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Resilient Stewardship:
Preserving Your Historic Property In an Era of Climate Change

CONNECTICUT STATE HISTORIC PRESERVATION OFFICE

R. CHRISTOPHER GOODWIN & ASSOCIATES, INC.

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Preserving your historic property in an era of climate change

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COVER: DETAILS OF SELECT HISTORIC CONNECTICUT PROPERTIES, 2016. CREDIT: RCG&A.

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Superstorm Sandy brought storm surge, high winds, and flooding to Milford's shoreline, much of which was developed in the early twentieth century. Credit: SHPO file photo.

I. INTRODUCTION

Have you noticed that paint seems to blister and peel on your building at a faster rate? Are the lower courses of brick in your foundation continually damp? Are you seeing more "nuisance flooding" in your neighborhood? Our climate is changing—globally, regionally, and locally—and scientists project that the pace of change is accelerating (U.S. Global Research Program:2018).

Climate change affects Connecticut's buildings in three major ways:

- **Changes in the environment and in weather patterns are resulting in new and greater seasonal stresses.**
- **Major storm events of increasing frequency and intensity pose risks for severe structural damage.**
- **Rising sea levels threaten buildings through site erosion and inundation.**

All buildings, including Connecticut's historic buildings, are vulnerable to these threats in varying degrees.

Our historic buildings are irreplaceable resources that contribute to Connecticut's rich cultural heritage. Whether stately colonial-era houses, modest turn-of-the-century cottages, sleek Midcentury Modern offices, or other forms, they are links to our past that enrich our communities and contribute to our state's quality of life. They anchor Connecticut's sense of place and create our image of home.

Historic buildings are distinctive in their design, materials, and workmanship—qualities often difficult to replicate in contemporary construction. Historic buildings are not just important for their architecture, though. They also contribute to community identity and support place-based economic development. They also are a resource whose use, and reuse, avoids many of the environmental impacts associated with new construction. Historic properties are valued for their sustainability in an age when 30-year life expectancies are common in new construction.

Connecticut faces new challenges to the preservation of its historic buildings. There are more than 36,000 designated historic buildings in the coastal counties of Fairfield, New Haven, Middlesex, and New London.; some 4,200 of them, or 11.6 percent, are located within currently defined hazard zones. Many of the state's oldest buildings are in riverine and coastal areas that are most vulnerable to major storms and rising sea levels. Meanwhile, **historic properties across Connecticut are experiencing new environmental stresses related to climate change.** These properties, whether listed in the State or National Registers of Historic Places (or both), include individual buildings and historic districts as well as sites, structures, and objects of local, state, and national historical significance.

Historic properties are valued for their sustainability in an age when 30-year life expectancies are common in new construction

Climate change is a complex problem, and people may feel powerless in the face of it. Historic preservation is one way to influence community outcomes. Cultural heritage is recognized internationally as a major factor unifying communities in disaster recovery and environmental adaptation. Not only property owners benefit from the preservation historic buildings. Preservation unites communities, and helps maintain them.

This booklet focuses on a small subset of climate change concern—strategies for maintaining historic buildings—for a general audience. It explains why climate change poses an increased threat to historic buildings, suggests an overall strategy for the treatment of historic buildings, and recommends pragmatic measures applicable to a range of building types.

II. ABOUT THIS GUIDE

This booklet is designed to be a reference for historic property owners experiencing climate change. It summarizes Connecticut's historic properties, reviews established national guidance, and indicates how environmental changes affect historic properties in Connecticut. It also explores strategies for meeting these challenges, whether for building maintenance and mitigation, and offers sources for further reading.

It is one of three complementary publications produced by the Connecticut State Historic Preservation Office (SHPO) to promote best practices in resilience planning for historic properties. While these publications focus on the state's four coastal counties, each contains useful information for property owners and communities across the state.

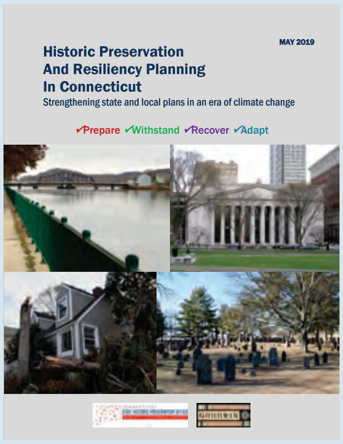
- ***Historic Preservation and Resiliency Planning in Connecticut* was developed to assist state and local planners, and engage a wider audience in the discussion of preservation planning needs in an era of climate change. It summarizes the SHPO's efforts to integrate historic preservation into resiliency planning in Connecticut and offers recommendations for incorporating preservation values in the resiliency planning process on the state and local levels.**

- ***Resilient Historic Resources: Best Practices for Planners* supports planners and preservationists in Connecticut's cities and towns. It outlines key steps for planners to take as they prepare for, withstand, recover from, and adapt to natural hazards and a changing climate—while incorporating the goal of protecting historic resources.**

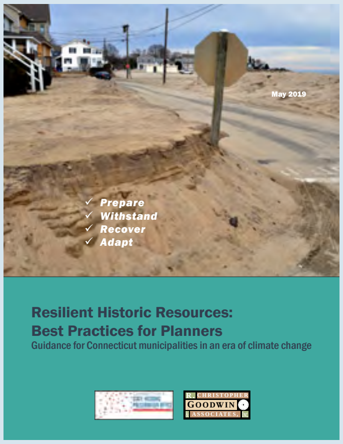
- **This publication, *Resilient Stewardship: Preserving Your Historic Property in an Era of Climate Change*, is for property owners. It addresses the threats to historic buildings from climate change and identifies pragmatic mitigation measures for owners.**

These documents were developed by a team led by the cultural resource management firm R. Christopher Goodwin & Associates, Inc. (RCG&A). The team included the planning and engineering firms Dewberry and Milone & MacBroom as well as SHPO staff. Produced as part of the SHPO's Hurricane Sandy disaster relief and recovery program, the documents were funded through the Emergency Supplemental Historic Preservation Fund administered by the National Park Service, U.S. Department of the Interior. Any opinions, findings, and conclusions or recommendations expressed herein are those of the authors and do not necessarily reflect the views of the Department of the Interior.

The SHPO, an office of the Connecticut Department of Economic and Community Development (DECD), oversees the state's program of historic preservation for Connecticut's citizens. It administers federal and state programs for the identification, registration, and treatment of resources that contribute to Connecticut's cultural heritage. Addressing the threat to historic buildings from climate change is part of the SHPO's commitment, and the State's overall commitment, to disaster preparedness and response.



Guidance on integrating preservation into state and local plans



Best practices on historic resource resiliency for municipal planners

Successful hazard management requires that planners, emergency operations managers, mitigation specialists, and property owners engage in four key steps associated with resiliency.

New Haven's Court Street Row (1869–70, rehabilitated 1960–62; NR) is one of many historic assets in the city's Wooster Square section. Credit: Douglas Royalty/SHPO.

