Maintaining Your Historic Home: A Practical Guide for Homeowners

Delaware County
Planning Department
Media, Pennsylvania
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This document has been prepared by staff of the Historic Preservation section of the Delaware County Planning Department to assist homeowners in the maintenance, repair, and preservation of their historic houses and is for informational purposes only.

While every effort was made to include only information from experienced professionals in the field, no warranties are made as to the completeness or accuracy of the information contained within. Likewise, homeowners are urged to consult and utilize qualified professionals experienced with historic architecture when undertaking any work.

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Introduction

Background

Our historic communities are unique, irreplaceable assets with importance that is partly derived from the architectural character of the buildings and their environs. Those who live in historic houses should take pride in their communities, which often stand out as neighborhoods of exceptional quality. Homeowners in historic areas such as these benefit the most when buildings are well maintained. In addition to being one of the most important investments in your life, and needing regular maintenance just like an automobile, your historic house has unique needs. The regular and appropriate maintenance and repair of materials will not only minimize damaging impacts and save the cost of substantial repairs later, but will also ensure the continued economic and social value of the historic resource to future generations.

Equally important to the actual maintenance of a property is the realization of the benefits of taking the effort to maintain the character of the individual house, as well as the block as a whole. First of all, the retention of historic details and the feeling associated with the house's character bolster community pride and retain a sense of place, time, and belonging. This also helps improve and maintain a higher quality of life within a neighborhood. Retaining a high degree of integrity in historic neighborhoods has also been shown to boost property values and attract outside investment in the area. Such neighborhoods are also typically more stable, envisioned as safe havens for raising a family, and retain high numbers of their residents.

About this guide

Maintaining Your Historic Home is designed as a practical maintenance guide for property owners of historic houses. Put simply, **the guide is intended to help people understand how to maintain, repair, and preserve details of their historic houses**. More specifically, the guide will help homeowners maintain the architectural uniqueness of their home and protect it from insensitive alterations by preserving original building materials and design standards. Adopting a planned approach to maintenance such as this recognizes factors that lead to materials deterioration and ensures that these materials are maintained to prevent failure and costly repairs.

This manual is not intended to address every unique issue that a property owner may confront. Instead it describes the most common building materials found within an historic neighborhood and addresses issues that commonly affect owners of historic houses by providing general guidance on maintenance and repairs.

Using this guide

Be smart about do-it-yourself projects. While some of the maintenance and repair efforts recommended by this guide may be an option for homeowners who have sufficient skill and knowledge, and may be more economical than hiring someone else to do it, some efforts may be beyond the homeowner's skill and will require building professionals. If a project is beyond your comfort zone, it is best left to professionals.

Always follow local building codes and procedures. Make sure the projects you are undertaking are within the local building codes. In addition, check whether or not the work you are doing requires a building permit before you may begin.

Work logically. While owning an historic house may appear overwhelming at times, and many projects may require attention at the same time, working in a logical order will help reduce costs, while providing the best results. Typically, significant structural issues should be addressed first and then efforts should be directed at maintaining the building envelope and preventing moisture penetration. Any cosmetic work should be completed last.

Maintaining a house's historic character does not make a house unlivable or inadaptable. A house is an important investment that evolves according to a homeowner's desires and needs and must maintain a certain level of comfort. While maintaining historic features and letting a house evolve may seem incompatible, both concerns can easily be addressed. Such ideas will be promoted through this guide.

Look for these tip icons throughout the text:


Recommended


Not recommended


General considerations and tips


Sustainable and energy efficiency tips

Planning for Maintenance

Understanding your historic house

Understanding material characteristics and potential condition issues. Understanding the materials in your home is the first step toward maintaining your home. When problems arise in historic buildings, some may find it tempting to undertake a quick – and sometimes inappropriate – treatment to maintain the livability of a house. Yet, in many instances treatments do not address the underlying causes of problems and may in fact cause additional building damage. As such, to maintain the longevity of the house and its character, it is important to understand the reasons why problems are occurring and ways to inspect for problems and address them appropriately. Equally important is that homeowners understand that historic houses respond to weather, the environment, and human interaction differently than modern houses; introducing modern materials into your house without understanding their characteristics may actually increase damage rather than improve the building.

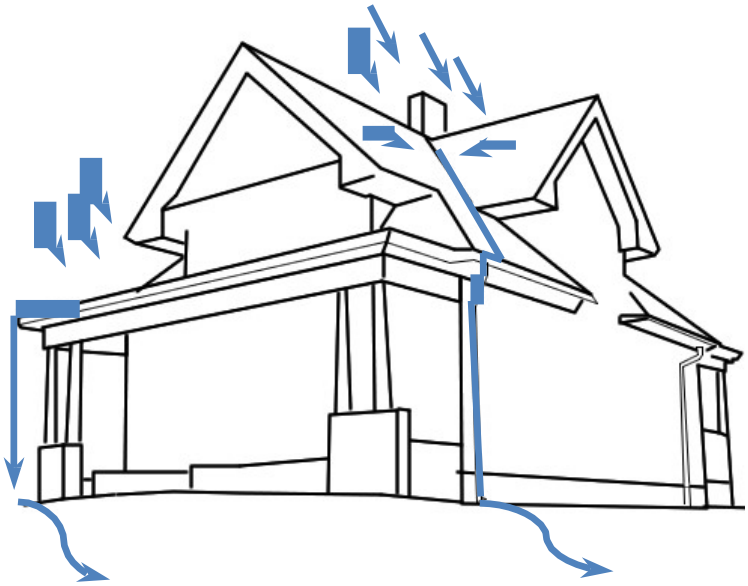
For example, original mortar has likely been replaced in many historic houses. The original mortar was likely very soft compared to the masonry and absorbed building movement from settling, thermal expansion, and other environmental impacts. Many homeowners, thinking they were saving the brick, have likely repaired joints with modern mortars of high Portland cement content. These mortars are exceedingly hard and deflect structural movement, rather than absorbing it, and redirect the vibrations to the masonry, which weaken the material and cause it to break apart. Ultimately, inappropriate treatments such as this lead to additional, costly repairs. By understanding your historic house and the component materials, you can avoid such situations and better understand why buildings deteriorate and how to appropriately maintain and repair materials.

