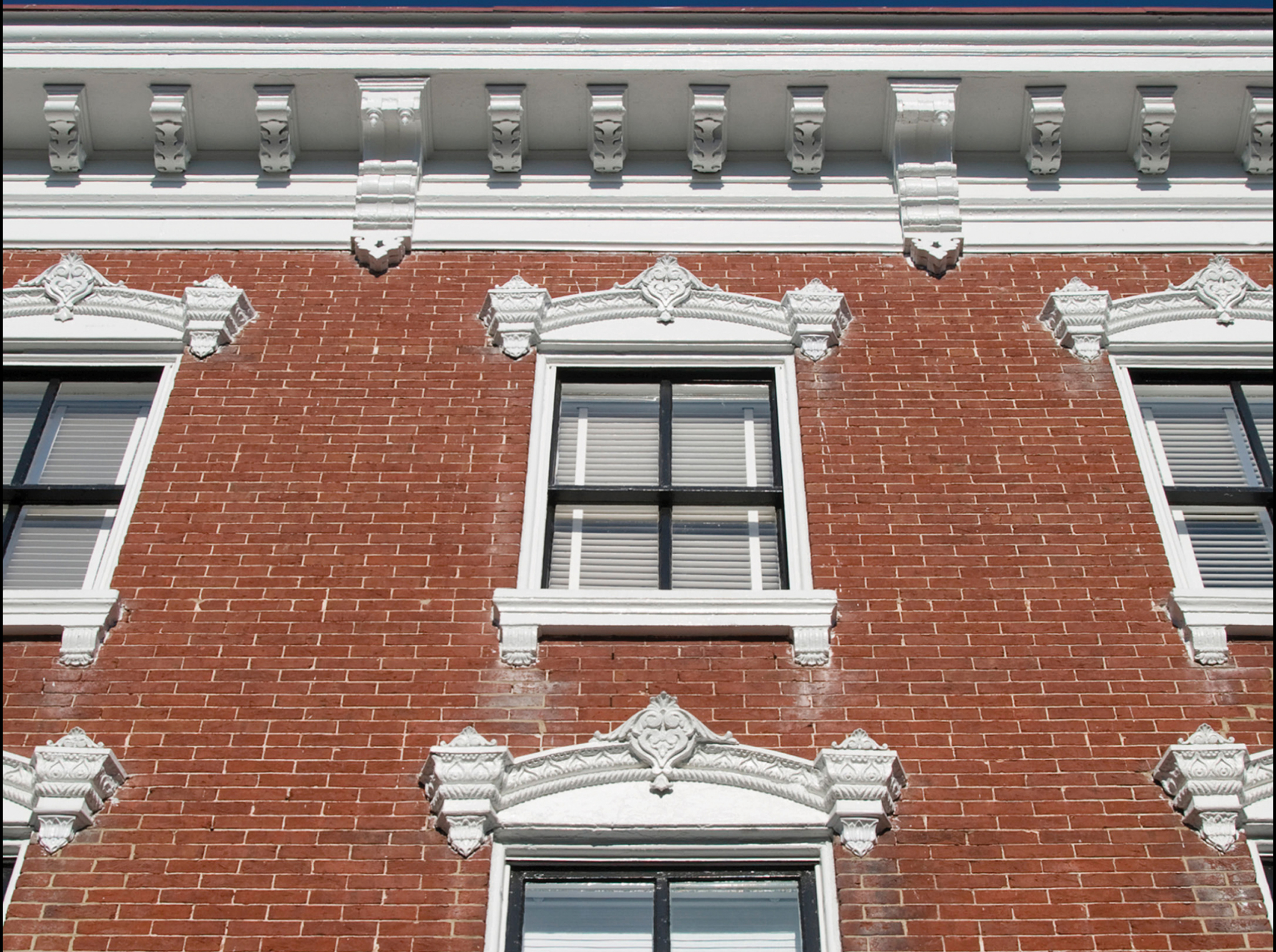
MAINTAINING AND REPAIRING

Old and Historic Buildings



John J. Cullinane, AIA

Maintaining and Repairing Old and Historic Buildings

Maintaining and Repairing Old and Historic Buildings

John J. Cullinane, AIA

WILEY
John Wiley & Sons, Inc.