III. HISTORIC PROPERTIES IN CONNECTICUT

Connecticut's historic buildings are tangible links to the state's architectural, social, cultural, and economic past. They include buildings that are the sites of significant events, buildings associated with important individuals, and buildings of exceptional architectural design. They represent the full range of building types from dwellings to churches, to industrial complexes, to commercial buildings, schools, libraries, and public buildings.

These buildings document the progression of Connecticut history and architecture over more than 300 years. **Traditional building forms and nationally popular architectural styles were adapted by Connecticut builders to be responsive to the environment, to the needs of the users, to economic status, and to social aspirations.** Builders selected materials for their availability, durability, and popularity.

Building technologies evolved over time. Heavy timber framing, common in the late seventeenth and early eighteenth centuries, was replaced by lighter-braced framing in the eighteenth and early nineteenth centuries. Balloon framing and platform framing followed in the late nineteenth and early twentieth centuries. Early masonry construction included random or coursed stone rubble; handmade bricks were fired in scove kilns. Later, industrial methods were applied to architectural products. Masonry ashlar with elaborate finishes became available, and builders relied on manufactured brick for its consistent size and firing. Advances in glass strength and production methods made possible larger windows

> ***Construction practices and architectural features evolved from timber framing and hand-carved ornament in the colonial era to standardized components and modular construction in the years after World War II***

with fewer sash divisions. Standardization and modular building components became more common after World War II, as building technologies developed to support wartime mobilization were applied to the peacetime economy.

Ornamentation also evolved. Early colonial buildings often included carved wooden brackets and pendants. Classically inspired wooden ornamentation, often emphasizing doors, windows, and cornices, marked the Georgian and Greek Revival architectural styles. Industrial fabrication made elaborate architectural components accessible and available to a wider market as the nineteenth century progressed. Architectural metals; turned and jigsawn wooden spindles, brackets, and railings; terra cotta; stained glass; and prefabricated building components were widely available through manufacturers' catalogs from the Victorian period.

Early colonial buildings often were rectangular, timber-frame structures sheathed in clapboard or shingles with steeply pitched roofs to withstand heavy New England snows. Gable, "saltbox," and gambrel roof forms were common. As trade flourished in the late eighteenth and early nineteenth centuries along Connecticut's waterways, larger buildings that reflected the region's prosperity appeared. This period saw the construction of Georgian- and Federal-style houses whose design emphasized symmetry and expressed the wealth and social position of their owners.

Many examples of mid-nineteenth century architecture were influenced by the Greek Revival or Italianate architectural styles. Expressing a cultural alliance with the democratic values of classical Greece, the Greek Revival style was adopted for public, private, and religious buildings. From monumental, full temple-front buildings to modest gable-front houses, these styles interpreted the scales and motifs associated with classical architecture. The Italianate style also enjoyed wide popularity. Distinguished by arched windows, heavily bracketed cornices, and elongated window and door bays, the style was part of the "picturesque" architectural movement. It was widely adopted in urban and rural settings in the nineteenth century.

During the latter half of the nineteenth century, industry in Connecticut grew exponentially. Manufacturing, gunsmithing, and textile production emerged as major industries across the state. Expansive factory complexes were constructed in popular architectural styles, some with entire communities of worker housing, schools, and places of worship. These were specialized, multi-building complexes that generally included monumental mill buildings distinguished by expansive windows for interior light and stair towers often ornamented in the latest architectural fashion. Mills generally were solid masonry construction with internal wooden structural frames designed to support machinery and withstand the vibrations generated during operation.

Nationally popular styles influenced Connecticut architecture and construction in the early twentieth century. Second Empire, Queen Anne, and Beaux-Arts styles enjoyed widespread popularity. As important, social conditions fostered nostalgia for the country's colonial roots and led to the Colonial Revival movement. After World War II, new housing incentives and the wide adoption of private automobiles changed the cultural landscape. Neighborhoods with sizable lots and ranch or Cape Cod-type dwellings became common in Connecticut's suburbs.

Connecticut also is noteworthy for the modernist architecture built during the second half of the twentieth century. Buildings in Modern, International, and Brutalist styles appeared in a variety of contexts from urban renewal areas to single-family housing, to apartment complexes, churches, and museums. The importance of these and earlier historic buildings is recognized through local historical designations, through inclusion in the State Register of Historic Places, through listing in the National Register of Historic Places, and through inclusion among the state's 60 National Historic Landmarks.

Industrial Heritage: The East Armory Building at the Colt Armory (1885) is representative of Connecticut's manufacturing history through its listing in the National Register and designation as a National Historic Landmark. The building is one component of the Coltsville National Historical Park in Hartford. Credit: Historic American Engineering Record.

Dixwell Avenue Congregational United Church of Christ (1968–69, NR) was designed in the Brutalist style by John M. Johansen. Credit: RCG&A.

Historic Property Designations in Connecticut

Local Historic Designations are planning tools established through local ordinances that recognize individual buildings and collections of buildings (historic districts) that are historically important to the community. Such designations may require the review and approval of exterior building changes by a Historic Preservation Commission appointed to oversee compliance with local design guidelines. Some municipalities also use Historic Resource Inventories of local properties for planning purposes.

The Connecticut State Register of Historic Places (State Register or SR) is the state's official listing of properties and sites important to the historical development of Connecticut and is administered the Connecticut State Historic Preservation Office. Listing in the State Register is a prerequisite for applying for Connecticut's Historic Homes Rehabilitation Tax Credit.

The National Register of Historic Places (National Register or NR) is the nation's official list of the buildings, sites, structures, objects, and districts that are worthy of preservation. The National Register is maintained by the U.S. Department of the Interior and administered in the state by the Connecticut State Historic Preservation Office. More than 1,675 historic properties in Connecticut are individually listed in the National Register.

Owners of National Register-listed houses may be eligible for Connecticut's Historic Homes Rehabilitation Tax Credit (30%). Owners of income-producing properties may be eligible for the CT Historic Rehabilitation Tax Credit Program (25%) and/or the Federal Historic Preservation Tax Credit Program (20%). Municipalities and nonprofit organizations may be eligible for grants from the SHPO's Historic Restoration Fund program.

The National Historic Landmark Program (NHL) includes properties of exceptional national significance recognized by the Secretary of the Interior and is administered by the National Park Service.

After Superstorm Sandy damaged St. Luke's Chapel in Stamford (1891, NR), the building's wood-shingle cladding was replaced in kind with a grant from the SHPO's Hurricane Sandy program. Credit: Douglas Royalty/SHPO.

IV. BEST PRACTICES FOR PRESERVATION

The Secretary of the Interior's *Standards for the Treatment of Historic Properties* are the nationally accepted ground rules for work on historic buildings and were developed to support informed decisions on preservation practices. There are standards and guidelines for building preservation, restoration, rehabilitation, and reconstruction.

The *Standards for Rehabilitation* accommodate contemporary use of historic buildings while retaining "character-defining," or historically important, features. The ten standards are nationally recognized criteria that support long-term preservation of historic buildings and generally are adopted in federal, state, and local historic preservation programs.

The *Standards for Rehabilitation and the Guidelines* are used by NPS and the SHPO in their review of work to historic buildings for building rehabilitation tax credit programs, grants for the rehabilitation of historic buildings, and other programs. The *Standards* also are the basis for design guidelines adopted by local historic district commissions for review of the appropriateness of proposed work. Understanding how the *Standards* apply to your building is important in planning work on your property.