Basic differences between…

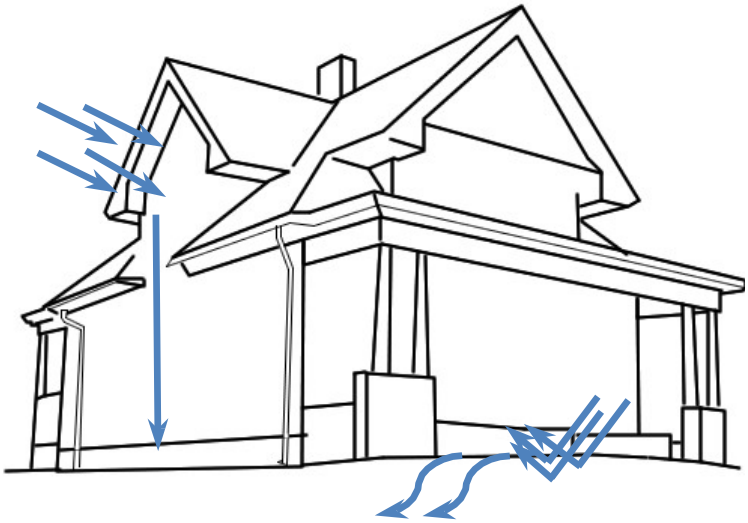
Historic houses	and	Modern houses
Varying materials, such as wood, masonry, and metals, carefully matched to one another and a particular locale and/or climate		Synthetic materials that are standardized, pre-assembled, and chosen from national producers without regard for locale and/or climate
Materials can last for many decades when well maintained		Materials have an average lifespan of 10-25 years when well maintained
Structural masonry of varying hardness due to placement in a kiln		Veneer masonry of extreme hardness due to firing at much higher temperature
Flexible mortar with high concentrations of lime		Rigid mortar with high concentrations of cement
Permeable construction designed to absorb water and then readily release it through evaporation		Emphasis on waterproofing to prevent water penetration. Once trapped, water cannot evaporate
Energy efficiency and comfort controlled naturally through use of building materials, openings, and building placement		Energy efficiency and comfort controlled by automated temperature control systems and insulation
Thick, heavy building materials with low levels of artificial insulation		Thin, lightweight building materials with high levels of artificial insulation




Understanding building connections. Just as it is important to understand how your historic house differs from a modern house, it is also important to understand the basic principles of how the different parts of the building envelope are connected. Building connections are best illustrated with a very basic discussion of how rain travels along a building. When your house is properly maintained, rainwater should be able to progress unimpeded from the roof to the ground.



- When rain falls on the roof, well maintained shingles with no breaks or holes will smoothly divert water along the slope, where some rain will fall from the overhanging eave to the ground.
- Remaining rainwater will be collected in the gutter attached to the eave, where it will be channeled to a downspout, which will direct the water away from the house.
- Rain may also be pushed toward the house's walls by air pressure or wind. Masonry or wood that has been properly maintained will allow the water to run down the face of the building without collecting.



- As the water continues to fall, it will also come in contact with windows, where glazing and paint seal the glass to the sash and keep water from penetrating. As the rain washes down the glass, a sloping sill directs the water away from the building.
- The final connection is the foundation. If masonry is well preserved, water will continue to flow down the face of the building toward the ground. If water splashes back against the foundation during heavy rain, tightly connected mortar joints will also protect the masonry and repel water from entering the building.

As illustrated, builders designed houses to be tightly connected, and what happens at one area of the house directly affects what happens in another area. A well-rounded and thorough maintenance program that properly addresses all portions of a building will help minimize problems migrating from one area to another.

On the other hand, if thorough and proper maintenance is not planned for, problems affecting the walls, windows, or roof may likely be a direct result of failure to maintain a connecting component. For example, if rain falls on a roof and gutters have corroded or are not properly connected, bulk water will run from the roof to the ground where it may pool against the foundation and eat away at mortar or infiltrate the building as water vapor. Or if mortar has weakened or broken away, water running along the face of the house may settle in the deteriorated joint and infiltrate the soft interior of brick, which can cause structural instability.

Understanding moisture in buildings. Moisture is the most dangerous enemy of any house. Materials such as masonry and timber are porous materials that naturally have the potential to absorb moisture, but when well maintained, these materials allow moisture to dry before it causes damage. However, if materials are damaged or inadequately maintained or repaired, moisture infiltration can lead to serious damage. As such, it is important to understand how moisture can damage a building and how moisture moves through a building.