Cover Image: (c) Frank van den Bergh/iStockphoto
Cover Design: Holly Wittenberg

This book is printed on acid-free paper. ♾

Published by John Wiley & Sons, Inc., Hoboken, New Jersey

Published simultaneously in Canada

Library of Congress Cataloging-in-Publication Data

Cullinane, John J., 1942-
Maintaining and repairing old and historic buildings/John Cullinane.
pages cm
Includes bibliographical references.
ISBN 978-0-470-76757-3 (cloth/cd); 978-1-118-33003-6 (ebk); 978-1-118-33278-8 (ebk); 978-1-118-33446-1 (ebk); 978-1-118-35453-7 (ebk); 978-1-118-35454-4 (ebk)
1. Architecture–Conservation and restoration. 2. Historic buildings–Maintenance and repair. I. Title.
NA105.C85 2012
720.28’8–dc23

2012004080
2012004080

Printed in the United States of America

10 9 8 7 6 5 4 3 2 1

Contents

Introduction

In the United States, prior to 1966, historic buildings were properties that just about anyone could recognize as important—they looked old, they had style, or they had a history. Buildings like Mount Vernon, George Washington's estate in Northern Virginia, and Old North Church in Boston, were properties that demanded preservation; they were clearly part of our national patrimony. They were a visual reminder of our past, something that was the subject of history lessons, or a destination on our summer vacations. The number of these properties was limited, and, because of that, manageable. Most were privately owned and maintained by motivated, highly trained and experienced staff, or local, state, or the federal governments.

The United States Capitol (Figure Intro 1) is the most iconic building in the country. Started in 1793, the Capitol building was built, burned by the British, rebuilt, extended under a cloud of great controversy, and restored. The final product is a noteworthy example of neoclassical architecture, recognizable internationally as a symbol of demographic government.

FIGURE INTRO 1
U.S. Capitol building

John Cullinane

In 1966 the world of preservation changed. Led by a groundswell of opposition to the impact of urban renewal on our cities and neighborhoods, Congress expanded the definition of what was important, and should be preserved—to properties of national significance they added buildings that were locally historic. The official listing of historic properties, the National Register of Historic Places, expanded immediately, with every state and just about every community nominating their favorite buildings and sites. From a list of some 2,500 properties in 1966, the National Register now holds over 85,000 historic buildings, archeological sites, objects, landscapes, and traditional cultural properties. In addition, there are more than 23,000 historic districts listed, containing more than one million contributing elements. The most common factor among all of these listed properties is that they are old—not ancient, but old—and they illustrate some aspect of our history, and the development and evolution of our country and our communities.

After passage of the National Historic Preservation Act the National Register of Historic Places invited nomination of properties that were significant to local communities, like this Shotgun house in the Butchertown neighborhood in Louisville, Kentucky (Figure Intro 2).

The first buildings constructed as our country was formed followed the designs and construction techniques used in the countries from which we

FIGURE INTRO 2
Shotgun houses, Louisville, Kentucky

John Cullinane

FIGURE INTRO 3 Georgian-style house, Alexandria, Virginia

John Cullinane

immigrated. In the cities they were made of stone and brick, in the countryside they were constructed mostly of wood.

The Carlisle House in Alexandria, Virginia (Figure Intro 3), illustrates the transference of the English Georgian-style architecture to American. Constructed in 1752, it represents one the best.

Whatever the material, the buildings were built by craftsmen, masters in their profession, who had brought their trade to the New World. Quickly, their traditional apprentice and journeymen training programs were incorporated into labor unions here as they were being formed. The end result is that older buildings, generally constructed before 1945, whether or not they have been identified as historic, are substantial, strong, and well built. After WWII, the pressures for new, inexpensive buildings led to the use of more economic materials and faster construction. Plaster walls gave way to gypsum board, slate and clay tile roofs were now asbestos and asphalt shingles. Most importantly, the "master craftsman" directing construction was given up. Labor became largely untrained, and the historic union apprentice programs quickly dissolved.

The old and historic buildings remain, and they continue to serve either their original or new purposes. However, maintenance and repair of these properties has become a challenge with the diminished sources of historic materials and trained craftsmen. This publication is designed to assist property owners and professionals in the work of repairing and maintaining old buildings in a manner that protects the integrity of the property and preserves its architectural and historic character.