Applying the Secretary of the Interior's Standards for the Treatment of Historic Properties to your rehabilitation or restoration project can extend the useful life of a building's historic fabric

Best preservation practices are grounded in respect for significant architectural design and in materials science. The design, materials, and construction of historic buildings often differ from those found in contemporary buildings. Compatibility in materials is important from a practical perspective. One example is the widely adopted caution against repointing soft historic brick with hard mortars. Mortars containing Portland cement often are harder than historic brick and differ from brick in seasonal expansion and contraction rates. In a brick wall, this can result in damaged or spalling brick as masonry units expand and contract and hard mortars do not.

The Secretary's *Standards for the Treatment of Historic Properties* are general enough to accommodate the full range of preservation treatments—preservation, rehabilitation, restoration, reconstruction—and the range of architectural styles. Application of these standards to work on your historic building will extend the useful life of historic building fabric.

Secretary of the Interior's *Standards for Rehabilitation*

1. A property will be used as it was historically or be given a new use that requires minimal change to its distinctive materials, features, spaces, and spatial relationships.

2. The historic character of a property will be retained and preserved. The removal of distinctive materials or alteration of features, spaces, and spatial relationships that characterize a property will be avoided.

3. Archeological resources will be protected and preserved in place. If such resources must be disturbed, mitigation measures will be undertaken.

4. New additions, exterior alterations, or related new construction will not destroy historic materials, features, and spatial relationships that characterize the property. The new work will be differentiated from the old and will be compatible with the historic materials, features, size, scale and proportion, and massing to protect the integrity of the property and its environment.

5. New additions and adjacent or related new construction will be undertaken in such a manner that, if removed in the future, the essential form and integrity of the historic property and its environment would be unimpaired.

6. Each property will be recognized as a physical record of its time, place, and use. Changes that create a false sense of historical development, such as adding conjectural features or elements from other historic properties, will not be undertaken.

7. Changes to a property that have acquired historic significance in their own right will be retained and preserved.

8. Distinctive materials, features, finishes, and construction techniques or examples of craftsmanship that characterize a property will be preserved.

9. Deteriorated historic features will be repaired rather than replaced. Where the severity of deterioration requires replacement of a distinctive feature, the new feature will match the old in design, color, texture, and where possible, materials. Replacement of missing features will be substantiated by documentary and physical evidence.

10. Chemical or physical treatments, if appropriate, will be undertaken using the gentlest means possible. Treatments that cause damage to historic materials will not be used.

The Gam Building in New London's Ocean Beach Park (1940, SR) is one of more than 4,000 designated historic properties in flood hazard zones along Connecticut's shore. Credit: Douglas Royalty/SHPO.

V. THE CLIMATE CHALLENGE

Climate trends already have exacerbated the environmental stresses on Connecticut's buildings. The state is experiencing precipitation of greater intensity, temperature ranges of greater extremes, rising seas, ocean acidification, and the invasion of vegetation and insects historically associated with more southerly zones (United States Department of Agriculture [USDA] 2018:6). These stresses create conditions for the accelerated deterioration of historic buildings. Understanding how they contribute to building deterioration is the first step in identifying solutions.

The United Nations Educational, Scientific, and Cultural Organization (UNESCO), which recognizes World Heritage Sites of cultural or natural importance, has identified two major and often overlapping categories of threats to historic buildings from climate change: those from hazard events and those associated with climate trends.

Major storms can cause immediate and catastrophic damage or loss of heritage resources. Sea level rise may be accompanied by increased erosion, more frequent flooding, and coastal and riverine inundation. These phenomena pose structural threats to historic properties. Deterioration of historic building fabric from new or intensified environmental stresses is a slower process that accelerates over time.

Blistering or peeling paint, as at the Fayerweather Lighthouse in Bridgeport (1823, NR), indicates trapped moisture—in this case, at least partly the result of infiltration from a cracked lantern slab atop the brick corbelling. Credit: Douglas Royalty/SHPO.

Historic Buildings and Environmental Stress

Owners of historic properties generally recognize the benefits of routine building maintenance; in many cases, proactive maintenance has avoided severe and costly damage. Owing to their unique design, materials, and construction, historic buildings are particularly vulnerable to environmental stresses posed by climate change.

Buildings are not static. For example, they respond to seasonal changes in temperature and humidity—within limits. Most historic buildings respond to normal patterns of change over the seasons. One simple example: a floorboard that contracts and creaks in the winter when the building is heated and interior humidity is low. In the spring, as humidity rises and the floorboard expands, the creaking disappears.

Threats to historic properties from hazard events include:

- ***Shore erosion as a result of storm surge***
- ***Building inundation related to flooding and storm surge***
- ***Building destruction and structural damage associated with storm winds***
- ***Building destruction from fire***

Threats associated with climate trends include:

- ***Building inundation related to sea level rise***
- ***Cyclical flooding as a result of sea level rise and rising water tables***
- ***Building deterioration related to changes in precipitation, temperature, and wind***
- ***Building deterioration associated with increased temperature and ocean acidification***
- ***Oxidation, such as rust, from increased atmospheric moisture***
- ***Building deterioration from temperature extremes***
- ***Invasion from insects, vegetation, and molds***

Henry Whitfield House (1639, NR, NHL), a stone masonry building near the shore in Guilford, is owned and operated as a museum by the State of Connecticut. Credit: Carol M. Highsmith (ca. 1980), Library of Congress.

Climate change is introducing new seasonal stresses on historic buildings. Individual buildings will respond differently to these stresses based on their design, condition, and materials. Historic buildings vary in materials and technologies. For example, the materials and building methods used in the Henry Whitfield House in Guilford (1639, NR, NHL), a stone building, differ dramatically from those found in the twentieth century Cape Cod and ranch houses that contribute to the Westbrook Town Center National Register Historic District. **Regional building techniques and traditions that have evolved in response to historic conditions over time may not be as responsive to current and projected conditions.** Another danger to historic buildings is that additional stresses related to climate change may accelerate the rate of building deterioration. Deterioration left unchecked only accelerates.

After Superstorm Sandy damaged the roof of a historic house in Greenwich, water infiltrated the building. Left unattended, such damage can lead to mold or even weaken the structure. Credit: Greenwich Historical Society.

Moisture Content

High moisture content leads to loss of strength in wood and affects the integrity of masonry. The presence of water in a building supports bio-deterioration from fungi, molds, insects, and vegetation, all of which need moisture to survive. And water can move through building materials as the result of capillary action, potentially depositing destructive soluble minerals and salts during evaporation.

Water is the Enemy

Water is the common denominator in the new environmental threats to historic buildings. Although not a new stress to historic buildings in Connecticut, climate change intensifies the threat of moisture damage. More and more severe storms, with intense precipitation coupled with high winds, increase the destructive power of water. This acceleration can lead to faster erosion of building materials and breaches in building envelopes.