Excessive moisture can ultimately lead to significant damage by:

- Compromising the structural integrity of materials
- Fostering growth of fungi and organic growth
- Exerting uneven expanding and contracting pressures on building materials
- Instigating rot development
- Causing cracks and breakages in interior finishes
- Causing metals to rust or corrode

Damaging moisture can enter a building through any number of points, but the movement of moisture into and through a building is typically driven by one of four means:

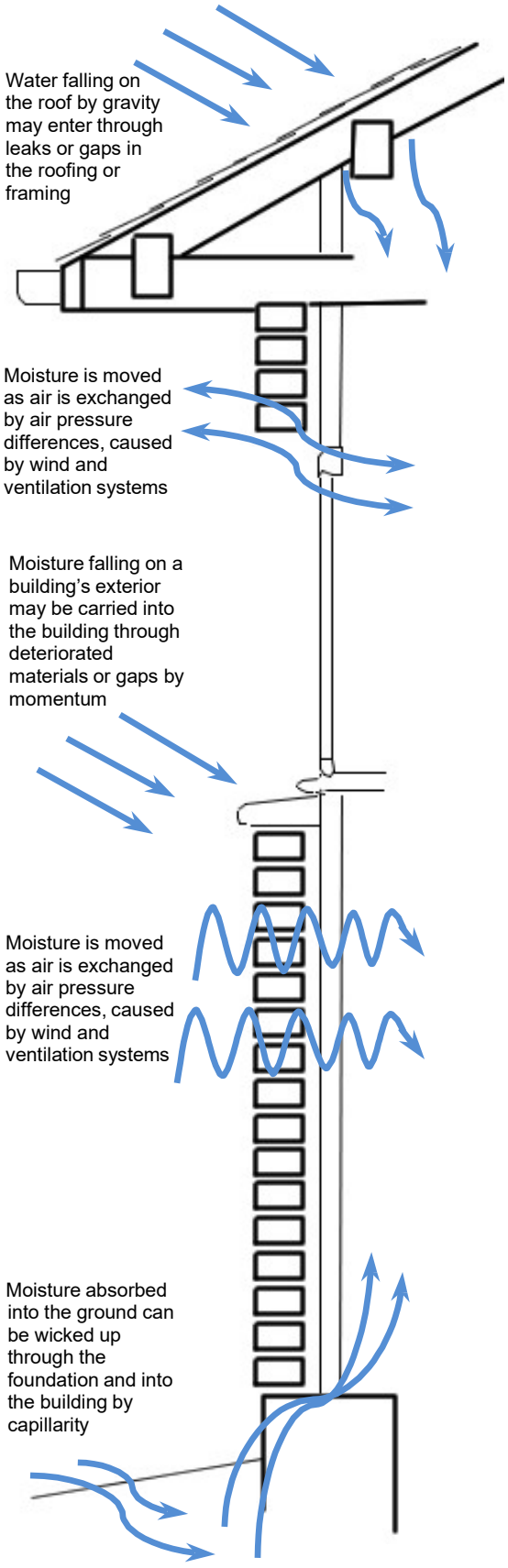
- *Liquid flow* is the movement of bulk moisture (i.e., rain water, ground water, or snow melt) by gravity or momentum.

- *Capillarity* is the movement of moisture due to surface tension. Spaces between materials or in the chemical composition of a porous material allow moisture to be drawn into a building. On foundations, this is commonly called rising damp because water wicks up through materials as it moves toward the surface to evaporate.

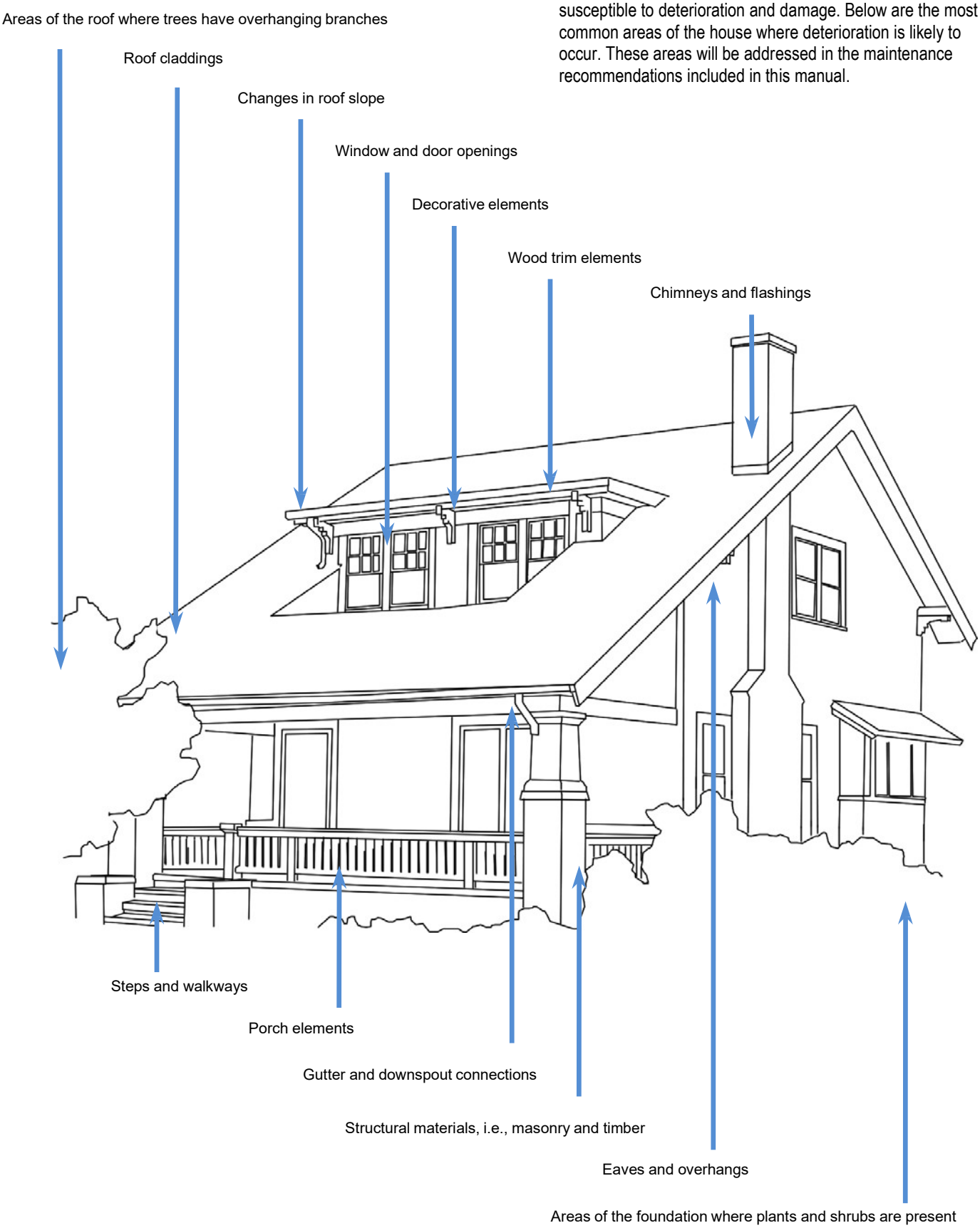
- *Air movement* is the movement of moisture in vapor form due to air pressure differences in buildings, which typically include wind-induced pressures, stack effect, and pressure differences caused by ventilation systems