The book provides assistance to architects and other design professionals seeking solutions to difficult design problems, to building managers charged with making the best choices in an always-challenging economic environment, and to contractors and their staff who are maintaining these properties on a daily basis. The publication is divided into two major parts. The first is the printed body of the book, and the second is a computer disc. The printed portion establishes the *what* and *why* of preserving old and historic buildings, along with the standards that should guide the general approach to the treatment of these properties, recommendations on energy conservation, and guidance on meeting handicap accessibility and fire-safety responsibilities. In addition, sections are included to assist in an understanding of how to plan for working with such buildings. The standards and guidance that are cited in the book are the *Secretary of the Interior's Standards for the Treatment of Historic Properties* and the National Park Service *Guidelines for Preserving, Rehabilitating, Restoring, and Reconstructing Historic Buildings*. Illustrations of successful treatment are provided, along with some cautionary examples, plus there are recommended step in meeting the *Standards*.

The second major section of this publication, the computer disc, contains a series of "How To" documents. These provide specific guidance on how to treat problems commonly found in old and historic buildings, along with a list of required materials and step-by-step instructions on doing the work. Of course, every building is different, and every condition unique, but the "How To" guidance should provide a good, common-sense approach to the work. These documents are in .pdf format, and can be searched by subject matter and printed, sent out into the field, or provided to contractors.

This is an image of a typical first page of a "How To" (Figure Intro 4). These documents are located on the disc attached to this book. As mentioned, they are in .pdf format, and can be downloaded and printed. They are guidelines on "How To" best perform selected repair work on old and historic buildings. The recommendations in the documents are consistent with the *Secretary of the Interior's Standards for the Treatment of Historic Properties*. Because every building is different, and every condition is unique, the recommendations are intended to assist in decision making.

HOW TO
Apply a Semi-Transparent or Opaque Stain to Wood

DEFINITION

A. Semi-transparent Penetrating Stains: Thin, moderately pigmented water repellents and water repellent preservatives which penetrate the wood allowing the natural grain and texture to show through.

1. The addition of the pigment protects the wood against ultraviolet degradation and increases the durability of the finish.
2. Semi-transparent penetrating stains made from water repellent preservatives (WRP's) are recommended:
   a. They provide additional protection against decay.
   b. They penetrate the wood rather than forming a film. They will not peel, flake or blister.

B. Solid Color (Opaque) Stains: Provide an opaque finish with a slightly lower concentration of pigment than regular paints. They result in a flat finish which hides the natural color and grain of the wood but maintain the original texture. Available in both an oil-based or latex-based product, solid color stains form a thin film on the surface of the wood and are therefore subject to peeling, flaking, etc., just as paint is.

MATERIALS

A. General:

1. Conventional spar, urethane, and marine varnishes are generally not recommended for exterior use. These film-forming finishes are quickly degraded by sunlight. If a long service life is not required, and the area to be varnished is fully protected from the sun, varnishes can be used satisfactorily, if properly applied.
2. All stains shall be from the same manufacturer, to avoid problems with penetration and coverage. Different batches of stain, even from the same manufacturer, should also be avoided for the same reasons.

B. Oil-modified alkyd semitransparent penetrating stain such as S-T Wood Preservative Stain, A14T5 (Sherwin Williams), or equal. Other manufacturers are listed in Section 2.01.

1. Oil/alkyd-based semitransparent penetrating stains, which contain a wood preservative, are recommended over latex-based products. Latex-based stains do not penetrate the surface and are subject to peeling, flaking, etc.
2. These stains are most effective on rough lumber and plywood, smooth lumber, weathered wood, and flat-grained surfaces of dense species that do not hold paint well.
3. They can also be used over other penetrating finishes that have weathered to the point of needing to be renewed.
4. They are NOT, however, effective over paint, solid-color (opaque) stains or varnish, nor on smooth plywood; **OR**

Solid-color (opaque) stain such as Series A14 (Sherwin Williams), or approved equal. Other manufacturers are listed in Section 2.01.

1. Though both oil- and acrylic-based solid-colored stains are available, the acrylic-based stains are considered by the USDA's Forest Products Laboratory to be the best of the opaque stains and are recommended here.
2. If the choice has been made to use an opaque stain, their use is recommended when going from a semitransparent penetrating stain or an opaque oil stain to a lighter color, to cover a previously creosoted surface, or when covering new, close-pored wood species such as Southern yellow pine. Like latex paint, acrylic-based opaque stains are also more resistant to mildew, are easy to apply and clean-up with soap and water.