Aside from dealing with flooding associated with storm surge and sea level rise, property owners must control moisture from three major sources—*surface water*, *groundwater*, and *condensation*. (Failing building systems, such as leaking pipes, blocked drainage systems, drainage from air-conditioning condensers, and sprinkler systems and water taps that drain into a building, also contribute to problems of internal water infiltration.)

Leaking pipes can create environments that support mold and other vegetation. Credit: RCG&A.

Surface water is a probable source of moisture in buildings whose foundations rise above the high-level mark of the water table. Damp walls are more likely with rising water tables and storms of greater intensity and frequency. Surface water can penetrate a building envelope from failed gutter systems and through site conditions that direct water into the foundation. Roof design can also contribute to water problems: Water channeled by roof eaves can create a trench around the perimeter of the foundation and seep into the building.

Site conditions can direct water into building foundations, resulting in deterioration. Credit: RCG&A.

Sprinkler systems can unintentionally direct water toward a building foundation. Credit: RCG&A.

Historically, moisture in exterior walls from precipitation would evaporate naturally during dry periods. Heavy, wind-driven, and prolonged precipitation associated with climate change can force moisture deeper and more widely into building materials and prolong the evaporation process. Open joints between architectural elements and cracks and fissures in historic materials provide avenues for water to migrate deep into a building during heavy rains.

Surface water frequently leaves an irregular pattern of staining, known as a high-tide mark, on a wall's surface. A regular pattern more often is associated with rising damp from groundwater or from splash-back, in which water is redirected into the building or onto the building face after hitting the ground. Splash-back from sidewalks, patios, or other hard surfaces can saturate a building's foundation and face. With climate change, greater volumes of water will be directed toward the building.

Groundwater is surface water that seeps into the ground and collects over impervious layers in the earth. Groundwater levels are controlled by the subterranean water table, which rises and falls with seasonal variation in rainfall.

The water table is defined as the highest water-saturation point below grade. During heavy rainfalls the level of the water table can match the level of the saturated ground surface. When this saturation point is reached, groundwater migrates to fill subsurface voids such as basements. This migration over time can accelerate the erosion of mortar from masonry foundation walls as well as force water into the building.

Repeated water infiltration can erode lime mortars and deposit salts during evaporation. Credit: RCG&A.

As groundwater migrates into the basement of a historic building, it carries salts from the soil. Concentrated salts are deposited in the lower building wall and attract greater moisture levels, while soluble salts migrate to the outer wall face as water evaporates. Salt crystals form in masonry foundation walls and over time can deteriorate the masonry unit.

Wind-driven water poses greater physical threats to historic buildings. Wind can force moisture into a building's interior. It can accelerate the erosion of external materials and can contribute to the further deterioration of building materials through rapid moisture evaporation if crystallized salts are trapped in the interior of walls.

Condensation occurs when water vapor in the air comes in contact with materials that are lower in temperature than the dew point. When moist air reaches its dew point, it condenses in liquid form. Condensation forms on the coldest surface available. These materials have the highest density and thermal conductivity.

Uninsulated pipes can create humid conditions that support mold. Credit: RCG&A.

Condensation can occur on the surface or within the wall. Surface condensation is caused by a combination of high relative humidity and low surface temperatures. Interior building systems and their use can affect humidity levels. Humidity problems are aggravated by poor ventilation. Interstitial condensation occurs when the temperature reaches the dew point in the interior of the wall. Interstitial condensation may involve the transport of soluble salts to the surface area, since water naturally mitigates to areas with a lower moisture content. This type of internal condensation is potentially more dangerous than surface condensation, since it can go undetected and result in serious damage.

Masonry buildings may or may not be painted. However, if painting or repainting a brick or stone building, be sure to use a vapor-permeable coating. Credit: Douglas Royalty/SHPO.

VI. MEETING THE CHALLENGE: BUILDING MAINTENANCE

Unfortunately, no one measure is likely to protect your property from climate change. Historic buildings and their environments are unique, and the rates of change in climate and weather patterns are uncertain. Supplementing seasonal maintenance with additional targeted maintenance may be critical. A three-step process is recommended:

1. Assemble data and regularly survey your building for maintenance problems.

2. Develop and execute solutions consistent with the appropriate standards and guidelines.

3. Monitor completed work to make sure that the problem has been corrected.

Assemble Data

- Check with your municipal planning office and/or the SHPO for data on your building that may be available from architectural surveys and historic designations. Helpful information may include descriptions of historically important architectural features, a history of the property, and an assessment of its significance. If your building is not listed in the State or National Register of Historic Places, consider the advantages of nomination. The registers are planning tools for historic properties, and listing may be a requirement for historic rehabilitation tax incentives or targeted preservation grants.

- Thoroughly photograph the exterior and interior of your building. The photos can help guide maintenance work on specific architectural elements, support insurance claims, and support applications for grants and preservation programs, as available.

- Know the standards and design guidelines that govern work on your building. Work on locally designated historic buildings and those within local historic districts generally must comply with local historic design guidelines. Federal and state historic preservation tax incentive programs and preservation grant programs will require that work is consistent with the Secretary of the Interior's *Standards for Rehabilitation*. While "routine maintenance" may be excluded from formal review, knowing how that term is defined and the limits of such work under the standards and guidelines is important.

- Assemble copies of other important papers for quick reference. These may include, but are not limited to, insurance policies, warranties, and contact information for trusted companies and craftspeople who have worked on your building.

- Research preservation contractors experienced in work on historic buildings as a resource for future work.

- Keep apprised of weather forecasts and plan accordingly. Close windows and doors. Secure garden furniture and potential storm projectiles. Keep mops, buckets, and other supplies on hand.

- Survey the interior and exterior of your building after minor storms and extreme changes in weather to identify failing systems and symptoms of possible damage. Symptoms indicating that work may be required include standing water or water stains, blocked or twisted gutter systems, unusually damp foundation walls, sand at the base of walls indicating failing masonry mortar; cracked or broken shingles and slates; rust stains on metal roofs; tree damage, damage related to ice dams; etc. Document problems with pictures.

Effective gutter and downspout systems can avoid cornice and raking board deterioration. Credit: RCG&A.

Develop and Execute Corrective Action

- Adopt and implement a seasonal building inspection and maintenance program, if you have not done so already. (See Appendix I, Historic Building Seasonal Checklist.)

- Add professional inspections by pest control companies to your routine building maintenance cycle to identify and treat potential infestations as early as possible.

- Develop plans for corrective action in accordance with the Secretary of the Interior's *Standards for Rehabilitation*. (See Resource Guide).

- Triage damage identified during regular surveys. Identify work that is beyond your skill set as a building owner and call a professional experienced in working on historic buildings.

- Apply for required approvals, such as building permits, Certificates of Appropriateness, etc., prior to executing work.

- Execute work.

Ensure That Maintenance Work Has Corrected the Problem

- Inspect the work area once work is completed. Document work with photographs.
- Monitor the area for symptoms of continuing failure after weather events.
- Consider more aggressive solutions, as appropriate.