- *Vapor diffusion* is the movement of moisture in vapor form due to vapor pressure differences, which are caused by the same forces as air pressure differences.

How does moisture enter a building?



Understanding your house's vulnerabilities. You should also be aware of those elements of your house that are most susceptible to deterioration and damage. Below are the most common areas of the house where deterioration is likely to occur. These areas will be addressed in the maintenance recommendations included in this manual.



Establishing a maintenance plan

Historic houses are largely constructed of natural materials that are well suited for construction. Materials such as masonry require the least maintenance of all building materials and can last indefinitely when well maintained. Yet, materials are still vulnerable to deterioration from neglect, weather, abrasives, and inadequate or improper repair. With this in mind, you should plan to maintain your property in a way that recognizes the characteristics unique to specific historic building materials.

But before undertaking any type of maintenance, repair, or improvements, **you should inspect and keep a record of the current condition of your house, using a thorough inspection checklist** (a sample checklist has been provided on the following pages). Using a checklist ensures a regulated, structured approach and guarantees that all significant materials, elements, and features are inspected, regardless of their condition. A checklist also lets you monitor continuing deterioration or the successfulness of past maintenance or repair. Once you have adopted an appropriate inspection checklist, you should determine how often you will inspect each building element. Ideally, you should inspect your house every fall and every spring to prevent small problems from worsening. Regular, thorough inspections are crucial for maintaining an historic house. A casual or superficial approach to inspecting your house will not provide you the information you need. You should develop a habit of examining your property regularly to develop an understanding of how your house is performing.

DEVELOPING A MAINTENANCE PLAN

- ✓ Carefully assess the condition of your property using an inspection checklist
- ✓ Determine how often you will inspect each element
- ✓ Identify which items you can appropriately inspect yourself
- ✓ Identify those items for which you may need professional assistance to properly inspect
- ✓ Maintain a list of qualified professionals, contractors, and tradesmen that may be contacted for advice, recommendations, or repairs
- ✓ Develop a timetable for maintaining, improving, and repairing items that need attention

TYPICAL INSPECTION TIMETABLE

BUILDING ELEMENT	FREQUENCY		
	6 months	12 months	12 – 60 months
Roof coverings		✓	
Gutters and downspouts	✓		
Flashings		✓	
Chimneys (from ground)	✓		
Chimneys (close inspection)			✓
Masonry, including mortar joints			✓
Painted masonry		✓	
Windows and doors		✓	
Painted wood elements	✓		
Sidings, stucco, and other claddings		✓	

Inspecting your house

Work logically and thoroughly. Start from ground level and examine each building elevation in turn by using a prescribed checklist.

Avoid damaging building elements. For example, some shingles can be broken by walking across them. Gutters and eaves can easily be damaged by carelessly propping a ladder against them, and brick and mortar can likewise be broken apart by haphazardly dragging a ladder across the face of the building.

Assess any risks involved. Tasks such as reaching high areas, inspecting areas of limited access, and walking on steep or slippery surfaces may prove dangerous. It is also advisable to wear heavy gloves, and if necessary, eye protection, when inspecting an historic house. If you are unable to gain access to a portion of the house, it is recommended that you hire a professional who has experience with inspecting such areas.