Whenever any work is scheduled on an old or historic building, planning is an essential component in deciding what to do and how to do it. Decision making has to be a thoughtful process. Understanding why a building was designed in a particular way, and why certain building materials were used, can assist greatly in ensuring a successful project—whether it's a major rehabilitation or simple maintenance. Old and historic buildings can have unique design features, which are important to preserve, but they also have aged materials and building systems, so in any treatment program there is a recognition that changes will be necessary. The goal is to undertake those changes while retaining the architectural character and integrity of the property.

Combining the planning and the treatment guidance in this book should help in making any project a success by ensuring preservation of what is important, while extending the life and functional use of the building.

CHAPTER 1

The Approach to Historic Buildings, Building Systems, and Historic Materials

Not all old buildings are historic, but when dealing with either, old or historic, everyone is in the same leaky boat—too much to do and not enough time, money, or personnel to get it done. And, there is a constant lurking question—should a building be saved and reused or replaced? Understanding the building—its history, character, integrity, and how it was put together, and with what materials, is critical in deciding how you approach the planning, design, treatment, and maintenance of a structure. Whether a building is actually historic is not the most important question; it's whether that building can serve a purpose, be maintained, and continue to be functional.

Everyone working with an old or historic building will encounter some common findings—an existing building that we could not afford to build now; a building that has lasted many years, through all types of storms, seismic events, and economic fluctuations; and a building that may have served more than one purpose—very well. Along with those, there are common concerns—the physical integrity of the building and its operating systems, the energy use of the building, and the existence of hazardous materials, specifically asbestos and lead-based paint. These are all issues that must be taken into account when making decisions on the disposition of the building. Some are critical, such as structural integrity, and others are more easily corrected—energy use, asbestos, and lead paint. A decision on whether a building can be rehabilitated and reused should not be made based on assumptions, but rather based on fact.

WHAT IS HISTORIC AND WHY?

In 1966, when the federal government expanded the nation's listing of historic buildings, the National Register of Historic Places, to include properties of local and state significance, it also established an official federal policy regarding the preservation and use of historic properties. The National Historic Preservation Act of 1966, as amended, states, "It shall be the policy of the Federal Government, in cooperation with other nations and in partnership with the States, local governments, Indian tribes, and private organizations and individuals to—. . . (2) provide leadership in the preservation of the prehistoric and historic resources of the United States. . . (16 U.S.C. 470-1)." Provisions of the Act also call for the government to preserve and reuse historic buildings before building new. Private organizations, along with local and state governments, had already discovered the social benefits and economic reality of adapting old and historic buildings to new uses; now the federal government officially joined the club.

The Willard Hotel (Figure 1.1) was threatened with demolition for decades before being rescued with the aid of a special appropriation by Congress to stabilize the structure. A local developer then undertook a project to rehabilitate the building and return it to its former status as the premiere hotel in Washington, DC. Additions to the hotel were placed on an adjacent site to increase the number of rooms and to provide commercial space. The project was undertaken using the Secretary of the Interior's Standards for Rehabilitation, and received federal tax credits for the work done.

Ever since we started constructing buildings, the continued use of old properties has been a priority, chiefly because of economics. It was less expensive to add on to and remodel existing structures than it was to start over. This is what we did—we fixed rather than replaced. This "old world" philosophy gave way to "new is better," as we grew as a nation, and expanded our communities and cities. More buildings were needed—more institutional buildings, more commercial, more government, and more housing. This requirement, combined with a strong sense of moving forward, and away from the "old world," created an atmosphere that ignored or devalued

FIGURE 1.1 Willard Hotel, Washington, DC

John Cullinane

existing buildings and neighborhoods. Prior to the 1950s, the question of preserving an old building because of its historic or architectural character was, in most cases, not yet a factor in our decision making; it was simply a matter of being practical.

After 1966, as more and more local and state buildings have been recognized for their historic or architectural significance, those "soft" issues have become major contributing reasons for preservation. It is a way of preserving a sense of time and place, with identifying where we grew up, and where our families came from. It allows us to appreciate who we are and how things have changed. It can preserve and rebuild the pride in our communities and neighborhoods, and it can be a powerful force in the revitalization of our cities. Regardless of the reasons to preserve buildings, experience has proven that the reuse of old and historic buildings is both emotionally meaningful and costs less than replacement, while the buildings are still able to serve a function in our contemporary world.