Develop a Five-Year Plan

Routine and supplemental maintenance work likely will identify systems and components that are nearing their life expectancy despite your best maintenance efforts. Roof cladding, masonry mortar, paint, and building trim may be among the building elements requiring greater repair and possible replacement "in kind." Advance planning for more major work generally is easier and more cost-effective than emergency projects. Consider a five-year plan to schedule and prioritize work. Such a plan will allow time to research products and companies, gather estimates from several sources, arrange financing, applying for approvals and permits, coordinate with your neighbors, and stage work for the least degree of stress and disruption.

After Superstorm Sandy, contractors installed helical piles to anchor the Old Barn at Greenwich Point (1887), which had been knocked off its foundation. Credit: Christopher Franco/Greenwich Point Conservancy.

Assessing Building Conditions

Maintenance solutions address visible damage and the conditions leading to that damage. Visible damage frequently is a symptom of an underlying condition that, left unchecked, may lead to more severe problems. Maintenance work that repairs cosmetic damage without eliminating its cause will be temporary at best and may actually accelerate building deterioration by masking more severe conditions.

Assessing conditions in a historic building is a two-step process. The first step identifies deteriorated building fabric, which is often a symptom. The second isolates the cause of the problem. Prioritize correction of the underlying cause of the problem, monitor the exterior damage to make sure that the condition has been corrected, then repair the affected element. This approach takes more time, but generally is more effective and less costly.

Be cautious and anticipate the long-term effects of proposed solutions. Consider reversibility and work requiring the least amount of building intervention. This year's magic goop for waterproofing may be next year's conservation challenge, as waterproof coatings can trap water within building walls and create future problems.

VII. MEETING THE CHALLENGE: MITIGATION

Depending on the design and location of your building, routine and supplemental maintenance may not adequately address the effects of climate change. Historic buildings were designed to withstand historic climatic conditions. Those conditions are changing, and additional measures to reduce, or mitigate, the effects of current conditions may be needed.

The objective of mitigation is to supplement existing historic building systems and to increase the building's ability to withstand environmental change. Mitigation measures vary in scale and complexity. Such measures often address a reoccurring problem, such as condensation caused by high interior humidity or interior seepage of surface water during routine storms.

Historic buildings are distinctive, and mitigation measures will depend on the type and severity of the problem. Any mitigation measure considered should preserve the historic building design, be as reversible as possible, and comply with relevant preservation standards and design guidelines.

Mitigation often supports historic building preservation in four major categories:

- Measures designed to address problems associated with flooding;
- Measured designed to address problems associated with increased precipitation;
- Measures designed to address problems with wind;
- Measures designed to address problems associated with extremes in temperature; and
- Measures designed to increase sustainability and energy efficiency.

Storms in Connecticut

Straight-line wind storms ***are common year-round. Speeds range from very low to very high.***

Thunderstorms ***typically occur during spring and summer. They form rapidly and produce high wind speeds and, often, heavy rain. They can spawn tornadoes and hail storms.***

Nor'easters ***typically occur in winter. These cyclonic storms produce heavy snow, rain, high waves, and wind and can last for several days.***

Hurricanes ***typically occur in summer and fall. They are systems of spiraling winds converging with increasing speed toward a storm's center, with forward movement ranging from 5 miles per hour to more than 25 miles per hour. They can deliver extremely strong winds for several hours, often with heavy rainfall. Occasionally they spawn tornadoes.***

Flood Mitigation

As discussed in Chapter V (The Climate Challenge), water is a primary source of problems in historic buildings in an era of climate change. Whether the result of major storm events, rising sea levels, or changes in weather patterns and the environment, many conservation issues in historic buildings can be traced to water. Flooding is a common problem addressed through mitigation measures. Four factors are considered in selecting the best mitigation measure for flood protection:

- Anticipated flood depths. Low depths are unlikely to put people at risk, but buildings and their contents may be damaged without flood protection. High-water depths may threaten the safety of people and may cause extensive damage to buildings.

Houses up and down Connecticut's shoreline were damaged during Superstorm Sandy after floodwaters entered basements, porches, and ground floors. Credit: SHPO file photo.

- Anticipated flood duration. Temporary flood defenses may keep water out if flooding is expected to last for a few hours. Longer durations allow water to penetrate into the building and may result in significant damage.
- Anticipated flood onset. Short-onset flooding (flash flooding) is particularly dangerous, since there is little warning to evacuate or protect buildings.
- The probability of flooding. Different approaches to flood protection may depend on the likelihood of flooding.

Flood mitigation boils down to two types of strategies: those that keep water out of a building and those that allow water to travel through a building

Mitigation measures are tailored to the expected type of flooding event and the severity of the threat. When such measures are applied to the preservation of historic properties, the architectural character of the building also is considered in designing mitigation.

Two types of flood mitigation are most common: (1) those designed to keep water out of a building, known as a *resistance strategy or dry floodproofing*, and (2) those that reduce flood damage by allowing water to travel through the building, known as a *resilience strategy* or *wet floodproofing*. Both types of mitigation can include temporary systems or permanent alterations.

Private industry is responding to the demand for flood resistance and resilience with the development of new and innovative products. Property owners are encouraged to research the latest products in selecting the best solution for your specific problem.

What is BFE (Base Flood Elevation)?

A Base Flood Elevation (BFE) is the computed elevation to which floodwater is anticipated to rise during a flood. FEMA uses historical flood data to develop Flood Insurance Rate Maps (FIRMs). FIRMs divide the floodplain into zones based on susceptibility to flooding, and regulations are imposed in Special Flood Hazard Areas (SFHAs). SFHAs are high-risk areas that would be inundated by base-flood levels.

For properties in SFHAs, the minimum conditions include requiring permits for new and substantially improved development to include elevating the lowest floor of all buildings to or above the BFE. The elevation requirement can be met by raising structures on fill, piles, post, piers, columns, walls, or a crawlspace. The space below the BFE is limited to parking, building access, and storage. Any openings may be covered only by devices that permit the automatic entry and exit of floodwaters. Historic properties typically are exempt from these regulations, unless they have been altered.

Resistance strategies include:

- Construction of permanent infrastructure to direct water away from buildings. Such measures include drainage systems leading to catchment areas, restoration of wetlands for natural buffers, seawalls, and levee systems. These measures are most often major public projects undertaken on a municipal or regional level.
- Construction of permanent on-site barriers to prevent water from entering the structure. Such barriers include earthen berms, site levees, and water-resistant retaining walls.
- Deployment of temporary barriers to prevent water from entering buildings. This technique ranges from sandbagging water access points to the periodic installation of prefabricated barriers designed to reinforce typical water access points such as doors and windows.
- Permanently sealing water access points such as basement doors and windows.
- Modifying the design of water access points to repeal water. This technique includes such measures as the installation of exterior bulkheads over open cellar stairwells or infilling basements.