Inspection Checklist

ROOF	Yes	No
Any sign of missing, broken, or warped shingles or tiles?	☐	☐
Are shingles losing mineral cover, curling, or do edges look thin?	☐	☐
Any signs of bubbles, separation, or cracking in felt?	☐	☐
Does the roof ridge sag?	☐	☐
Is paint peeling or blistering on cornices and overhangs, especially the underside?	☐	☐
Are there brown stains on cornices or overhangs, suggesting ice dam problems?	☐	☐

FLASHING, GUTTERS, AND DOWNSPOUTS		
Are there loose, rotted, or missing gutters or downspouts?	☐	☐
Do gutters slope uniformly with no low spots?	☐	☐
Are gutters clean and do they drain correctly?	☐	☐
Do gutter connections leak?	☐	☐
Are downspouts connected to a splashblock?	☐	☐
Is there loose, missing, or rusted metal flashing at chimneys, valleys, ridges, or walls?	☐	☐

CHIMNEYS		
Are brick or mortar cracked, crumbling, or missing at chimneys?	☐	☐
Are chimneys lined?	☐	☐
Are fireplaces usable? Do they smoke? Are dampers installed?	☐	☐

EXTERIOR WALLS		
Does the wall seem out of plumb, unlevel, or are there bulges?	☐	☐
Do doors and windows line up squarely in their openings?	☐	☐
Are there open joints around doors and windows or trimwork?	☐	☐
Is there mold or mildew on the wall surfaces?	☐	☐
Is any stucco, wood, or masonry water stained?	☐	☐
Where paint is present, is it peeling, cracking, or blistering?	☐	☐
Is paint powdering or chalking to a dull powdery surface?	☐	☐
Are there major cracks in the masonry or mortar?	☐	☐
Is any masonry loose, missing, or deteriorating?	☐	☐
Is any mortar soft or crumbling?	☐	☐
Are any bricks spalling or crumbling?	☐	☐
Where siding is present, is any dented, faded, or corroded?	☐	☐

FOUNDATION		
Is there vertical or diagonal cracking in the masonry?	☐	☐
Is masonry spalling, loose, or deteriorating?	☐	☐
Is mortar soft or crumbling?	☐	☐
Does the ground slope away from the foundation?	☐	☐
Is any organic growth, mold, or mildew attached to the foundation wall?	☐	☐

WINDOWS AND DOORS		
Are all window and door components, interior and exterior, sound and if needed, painted?	☐	☐
Is putty around glass cracking, soft, or pulling away from the glass?	☐	☐
Do sills, sashes, or frames show signs of deterioration?	☐	☐
Is there evidence of moisture penetration around openings?	☐	☐
Do window sashes operate smoothly?	☐	☐
Are sashes loose in their frames?	☐	☐
Does heavy condensation build on the interior or exterior of the sash during winter?	☐	☐
Are doors adequately weather-stripped?	☐	☐
Are there open joints in need of caulking?	☐	☐
Do window and door locks function properly and smoothly?	☐	☐

PORCHES	Yes	No
Are there loose or deteriorated structural or decorative components?	☐	☐
Are masonry piers plumb and sound?	☐	☐
Are stairs and railings in good condition?	☐	☐
Do porches properly slope away from the building?	☐	☐
Is there unusual settling of the porch foundation?	☐	☐
Are there signs of excessive deterioration or cracking in the porch floor?	☐	☐

INTERIOR SPACES		
Are wall or ceiling coverings damp, loose, cracked, or deteriorated?	☐	☐
Is there evidence of water penetration on the ceiling or around window and door openings?	☐	☐
Do any floors sag? Do they sag or bounce when walked on or occupied by heavy weight?	☐	☐
Do doors open and swing freely on hinges?	☐	☐
Are all stairs sound and do they feature adequate handrails?	☐	☐
Are there signs of moisture problems in kitchens or bathrooms?	☐	☐
Does any of the lower wall space feel moist?	☐	☐

ATTIC		
Are there signs of leaks on the underside of the roof, near openings, or near wall junctures?	☐	☐
Is the attic properly ventilated?	☐	☐
Do rafters bow?	☐	☐
Are rafter plates deteriorated?	☐	☐
Are there signs of vermin infiltration?	☐	☐
Is there insulation in the attic or on roof rafters?	☐	☐

CELLARS, BASEMENTS, AND CRAWL SPACES		
Do walls and floors show signs of excessive moisture?	☐	☐
Any sign of vermin infiltration or insect damage?	☐	☐
Does the area smell of mold or mildew?	☐	☐
Is there salt buildup on the walls?	☐	☐

PLUMBING		
Is there evidence of leaking under sinks or toilets?	☐	☐
Are water pipes in good condition?	☐	☐
Is water pressure adequate?	☐	☐

HEATING AND VENTILATION		
Do filters need to be replaced?	☐	☐
Is heat distributed evenly?	☐	☐
Do thermostats work correctly?	☐	☐
Are ducts and pipes adequately insulated?	☐	☐
Any signs of leaks or rust spots?	☐	☐

ELECTRICAL		
Are circuit breakers or fuses in good condition, labeled, and of the correct size?	☐	☐
Is wire insulation frayed?	☐	☐
Do all light switches work properly?	☐	☐
Do all wall outlets work properly?	☐	☐
Are there ground fault interruption (GFI) type outlets in kitchens, laundries, and bathrooms?	☐	☐

SITE		
Is the site sufficiently graded and drained?	☐	☐
Are large shrubs or trees a sufficient distance from the house?	☐	☐
Do trees or limbs hang over the house's gutters and downspouts?	☐	☐

After assessing the condition of your house, develop a prioritization plan for potential maintenance, improvements, and repairs. Typically, you should first address those problems that affect the safety and structural soundness of your home. Then, you should undertake any maintenance and repairs to address minor problems that may potentially progress into major problems. Finally, you should address any areas that you want to maintain or repair for aesthetic reasons.