The preservation movement in cities and communities throughout the country has helped in revitalize neighborhoods through rehabilitation of residential and commercial properties, such as this shotgun house in the

Butchertown neighborhood of Louisville, Kentucky (Figure 1.2). This style of building was common to towns along the Mississippi and Ohio Rivers, and elsewhere in the Northeast. Individually they are interesting pieces of architecture and history, a blend of simple Federal style with Victorian details. In the context of a neighborhood, they foretell the development of company towns, such as Pullman, outside of Chicago. They were workers' housing built within a larger city, which now form historic districts in many communities.

Over the years, federal, state, and local taxing agencies have reinforced the policy of preservation and reuse by offering a variety of incentives, from a reduction in property assessments in exchange for façade and property easements, to direct preservation loans from state historic commissions, and tax credits from the federal government for certified commercial rehabilitation projects. Since its inception in 1976, the federal Historic Preservation Tax Incentives Program has generated over $5.5 billion in historic preservation work. Each state has its own version of tax credits, which, added to the federal program, makes reuse of historic buildings an obvious choice for developers and individuals.

The reuse of old and historic buildings has also turned out to be a major contributor to the movement toward sustainable design and energy conservation. The concept of "embodied energy," preserving and reusing the energy that was used to construct the building, is an important part in

FIGURE 1.2 Shotgun House, Butchertown, Louisville, Kentucky

John Cullinane

measuring the value of a structure. Reusing the existing structural systems, exterior building materials, windows, and doors saves money, and it preserves the character and integrity of a building. It is only logical that if you can reuse the foundation under a building, you save the cost of constructing a new foundation. The same logic applies to all components of a structure. In addition, there are inherent design elements of old and historic buildings that lend themselves to saving energy, such as tall ceilings, natural lighting, and cross ventilation, gravity heating systems, and heavy-duty construction materials. Unfortunately, many lose sight of those very positive contributions to conservation when making decisions on the treatment of old buildings. Armies of marketing personnel work very hard in convincing each of us that new is better, that a triple-insulated anything is better that what we have, and that the "new" materials require no maintenance. Even a cursory examination of reality proves those assertions overblown at best.

Every building material has a measurable energy value—the amount of energy that was used when it was formed, plus the energy used to transport and place the finished material in a building. It is referred to as "embodied energy." For example, each standard-sized brick represents 15,000 Btu of energy to make, transport, and place. The sum of the material values of all of the materials found in an old building represents the embodied energy present in the building.

BUILDING SYSTEMS

Most buildings can be separated into three major sections—building systems, finishes, and the exterior envelope. The building systems will make up most of the working components of the building, such as the structural system; the framing system; the mechanical, electric, and plumbing systems; waterproofing; ventilation; fire safety systems; and the like. The finishes will include the flooring materials, walls, ceilings, kitchens, baths, nonstructural wood or decorative plaster, lighting fixtures—those parts that you normally notice as you walk through a building. The exterior envelope, on the other hand, is what everyone sees from the outside. It is the public face of the structure; it better defines the architectural character and style of the building than any other component, and it is the most vulnerable to changes that could damage the architectural significance of the structure. In addition, changes to the exterior of old and historic buildings, whether they are the result of age, lack of maintenance, or accident, or are intentional, tend to make permanent impressions. The exterior envelope will be composed of the exterior surface materials for the walls and the roof, plus the windows, doors, and decorative materials—what everyone notices when first seeing the building; it forms their first impression.

The front elevation of the Commander's Residence, at the Portsmouth Naval Shipyard in Kittery, Maine (Figure 1.3) illustrates the dramatic style of the building. Dating from the mid-19th century, this building has been rehabilitated and continues to serve its original purpose more than 150 years later. The interior of the building illustrates craftsmanship in wood detailing and in the stairway design. Residences for senior officers constructed at military installations mimicked high-style houses in the private market, complete with steward's quarters and commercial-scale kitchens. Historic family housing continues to be the most favored type at military installations because of the buildings' design, style, and size.