Most property owners employ mitigation measures that are resilience strategies. These are intended to allow water to enter and exit a building while safeguarding building systems and contents. Resilience strategies include:

- Creating a path for water through the building. Such measures may include the addition of open storm vents in the foundation, the installation of sump pumps, and the addition of floor drains. More aggressive measures include sacrificing and retrofitting the first story of the building as a flood path or elevating a building to allow water to move under the structure. These measures have the potential to impact the integrity of historic resources and require careful planning and design.
- Elevating or floodproofing HVAC and/or mechanical units, ductwork, electrical systems, and other utilities above the Base Flood Elevation (BFE) to protect against flood damage and reduce repair costs.
- Replacing non-historic building finishes on lower levels of your building with flood-resistant materials. Such measures may include replacing carpeting with tile or installing flood-resistant insulation and gypsum wallboard (sheetrock).
- Anchoring fuel tanks to the floor and making sure vents and fill line openings are above the BFE. (This may require permission from your fuel provider.) Fuel tanks can tip over and float in a flood, resulting in fuel spills and fire hazards.

- Installing backflow valves on sewer systems to prevent sewage backup in the building.

- Relocating or elevating storage systems above anticipated water levels .

Precipitation Change Mitigation

Increased volume and intensity of precipitation may overwhelm historic systems. Mitigation measures to augment these systems include:

- Installing larger gutters and downspouts to accommodate increased volumes of water.

- Installing additional sub-grade drainage systems, such as French drains, to direct water away from buildings.

- Modifying hardscape surrounding the building to control or eliminate splash-back onto the face of the building.

- Correcting drainage on architectural elements where water and snow may collect, melt, and saturate horizontal surfaces, and refreeze. This pattern often occurs at the top courses of brick chimneys, on brick window sills, and on masonry fences. Consider minor design modifications or the addition of a cap course to slant surfaces to direct water away from the element.

Winds from Superstorm Sandy damaged the slate tile roof of the Mary Moody House (a.k.a. Chetstone; 1875, NR), a Victorian Gothic mansion in New Haven's Fair Haven Heights section. Credit: Ian Christmann.

Wind Mitigation

High winds can damage historic buildings anywhere in Connecticut. Factors to consider in determining a building's vulnerability to wind damage include site location, construction type, and history of wind events in the area. Mitigation measures against wind damage can include:

- Establishing windbreaks away from the building, if site size allows.
- Anchoring lawn and street furniture to eliminate the potential for flying projectiles.
- Reinforcing garage doors and double-entry doors to prevent failure under wind pressure. Garage doors can be reinforced with girts and by strengthening the gilder wheel tracks. Double-entry doors can be reinforced with a heavy-duty deadbolt, adding slide bolts on one of the doors, and using longer hinge attachments on doors and frame.
- Adding wood bracings to reinforce gable-end roofs, which are more susceptible to high wind damage than other roof types.
- Installing hurricane shutters to protect windows and glass doors.
- Installing hurricane straps to anchor the roof to the building walls.

Temperature Change: Mitigation

Temperature extremes are accompanying changes in weather patterns. Extremes in heat and cold affect historic buildings over time; shorter weather cycles with greater differences between high and low temperatures cause additional stresses on historic fabric. Temperature is one factor that can promote the invasion of vegetation, fungus, molds, and wood-boring insects. Mitigation measures to address temperature change include:

- Ventilating enclosed areas such as basements, crawlspaces, and attics to eliminate excessive humidity. Mitigation will vary depending on conditions and can include such measures as the installation of vents to encourage air flow, installation of exhaust fans that vent to the exterior of the building, and installation of humidifiers and/or dehumidifiers to regulate moisture levels.
- Renewing seals on door and window openings to control condensation from interior and exterior temperature differentials.
- Renewing plumbing seals. Pipe sealants most often fail at the point where plumbing exits the building.
- Installing covers and caps on air-conditioner condensers to prevent water infiltration. In extreme temperatures, water inside units can freeze, causing damage.

Rooftop solar arrays can be compatible with historic preservation standards, as at the Eli Whitney Boarding House in Hamden (1827, NR), the headquarters of the Connecticut Trust for Historic Preservation. Credit: Douglas Royalty/SHPO.

Mitigation: Sustainability and Energy Efficiency

Energy production and consumption are the greatest sources of global greenhouse gas emissions (World Resources Institute). Residential buildings alone account for approximately 25 percent of the energy consumed in the United States (American Council for an Energy Efficient Economy).

Although energy efficiency rarely was a priority at the time of construction, historic buildings often considered the environment in their designs through such features as directional orientation for light and cross-ventilation. With planning, the sustainability and energy efficiency of the majority of historic building can be improved by applying contemporary technologies in projects consistent with the Secretary of the Interior's *Standards for Rehabilitation & Illustrated Guidelines on Sustainability for Rehabilitating Historic Buildings*.

Such technologies should augment historic features, such as thick walls, light-reflecting finishes, operable windows and shutters, vents, awnings, and porches, to improve the effectiveness of the building as a system. Energy efficiency often can be increased through a series of small projects to progressively improve a building's energy footprint. Generally, the major point of energy loss in historic buildings is an uninsulated attic; leaking windows are another.

Sustainability and energy-efficiency mitigation measures include:

- Undertaking a whole building energy audit to identify sources of energy consumption and determine ways to decrease consumption. Be sure to hire professionals knowledgeable in historic buildings and experienced in solutions that will retain and complement historic fabric. Prioritize the audit's recommendations into immediate, interim, and long-term projects, and integrate the projects into your maintenance plan. Be sensitive to potential safety hazards, such as asbestos. Retain a licensed professional to abate hazardous materials.

- Implementing simple measures, such as closing blinds, curtains, or shades and using draft-snakes at the base of exterior doors, to increase energy efficiency.

- Considering energy ratings when replacing appliances such as refrigerators and water heaters.

- Reducing air infiltration into the building and the migration of heated or cooled air from the building. Gaps, cracks in foundations, walls, roofs, doors, windows, open fireplace chimneys, and small holes in attic floors can contribute to energy loss.

- Installing insulation, starting in the attic, which can reduce energy costs by as much as 50 percent. Pay particular attention to ventilation. If insulation is installed without appropriate air seals and ventilation, it can become damp and lose its effectiveness. Damp or wet insulation can also support mold growth and/or trap moisture, which leads to structural damage. Appropriate insulation in key locations—attic spaces, crawlspaces, basements, surrounding heating/cooling ducts, and surrounding water pipes—provides the greatest energy benefit with the lowest risk of damage.

- Prioritizing window repair for energy efficiency. Leaking windows can account for up to 15 percent of a building's energy loss; the U.S. Department of Energy estimates that deteriorated windows can be responsible for up to 25 percent of heating or cooling bills. Original windows contribute substantially to the design of historic buildings. They are likely constructed of high-quality materials that are no longer available. Windows that predate ca. 1950 were built from old-growth wood, which is denser, more rot- and warp-resistant, and holds paint better than modern wood. Repairing historic windows generally is more cost-effective than replacement and can achieve the same level of energy efficiency. Consider adding storm windows to supplement historic windows. The design of storm units should not detract from or obscure the design of historic windows.

Even the most neglected windows often can be repaired and made as energy efficient as new windows. Credit: RCG&A.

Connecticut Green Bank

The Connecticut Green Bank, the nation's first "green bank," aims to accelerate the deployment of clean energy by leveraging public funds to attract private investment in clean energy projects. As a result, it makes clean energy more affordable and accessible to consumers. Established by the Legislature in 2011, the Connecticut Green Bank supports the state's goal of achieving cleaner, less expensive, and more reliable sources of energy while creating jobs and supporting local economic development (Public Act 11-80). The Connecticut Green Bank's programs for homeowners include loans for energy-efficiency upgrades and rebates for solar installations. For more information, see www.ctgreenbank.com/programs/homeowners.