Establish a series of long-range goals and objectives to address the preservation of your historic house. These goals should take into account your available budget, as well as your lifestyle, both of which will dictate what and when you repair. While some serious problems may require immediate attention to maintain the livability of a home, others may be completed at a later date and in phases, if necessary.

HOW TO INSPECT YOUR HOUSE

- Start the inspection from ground level, using binoculars for areas above the first floor
- Adopt a systematic approach, using the
- sample checklist or prepare your own
- Inspect each elevation in turn
- Record your observations on the checklist

RECOMMENDED EQUIPMENT

- Inspection checklist, with copies for each elevation
- Notebook
- Extending, lightweight ladder
- Binoculars
- Heavy-duty gloves
- Flashlight
- Metal probe for checking the soundness of timber goods

When maintenance and repair is necessary

Maintenance and repair are a necessary part of owning any home in order to fix any elements that have decayed or deteriorated due to weather, the environment, human interaction, or other impacts. When dealing with historic homes, the prospect of proper maintenance and repair is an even more important issue. Maintenance and repair that is incompatible or unsympathetic to the historic nature of the house will not only have a negative impact on the character and value of the property, but may also lead to additional problems in the future. Follow these general practices when working on historic houses:

- Avoid removing character-defining features.
- Proper maintenance is preferable to repairs. Repairs are preferable to replacement. Replacement with in-kind materials is preferable to alteration.
- Always clean using the gentlest means possible.
- Modern materials react differently than historic materials. Make sure you understand the characteristics of new materials before introducing them into the building.
- Alterations and additions should be done so that they are reversible and can be removed without damaging historic materials.
- Every home and problem is unique, and any repairs should be carefully considered before undertaking.

WHEN CONSIDERING A PROFESSIONAL...

- Meet with the contractor or craftsman before repairs are necessary
- Discuss your anticipated maintenance and repair needs
- Assess the knowledge and experience of the chosen professional
- Seek information on similar past work that they have completed, and if possible, visit the site
- Establish a relationship with the contractor or craftsman so that they become familiar with your house and your needs
- If working with a company, make sure the individual person who will be working on your property has appropriate knowledge and experience
- Although cost is a primary factor, do not let it be the only factor. You get what you pay for

Whenever possible, use recycled or salvaged materials to complete maintenance, repairs, and alterations. Using reclaimed materials is always more sustainable than using newly acquired or manufactured materials and is often a cheaper alternative. Common recycled building materials include: timber, brick and stone, doors, windows, hardware, some roofing tiles, and some metal fixtures.

Roofs, Chimneys, and Gutter Systems

Roofing

In addition to providing shelter, the roof is a prominent and character-defining feature of an historic house, and is characterized not only by cladding materials, but also by the framework, shape, slope, orientation, and color. All contribute to the character of a building and can have a visual impact on not only the individual house, but also the entire street. Historically, the roof shape and materials were matched to climatic conditions of a particular locale, but over time, materials and shape also became associated with particular styles and time periods. The roof is also the first defense in buffering weather and moisture infiltration.

Common sources of deterioration

Heat and **ultraviolet light from the sun** will degrade shingles over a period of time, especially on the south and west elevations where materials are exposed to the sun for long periods. Heat can also cause some flashings to warp.

Water can penetrate shingles, and if they are not allowed to dry out properly, the shingles may begin to rot or deteriorate. Water from rain can also get under shingles or flashings that are not properly installed or maintained and cause damage to decking and structural systems. In the winter, if the roof does not drain properly, ice dams may form, leading to condensation and water damage on interior surfaces.

Weather is a natural source of roof deterioration. All roof claddings will naturally break down over time as a result of exposure to environmental impacts. Some weather effects, such as hail or snow, can instigate rapid deterioration and damage.

Wind can force shingles to curl or bend and can push debris and water into and under shingles. Shingles that are already thin and deteriorated may easily be dislodged or blown off of a roof in high winds.

Trees in the vicinity of a roof may have overhanging branches that can puncture shingles. Falling leaves may collect on a roof, retaining damaging moisture and debris.

Moss and **algae** can form on damp, shaded areas of shingles. Over time, the growth will degrade shingle materials and can penetrate to the support structure.

Inadequate or **improper installation**, **maintenance**, and **repair** can cause just as much damage as weather. Failing to install roofs correctly can lead to moisture penetration and retention or may increase the rapidity at which materials degrade. Roofs must also be regularly maintained to ensure that they function properly, and necessary repairs should be addressed immediately. Failing to do so will easily lead to further deterioration.

SIGNS OF ROOF DETERIORATION AND RELATED PROBLEMS

Shingles

- Small holes or cracking slate shingles
- Curled or warped asphalt shingles
- Missing, torn, cracked, or slipped shingles
- Popped nails
- Buckling
- Rotted wood shingles
- Thin, worn granule coatings
- Algae, moss, or mold growth
- Staining and discoloration
- Dislodged ridge tiles
- Ice buildup

Roof structure

- Damp spots or stains on interior surfaces
- Loose or deteriorated flashing around chimney, valleys, or ridges
- Cracks in roof membrane
- Interior condensation
- Sagging roofline or decking

Deterioration that is not addressed can compromise the effectiveness and soundness of your roof system.

Maintaining your roof system

Inspect your roof. At a minimum, roofs and support systems should be inspected once a year, usually in spring, for damage. Ideally, roofs should be inspected twice a year, during both spring and fall.

Allow for proper attic ventilation. Do not let heat and moisture build up in the attic. This can cause or accelerate deterioration.

