Design Guidelines

• Key Principles to remember:
  – Maximize inherent sustainable qualities of a historic structure first
  – Retrofit with new technologies that are sensitive to the historic integrity of the structure
  – Maintain building components in good condition to preserve embodied energy and historic integrity
  – Use landscapes for energy conservation
Integrating Sustainability Into Guidelines

- Site planning guidelines address solar access
- Varied massing is encouraged for design character

Ann Arbor, MI
21.0 Green Design in Building Elements

Individual building elements and materials play an integral role in the systems (environmental and otherwise) of the building as a whole and of the building with its site.

Building elements should be arranged to maximize the efficiency of the building’s performance. Materials and systems should be chosen based on their environmental impacts and their performance as both individual building elements and with the building systems as a whole.

21.1 Use sustainable materials to the maximum extent feasible.
- Use materials which have long life spans and require minimal maintenance.
- Use regional, reclaimed, recycled, recyclable and rapidly renewable materials.

21.2 Avoid toxic or otherwise hazardous materials.
- Use adhesives, sealants, paints, carpets and other interior finish materials, which emit no, or low levels of harmful air contaminants such as Volatile Organic Compounds (VOCs).

21.3 Use and apply building materials in a manner which supports sustainable building systems and functionality.
- Use materials and components with high thermal mass and insulation values.
- Use low-e or triple pane insulating glass.
- Use high efficiency lamps and fixtures.
- Use lighting fixtures with minimal light pollution to night skies and adjacent sites.
- Avoid thermal bridges at joints and structural components.
- Avoid large exterior surfaces of dark materials to reduce high thermal absorption and expansion, especially on east and west exposures.
8.0 Sustainable Site Design

The arrangement of buildings, planted area and hard surfaces plays a critical role in how a site relates to the environment, and how buildings on that site operate. Site design can affect environmental considerations for both the site itself and neighboring properties. For example, reducing the amount of impervious surfaces coupled with the implementation of an on-site infiltration systems can reduce the harmful effects of stormwater runoff to adjacent sites.

A site design should support sustainable building principles to maximize energy efficiency and renewable energy strategies as well as to limit negative impacts on local ecosystems. These local ecosystems can be supported through the conservation of existing natural areas and restoration of damaged areas within a site. Allocating open space is critical to the success of biodiversity within a site and is encouraged.

A site design should take into account effects on an adjoining property’s access to light and air as well as its ability to implement the same environmental design principles. Also, the effects of light pollution to adjoining sites and the neighborhood should be mitigated.

8.1 Locate site features to maximize green building principles for solar access and energy efficiency.
- Minimize access roads and parking footprints, and share with adjacent properties when feasible.
- Position a new building on its site to optimize energy efficiency, allowing for both passive and active strategies.
- Site a structure to maximize daylighting strategies for all portions of the building.
- Locate a building and site elements to take advantage of prevailing southeast winds for natural ventilation.
- Walkways, landscaped areas and mid-block passages should be used with setbacks to provide solar access, natural ventilation and access to secondary portions of structures and neighboring properties.
- Conserve sharing parking facilities with an adjacent site.
- Minimize the use of impervious surface treatments.

8.2 Utilize exterior lighting that minimizes light pollution to adjacent sites and the neighborhood.
- Only light areas as required for safety and comfort purposes.
- Use light fixtures that shield and focus light onto the ground.
- Use light bulbs that have low lumens levels.

8.3 Utilize landscape areas and features to promote energy efficiency.
- Locate open space where it will provide access to light and air for multiple properties.
- Locate deciduous trees and plants to provide summer shade while also allowing for solar access in the winter.
- Locate landscape elements to allow for natural ventilation.
- Maximize the use of native plant species which are best adapted to the climate and require less energy and resources to maintain.
- Use plant species which require low levels of water and maintenance.
- Utilize irrigation systems which have high efficiency or reuse water from site drainage systems.
- Maintain existing mature trees and other large-scale vegetation where feasible (4"-5" caliper).

8.4 Provide natural stormwater systems and retention basins.
- Design a retention basin on site to utilize existing runoff patterns and vegetation.
- Avoid paving a runoff basin.
- Design a landscape a retention basin to provide water absorption and serve as a year-round visual amenity for the site.
- Provide soil areas with high water absorption rates where feasible.
- Integrate the site drainage system with bioswales and on-site retention basins into site open space.
- Locate water inlets for most direct, positive site drainage.

8.5 Minimize runoff from parking lots and structures.
- Use permeable paving, approved by public works, for surface lots to the extent feasible.
- Direct run off from parking structures into on-site systems for landscaping, or otherwise retain runoff on site through the use of bioswales or similar strategies.
- The area of parking lots should be kept to a minimum.
Observations

- Preservation is key to sustainability
- The relationship is not well understood
- Planners need to keep preservation in the discussion
- New data will be emerging
- New standards will be forthcoming