- Considering upgrades to heating and cooling systems. Investigate a combination of solutions and approaches, such as zoning and on-demand heating and cooling. Consider the impact of ductwork and heating vents in character-defining interior fabric.

- Considering renewable energy sources such as solar. Solar collectors often can be added to secondary roof slopes with minimal impact to the design of the principal elevation of an historic building.

How high can a building go before it loses its integrity? Can well-designed entries and porches, screens, and landscaping mitigate the potential impact of elevation? The answers are often unclear. Credit: SHPO file photo.

VIII. BEYOND MAINTENANCE AND MITIGATION

Supplemental maintenance and additional mitigation measures can minimize the effects of climate change to many historic buildings. However, major storm events and rising sea levels may force some property owners to consider other adaptation measures. Unfortunately, these measures, which include major building elevation, moving, and retreat, may require the substantial modification or even the loss of historic buildings. Sadly, consideration of these adaptation measures may be necessary for safety in high hazard areas.

Elevating a house after Superstorm Sandy. Credit: RCG&A.

Elevating a structure can affect the building's design and its relationship to its setting. Such changes can cause a building to lose its historic integrity

Building elevation is among the most controversial and debated topics in historic preservation. The strategy, which elevates a structure above the BFE, can affect the design of a building and its relationship to its setting. These changes can be substantial enough for a building to lose its historic integrity. Retaining a building's historic integrity while elevating it sufficiently to provide flood protection can present conflicting priorities. Preservation seeks to minimize alterations to building scale, design, workmanship, materials, and setting, while elevation, as an adaptation measure, often requires changes in height, design, and site relationship to be effective. Despite these challenges, historic buildings have been successfully elevated with minimal loss of historic integrity. Elevation projects are evaluated on a case-by-case basis, and standardized approaches appropriate for non-historic buildings likely will not be successful in minimizing impacts. Seeking technical assistance from the SHPO during the preliminary planning stages of any elevation project is strongly recommended.

Sites for moved structures should be selected to replicate the historic relationship between building and site as closely as possible. Credit: RCG&A.

Moving a historic building generally is not a preferred preservation strategy. However, relocating a building from an area of extreme hazard to ensure its preservation may be an option to consider. Recreating the relationship between the building and its original site in a context similar to its original setting is key. Moving a building is a major undertaking that requires substantial planning and exacting staging. Research, site preparation, building preparation, and post-move rehabilitation are critical to success.

With increased storm surge and sea level rise, circumstances may warrant retreat in areas of severe vulnerability and/or land loss. Retreat and the abandonment of historic buildings due to climate change may be options in the future based on the availability of resources, the relative significance of the resource, and community resiliency priorities. Historic properties have been lost in the past as a result of storms, redevelopment, and transportation improvements. In such cases, creating an archival record documenting these resources assumes greater significance to future generations.

The William D. Bishop Cottage Development Historic District in Bridgeport's South End (1880–81, NR) is an early planned worker housing development in the city—and an environmentally vulnerable historic resource. Credit: Douglas Royalty/SHPO.

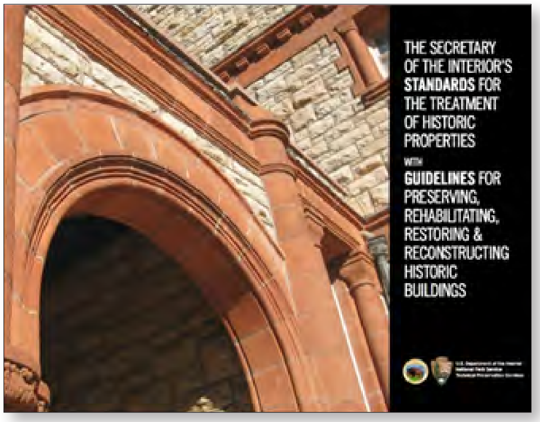
IX. CONCLUSION

Accelerating climate and weather pattern changes are introducing new stresses to our state's historic buildings, posing greater challenges to historic property owners. In addition to major storm events and rising sea level, increased volumes and intensity of precipitation, winds of greater velocity, and extremes in temperature are now routine threats to Connecticut's heritage resources. Supplemental maintenance with the addition of mitigation measures can preserve historic buildings. Adaptation measures are last options.

Preservation of historic buildings is a vitally important subset of climate change concern. Preservation of historic buildings can unify communities as state and local governments and citizens work to make Connecticut climate-resilient and climate-resistant.

RESOURCE GUIDE

The National Park Service has developed a substantial body of work on historic preservation practices and building conservation. The following publications can help property owners meet both traditional maintenance needs and the new challenges associated with climate change.



The Secretary of the Interior's *Standards for the Treatment of Historic Properties with Guidelines for Preserving, Rehabilitating, Restoring & Reconstructing Historic Buildings* (2017)

www.nps.gov/tps/standards/rehabilitation.htm

National Park Services Technical Preservation Notes

www.nps.gov/tps/how-to-preserve/tech-notes.htm

Doors

1. *Historic Garage and Carriage Doors: Rehabilitation Solutions*. Bonnie Halda, AIA. 1989.

Exterior Woodwork

1. *Proper Painting and Surface Preparation*. Sharon Park, AIA. 1986.
2. *Paint Removal from Wood Siding*. Alan O'Bright. 1986.
3. *Log Crown Repair and Selective Replacement Using Epoxy and Fiberglass Reinforcing Bars.* Harrison Goodall. 1989.
4. *Protecting Woodwork Against Decay Using Borate Preservatives.* Ron Sheetz and Charles Fisher. 1993.

Finishes

1. *Process-Painting Decals as a Substitute for Hand-Stenciled Ceiling Medallions.* Sharon Park, FAIA. 1990.

Historic Glass

1. *Repair and Reproduction of Prismatic Glass Transoms*. Chad Randl. 2002.
2. *Repair and Rehabilitation of Historic Sidewalk Vault Lights.* Cas Stachelberg and Chad Randl. 2003.

Historic Interior Spaces

1. *Preserving Historic Corridors in Open Office Plans*. Christina Henry. 1985.
2. *Preserving Historic Office Building Corridors.* Thomas Keohan. 1989.
3. *Preserving Historic Corridor Doors and Glazing in High-Rise Buildings.* Chad Randl. 2001.

Masonry

1. *Substitute Materials: Replacing Deteriorated Serpentine Stone with Pre-Cast Concrete.* Robert M. Powers. 1988.
2. *Stabilization and Repair of a Historic Terra Cotta Cornice.* Jeffrey Levine and Donna Harris. 1991.
3. *Water Soak Cleaning of Limestone*. Robert M. Powers. 1992.
4. *Non-destructive Evaluation Techniques for Masonry Construction.* Marilyn E. Kaplan, Marie Ennis and Edmund P. Meade. 1997.