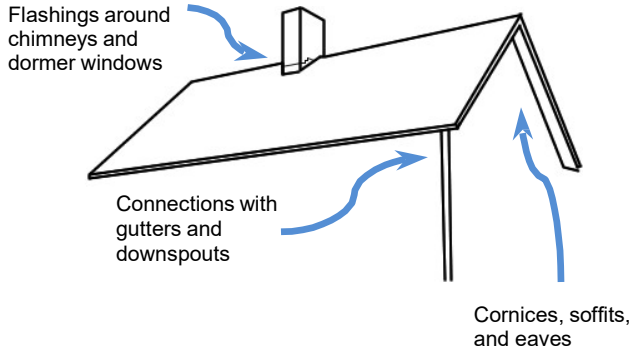
Remove growths and debris. Clean organic growths with diluted bleach water and spray debris off roofs as necessary. Never power wash a roof; it can push excessive water under shingles and destroy coatings.

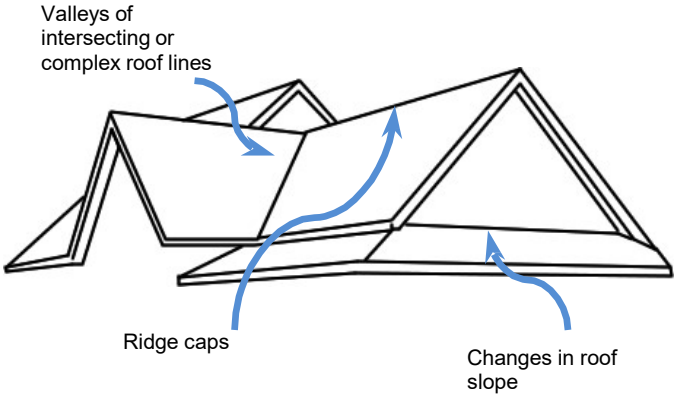
Cut back overhanging trees. Trim tree branches to decrease the amount of moisture-retaining leaves.

Reapply protective coatings as necessary. Some shingles have coatings to protect from fire or weather. If present, these typically must be re-applied about every five years to maintain their effectiveness

Monitor for leaks, damp areas, or stains. Watch for leaks or signs of moisture penetration on the interior and exterior of the house. Determine under what conditions the moisture appears.

Check these vulnerable roof points!





Common roof repairs

Replacing damaged wooden shingles.

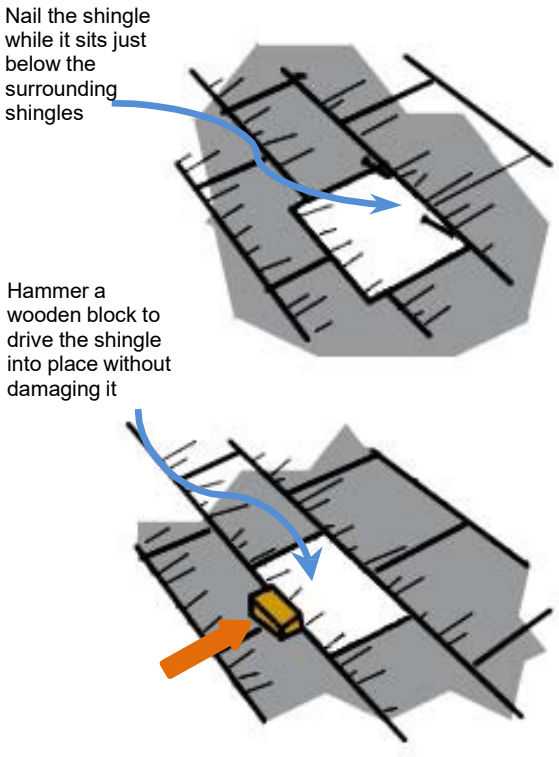
① Using a hammer and chisel, carefully split the damaged shingle along the grain
② While being mindful not to damage decking, use a shingle ripper to cut the nails anchoring the damaged shingle
③ Insert a new shingle, fitted so that a 3/8" gap remains on either side to account for expansion, so that it sits just about ¼" below shingles in the same row
④ Secure the shingle with two roofing nails just beneath the shingle above, driven in at an angle of about 45°
⑤ Place a wooden block against the bottom edge of the new shingle and hammer the block until the shingle is driven into alignment with surrounding shingles. Nails will bend into place and be hidden by the overlapping shingle

Replacing damaged slate.

① Using a slate ripper, hook the nails that fasten the slate, and pull the nails out with the slate
② Slide in the matching slate and nail in the overlying slot
③ Tap the nail down and slide a bib flashing under the slate but over the nail head

Note: This is the most common method of securing slates, but some slate roofs are secured by hooks rather than nails. Make sure you use the appropriate method.

Installing replacement wooden shingles



Repairing Torn, Split, or Curled Asphalt Shingles.

① Carefully lift the torn, split, or curled corner of the shingle
② Using a putty knife, spread a thin layer of roofing cement under the corner of the shingle
③ Replace the corner or torn portion of the shingle and secure with a roofing nail
④ Spread a thin layer of roofing cement over the nail head and any present cracks

Replacing Damaged Asphalt Shingles.

① Using a thin pry bar, carefully lift the shingles overlapping the damaged piece by releasing the sealing tape that holds them in place
② Carefully pry nails from the damaged shingle and overlapping pieces.
③ Slide the damaged shingle out.
④ Slide the replacement shingle in while being careful not to tear any roofing felt.
⑤ Nail the new shingle in place with galvanized roofing nails.
⑥ Cover the nail heads with roofing cement and re-seal any overlapping shingles with roofing cement.