Understanding the building systems, the finishes, and the exterior envelope of a structure is critical in making a smart decision on how the building should be treated. Combined with that knowledge, there are three principles that should always be followed:

1. Treat the building as gently as possible.
2. Repair rather than replace.
3. Only do the work that is necessary.

FIGURE 1.3 Commander's House Portsmouth Naval Ship Yard, Kittery, Maine

John Cullinane

Numbers one and two are obvious. They are intended to avoid unnecessary damage to the building and to preserve as much of the original building fabric as possible. The logic behind number three is not as apparent. In an environment that advocates a "new is better" philosophy, it is easy to take a "while we are at it . . ." approach when working on a building. An example is having the fascia on a side of the old building fall during a storm. It is common to hear the repair contractor explaining that because all of the fascias are the same age, "while we are at it, you should go ahead and replace all of them. It is just a matter of time before they all fail, and you will save money by doing it now." It is tough to resist that argument. That is one reason why knowing how the building is constructed, its systems and materials, is so important in making treatment decisions. Following the "while we are at it . . ." approach wastes money by doing unnecessary work and subtracts from the physical integrity of the structure. It should be avoided.

The structural systems are literally the foundation of the building. They are made up of footings, foundation walls, water tables, floor framing, supporting walls, and the roof structure. They extend from below the ground to the roof, and their design closely reflects the age of the building, the skills of its builder, and the site's geography. In most cases, the footings and foundation walls are taken for granted; there is an assumption that if they have supported the building for so many years, they will continue to do so. The problem with that assumption is that many conditions change over the years, and many of those changes can, and do, have significant impacts on old foundations. The water table under the building may have changed, and a once-dry foundation becomes subject to hydrostatic pressures that were never considered during the original design. Long-term insect attacks can damage the foundations and go unnoticed for years, as can wind erosion and water damage.

Figure 1.4 is a photograph of a wood pier that has been eroded by wind and weather. Hidden under a crawl space, the deterioration continued completely unnoticed. Often, a structural failure is the first indication of a problem.

Site drainage is a constant issue as landscaping is installed and maintained around the edges of the building. Ensuring that rainwater drained away from the structure would have been part of the original site design, but with continued landscape maintenance and the addition of mulch, those building edges eventually become a depression that captures water and directs it to the foundations. If you find a damp or flooded basement, this may be the cause, which might be corrected easily by simply removing the multiple layers of mulch that have been added to planting beds over the life of the building and restoring the original grade adjacent to the structure.

FIGURE 1.4 Deteriorated wood piers

John Cullinane

On occasion, the foundations that appear on original drawings were installed differently, or not at all. These situations can cause real problems when trying to preserve or rehabilitate an old building. There may be telltale signs or evidence of these issues, such as uneven building settling, cracks in basement walls, or in upper-story masonry, or having to lean sideways when you are walking down a hallway. Also, doors and windows may not close or open, or there may be evidence of woodwork being trimmed to accommodate for the settling.

Figure 1.5 illustrates attempts at a workaround for structural failures rather than finding the cause of the problem. Something settled in the foundation or floor or ceiling. The end result is that shifts in the structure made it impossible to operate this door. The door was "trimmed" so that it would continue to function. Likely the first "trimming" was modest, but as the structure continued to move, the door changed shape to accommodate the frame. This is an obvious indication that further investigations of the stability of the structure have to be undertaken, failures identified, and corrections made, and then the door and frame can be repaired or replaced.

None of these factors necessarily mean that the building is at risk of falling down; this just means that they are something that must be considered when developing a treatment plan for the structure. Determining the stability of a foundation is best done with the assistance of a structural engineer and should be accomplished before any major improvements are made to the building. There is no logic in investing in rehabilitating a structure until you know if it is stable.