Mechanical Systems

1. *Replicating Historic Elevator Enclosures*. Marilyn Kaplan, AIA. 1989.

Metals

1. Conserving Outdoor Bronze Sculpture. Dennis Montagna. 1989.
2. Restoring Metal Roof Cornices. Richard Pieper. 1990.
3. In-kind Replacement of Historic Stamped-Metal Exterior Siding. Rebecca A. Shiffer. 1991.
4. Rehabilitating a Historic Iron Bridge. Joseph P. Saldibar, III. 1997.
5. Rehabilitating a Historic Truss Bridge Using a Fiber-Reinforced Plastic Deck. Chad Randl. 2003.
6. Repair and Reproduction of Metal Canopies and Marquees with Glass Pendants. Lauren Van Damme and Charles E. Fisher. 2006.

Museum Collections

1. *Museum Collection Storage in a Historic Building Using a Prefabricated Structure.* Don Cumberland, Jr. 1985.
2. *Reducing Visible and Ultraviolet Light Damage to Interior Wood Finishes*. Ron Sheetz and Charles Fisher. 1990.

Site

1. *Restoring Vine Coverage to Historic Buildings*. Karen Day. 1991.

Temporary Protection

1. *Temporary Protection of Historic Stairways*. Charles Fisher. 1985.
2. *Specifying Temporary Protection of Historic Interiors During Construction and Repair*. Dale H. Frens. 1993.
3. *Protecting A Historic Structure during Adjacent Construction.* Chad Randl. 2001.

Windows

Please note that 1–9 are available only in The Window Handbook: Successful Strategies for Rehabilitating Windows in Historic Buildings, which can be purchased through the Historic Preservation Education Foundation.

1. *Planning Approaches to Window Preservation.* Charles Fisher. 1984.
2. *Installing Insulating Glass in Existing Steel Windows.* Charles Fisher. 1984.
3. *Exterior Storm Windows: Casement Design Wooden Storm Sash*. Wayne Trissler and Charles Fisher. 1984.
4. *Replacement Wooden Frames and Sash*. William Feist. 1984.
5. *Interior Metal Storm Windows*. Laura Muckenfuss and Charles Fisher. 1984.
6. *Replacement Wooden Sash and Frames With Insulating Glass and Integral Muntins*. Charles Parrott. 1984.
7. *Window Awnings*. Laura Muckenfuss and Charles Fisher. 1984.
8. *Thermal Retrofit of Historic Wooden Sash Using Interior Piggyback Storm Panels.* Sharon Park, AIA. 1984.
9. *Interior Storm Windows: Magnetic Seal.* Charles Fisher. 1984.
10. *Temporary Window Vents in Unoccupied Historic Buildings.* Charles Fisher and Thomas Vitanza. 1985.
11. *Installing Insulating Glass in Existing Wooden Sash Incorporating the Historic Glass.* Charles Fisher. 1985.
12. *Aluminum Replacements for Steel Industrial Sash*. Charles E. Fisher. 1986.
13. *Aluminum Replacement Windows with Sealed Insulating Glass and Trapezoidal Muntin Grids.* Charles Parrott. 1985.
14. *Reinforcing Deteriorated Wooden Windows.* Paul Stumes, P.Eng 1986.
15. *Interior Storms for Steel Casement Windows*. Charles E. Fisher and Christina Henry. 1986.
16. *Repairing and Upgrading Multi-Light Wooden Mill Windows*. Christopher W. Closs. 1986.
17. *Repair and Retrofitting Industrial Steel Windows*. Robert M. Powers. 1989.
18. *Aluminum Replacement Windows With True Divided Lights, Interior Piggyback Storm Panels, and Exposed Historic Wooden Frames*. Charles Parrott. 1991
19. *Repairing Steel Casement Windows*. Chad Randl. 2002.
20. *Aluminum Replacement Windows for Steel Projecting Units with True Divided Lights and Matching Profiles*. Chad Randl. 2003.
21. *Replacement Wood Sash Utilizing True Divided Lights and an Interior Piggyback Energy Panel.* Charles E. Fisher. 2008.
22. *Maintenance and Repair of Historic Aluminum Windows.* Kaaren R. Staveteig.

FOR PRESERVATION ASSISTANCE

Connecticut State Historic Preservation Office 450 Columbus Boulevard, Suite 5, Hartford, CT 06103 (860) 500-2360	*Connecticut Trust for Historic Preservation* 940 Whitney Avenue, Hamden, CT 06517 (203) 562-6312
Connecticut Main Street Center PO Box 270, Hartford, CT 06141 (860) 280-2337	*National Trust for Historic Preservation* 2600 Virginia Avenue NW, Suite 1100, Washington, DC 20037 (202) 588-6000 info@savingplaces.org
Greenwich Preservation Trust PO Box 4719, Greenwich, CT 06831 (203) 661-6343 info@greenwichpreservationtrust.org	*Hartford Preservation Alliance* 56 Arbor Street, Suite 406, Hartford, CT 06106 (860) 570-0331 info@hartfordpreservation.org
Milford Preservation Trust PO Box 5343, Milford, CT 06460	*New Haven Preservation Trust* 922 State Street, New Haven, CT 06511 (202) 562-5919 info@nhpt.org
New London Landmarks 49 Washington Street, New London, CT 06320 (860) 442-0003 director@newlondonlandmarks.org	*Norwalk Preservation Trust* PO Box 874, Norwalk, CT 06852 (203) 852-9788 info@norwalkpreservation.org

APPENDIX I

Property Maintenance: A Seasonal Checklist

<u>Exterior</u>

- ☐ *Clear Gutters and Downspouts*
- ☐ *Inspect All Exterior Walls for Symptoms of Water Infiltration*
- ☐ *Inspect Roof and Roof Flashing*
- ☐ *Inspect Property for Potential Infestation*
- ☐ *Inspect Heating and Cooling Systems*

  Tip: Inspect heating system in late summer or early fall before heating season begins. Similarly, inspect cooling system in late winter or early spring before cooling season begins.
- ☐ *Drain and Winterize Exterior Plumbing (seasonal)*
- ☐ *Check Gutter and Downspouts (seasonal)*
- ☐ *Inspect Landscaping for tree limbs that may pose a danger during rain storms and site grading to Ensure Water is Traveling Away from House (seasonal)*
- ☐ *Inspect Siding and Repair or Replace as Needed (annual)*
- ☐ *Seal Cracks and Gaps in Windows and Doors (annual)*

<u>Interior</u>

- ☐ *Check for Frayed Cords and Wires (seasonal)*
- ☐ *Inspect Crawl Space and Attic for Moisture (seasonal)*
- ☐ *Inspect for Signs of Insect Infestation (seasonal)*
- ☐ *Check for Signs of Water Damage Throughout House (annual)*

  Tip: After heavy rains, be alert for wet or damp areas throughout your house. This may help you discover early water damage.
- ☐ *Replace Batteries in Smoke and Carbon Monoxide Detectors (annual)*
- ☐ *Inspect Fireplace; Hire Professional (annual)*
- ☐ *Check your water heater and hoses on the clothes washer, refrigerator, and dishwasher for cracks and bubbles (annual)*

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