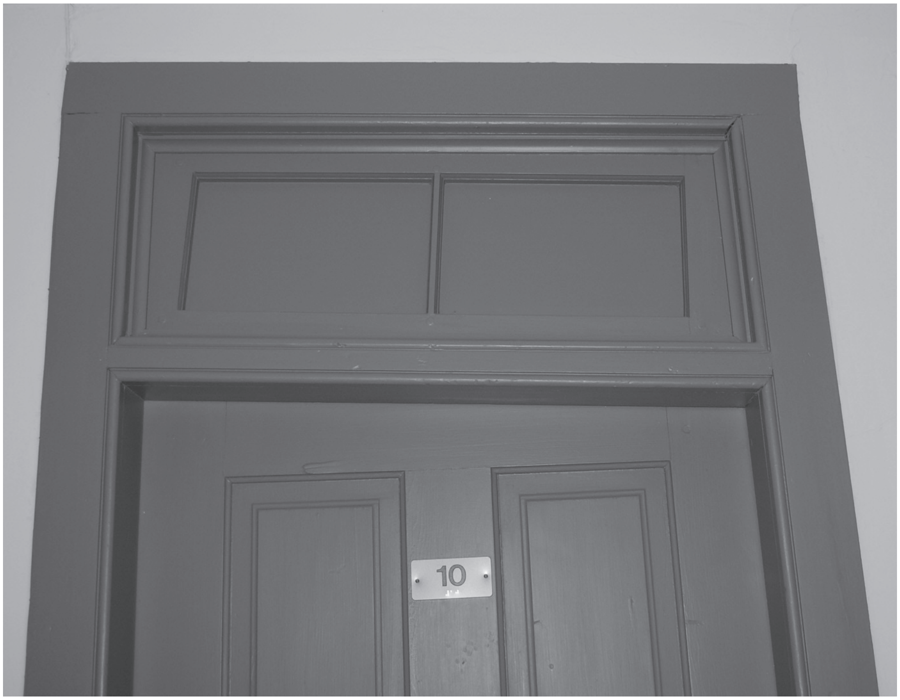


FIGURE 1.5 Wood door, Robert Morris Inn, Oxford, Maryland

John Cullinane

Figure 1.6 shows a stone wall that has failed because of excess vertical loads. Originally constructed as part of a small one-story structure, ca. 1723, the wall functioned well. As the building was expanded, a second floor was added on top of the stone. This caused a failure in the original lime mortar, and the wall expanded outward. This condition can be easily corrected by clamping the outside and inside of the wall together, which will prevent further movement and failure. This condition would not rule out the possibility of rehabilitation of this building.

When there is solid ground, the purpose of the footings is to spread the weight of the building across as much surface area as possible. In instances where the ground is unstable, the building will likely be supported on piers and grade-beams, instead of footings and foundation walls. Some of the earliest buildings are supported simply on wood planks laid flat on solid ground. Kept underground, and away from water, these rudimentary footings can offer sufficient support, even for contemporary uses. Just because they look very different from what we would currently use does not mean that they will not work. They are a component of the existing building that should be understood before making any decisions on treatment. The same approach should be taken on all other building components—understand

FIGURE 1.6 Failing foundation wall, Belvoir, Scott's Plantation, Crownsville, Maryland

John Cullinane

the existing conditions and purpose of what exists before deciding on how it should be treated.

In an old and historic building, foundation walls are the transition between the footing and the building, transmitting the weight of the structure to the footings. Most often they look like part of the building wall, but they have also a separate and very important role—preventing "rising damp." Rising damp describes the action of ground moisture rising up a wall by capillary action. Once in the building walls, the moisture can saturate any porous building material, such as plaster, and can facilitate the growth of mold.

In old brick and soft stone buildings, an effective method of preventing rising damp was to construct the foundation wall of a very dense stone or brick, which would block passage of the moisture. In an old building it is referred to as a "water table," shown in Figure 1.7. In 19th century buildings, the water table often protruded and was visible. At the beginning of the 20th century, the water table was often a simple piece of slate inserted in a mortar joint just above the ground. As our technology and skills advanced, new construction started directing the groundwater away from the building with foundation drains, and flashing at the junction of the foundation wall and upper wall will prevent rising damp. Again, knowing how a building is put together can help in developing a plan for doing work.

FIGURE 1.7 Brick water table

John Cullinane

How the buildings we encounter are "framed" is also evidence of their age. For lightweight construction, between ca. 1850 and 1950, buildings generally used what is known as "balloon framing." It's a building method, which replaced timber framing, that utilizes long, continuous wood members (studs) that run from the sill plate at the top of the foundation wall all the way up to the roof. With the advent of manufactured nails in the mid-19th century, balloon framing became the preferred system for use on buildings ranging in size from single-family houses to multistory apartment buildings and institutions. It required much less skill than timber framing and took advantage of the availability of good hardwood. Once it became more difficult to acquire long lumber, "platform framing," in which a building is constructed one floor at a time, came into wide use and acceptance.

How the building is framed will dictate many treatment options, such as installing insulation, providing for fire protection and security, and isolating sound. Depending on when and where a building was constructed, lumber will also be of different dimensions and the wood of different species. Almost all of the old wood will be hardwoods—oak, ash, and walnut in the Northeast; heart pine in the South; cypress in Florida; mahogany, walnut, and poplar throughout the Midwest; and redwood in the Far West. New framing materials are generally southern pine, a much softer material.

After the structural support, the most critical system in a building will be moisture protection. Many building components fall under the umbrella of this term, from foundation drainage all the way up to the roof covering, with many elements in between. The most troublesome issue plaguing old and historic buildings is water—water vapor, dampness, humidity—whatever form it takes. Buildings and water do not work well together. And, because they have been around longer, old buildings tend to show the scars of their battle with water more readily than new ones. It doesn't mean that newer buildings are any less susceptible to the ravages of water, it just means that on old buildings the evidence of damage can generally be seen on the surface, while on newer buildings, the damage may be hidden behind layers of synthetic materials.

Protecting buildings from water damage has always been a priority in design and construction. The earliest buildings used some very progressive methods, and some "old world" techniques, such as water tables and flashing. Unfortunately, they also missed a couple of major concerns—drainage and water vapor. Outside of dense urban development, few, if any, older buildings will have foundation drains—and, virtually none will have vapor barriers. These are common on newer construction and serve necessary functions.

The lack of foundation drains on old buildings can result in moisture problems in basements. This is a problem that can be solved in a number of ways—installing foundation drains, waterproofing the outside of the foundation walls, or creating a gutter system inside the basement that drains to a sump pump. The best solution will be to prevent the water from entering the basement, rather than trying to direct it once it is inside.

The lack of foundation drains or vapor barriers does not render old buildings obsolete; it is just another consideration in developing an overall treatment plan for rehabilitation of the property. To some extent, it makes it easier to determine what needs to be done—if you find a leaky basement, the lack of foundation drains will be a prime suspect. And, the lack of a vapor barrier will answer many questions regarding balancing a new air-conditioning system. A good thing is that there are workarounds for whatever was lacking in the original design and construction.

The most direct attack by water will be through failure in the roof—the roofing material, flashing, gutters, and downspouts. Whenever you see wood deterioration or rot in a column, or on a deck, or the presence of algae—look up. You will generally find a stopped-up gutter or a detached downspout. Maybe the downspout has been damaged and is not allowing the rainwater to drain from the roof, and the water is backing it up into the gutter, which is, in turn, filling and overflowing back into the building.

The source of a water back up problem is not always as obvious as in this situation at a historic building in the Annapolis Historic District in Maryland. The crushed downspout (Figure 1.8), and the failure to repair the damage, resulted in water backing up and filling the gutter to overflowing. The water then penetrated the wood framing, causing damage to the fascia boards and soffits. What was a simple repair has turned into a very expensive project of patching and building materials and finishes.

The purpose of whatever drainage system is installed is to transport that rainwater away from the building. The process is straightforward—the rain hits the roof surface, the water is collected into a gutter, and is then conveyed into a vertical drain (downspout) that carries it down to the ground, or into a drainpipe, which takes it away from the building. There are many variations on the system, but the concept and purpose are the same—prevent water from entering the building, and get it completely away from the structure. The management of stormwater is a constant issue in any building, regardless of size or age. The failure to protect a building from water will eventually lead to its destruction. Before that happens, however, the cost of maintaining the building being affected by water penetration will be high, very high.

FIGURE 1.8 Crushed downspout

John Cullinane

Two more examples of damage caused by a poorly maintained drainage system are the porches on an apartment building at Fort Hamilton in Brooklyn, New York, which lasted more than 75 years before replacement was necessary. Figure 1.9 is an image of one of the porches five years after replacement. There were two problems that caused the extensive water damage. The first was a poor water drainage system. The roofs over the porches were designed with a very slight pitch to a single drain. When that drainage was interrupted, water backed up and leaked into the wood framing. The damage was extensive enough that the porches had to be rebuilt. The original historic plans were reused, along with the fragile drainage system. The same failure occurred, but the framing members were now made of soft yellow pine, instead of the original red oak. This time it only took five years for the porches to fail and require replacement.

The second problem was the wood columns (Figure 1.10). Although they may look solid, historic wood columns are made up of staves, similar to wine