Repairing damaged flashing. Most flashing can be patched to cover holes or other damage, but all patches are just temporary measures and should be inspected regularly. Copper flashings can be repaired with a soldered patch, but aluminum should be patched with a cold patch. The typical patching process involves cleaning the metal, cutting a patch that overlaps the damage by at least 3 inches on each side, coating the pack with flashing cement and securing to the flashing, and if necessary, painting to match existing flashing.

Replacing damaged flashing. Flashing may fail at valleys, ridges, and along chimneys or dormer windows. Depending on where the flashing is located, replacing damaged flashing can be a laborious job and is best left to professionals. Replacing flashing typically involves removing surrounding shingles, cutting new metal to match the angle of the ridge, slope, junction, or valley, securing the flashing, and reinstalling any shingles that were removed.

RECOMMENDED

- ✓ Replacing roofing with materials that retain the visual appearance of the roof and match as closely as possible to the size, color, and texture of historic materials
- ✓ Only replacing shingles when the temperature is between 40 and 85 Fahrenheit; shingles will be brittle and prone to damage in higher or lower temperatures
- ✓ Using established methods such as copper tab or the hidden nail technique to install new shingles
- ✓ Installing a variegated or blended color shingle
- ✓ Using only materials that are suitable for your roof's slope
- ✓ Maintaining existing eaves and cornices

NOT RECOMMENDED

- × Removing historic roofing that is still in good overall condition
- × Using roofing cement patches on non-asphalt roofs. In addition to detracting from the visual appearance of the roof, the cement will crack on other materials and pull apart materials
- × Changing the original roof form
- × Removing features such as ice guards, decorative ridge caps, chimneys, or dormers

The roofing system is the house's first line of defense in deterring moisture infiltration, air infiltration, and pests. As such, the roof should be well maintained, and any damage should be immediately addressed so that it does not compromise the ability of the roofing system to function correctly.

Chimneys

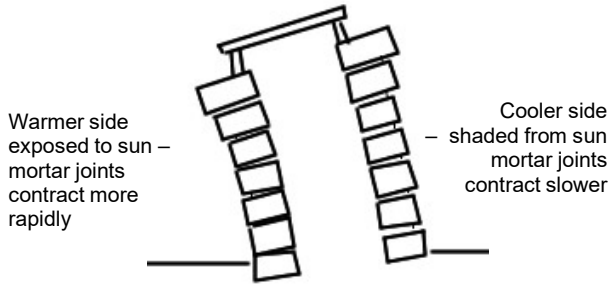
Chimneys are a character-defining element of the roof system. Chimneys originally provided ventilation for open fireplaces and essentially served as an exhaust fan by helping draw air throughout the house. However, as automatic temperature control systems became widespread in housing, the use of fireplaces (and thus chimneys) decreased rapidly. In many instances, chimneys became a mechanism for hiding furnace flue pipes, but many owners also viewed chimney stacks as unnecessary and either shortened, removed, or covered the chimney in alternative claddings to save on maintenance. Unfortunately, this not only detracts from the appearance of the house, but also often leads to further deterioration.

Common sources of deterioration

Water penetration. Like all masonry, chimneys are susceptible to water penetration, which will destroy mortar and cause masonry to deteriorate. Chimneys are even more exposed to moisture damage since they are open to the weather and rely on watertight flashing to stop infiltration along their base.

Uneven heating and cooling. All masonry and mortar reacts to fluctuations in temperature, but active chimneys are even more susceptible to damage from uneven temperatures. In the winter, mortar expands due to flue heat and then contracts from the cold temperatures. On sides exposed to the sun, the contraction rate is slower than shaded areas, which can cause chimneys to lean.

What causes chimneys to lean?



Maintaining your chimney

Check and maintain flashings. Ensuring that flashings are watertight is key to preventing moisture from penetrating the chimney at the roof line.

Inspect for mortar and masonry deterioration. Regularly inspect for cracked, loose, or damaged masonry and mortar that may compromise the structural stability of the chimney. Repair as necessary.

Clean the chimney. Both the chimney structure and the flue should be well maintained. Soot buildup can damage mortar over time, as can moss and organic growth on the exterior of the chimney.

Common chimney repairs

Repointing mortar and repairing or replacing masonry. Repairing masonry and mortar is the most common chimney repair and is handled in the same manner as masonry walls. Please see the section on *Walls* for details on masonry repair.

Correcting structural leaning

① Document the design of the chimney
② Deconstruct the chimney to the first sound course
③ Rebuild the chimney using a mortar mix that matches the historic mortar
④ Install a new liner if the chimney is to be used
or…
Cap the chimney if it will not be used

SIGNS OF CHIMNEY DETERIORATION

- Spalling (delaminating, flaking or breaking away of finished masonry surface)
- Loose, cracked, or dislodged masonry
- Mortar that has softened, cracked or broken
- Structural leaning

RECOMMENDED

- ✓ Documenting the chimney before any repairs are undertaken
- ✓ Patching flashings as necessary to prevent leaks
- ✓ Regularly cleaning chimney exteriors and flues
- ✓ Repairing damaged mortar and masonry to maintain structural stability
- ✓ Capping unused chimneys

NOT RECOMMENDED

- × Removing or shortening chimneys
- × Covering chimneys in siding or other claddings, including stucco (unless it was historically covered)
- × Using incompatible replacement mortar or masonry
- × Altering the historic character and detail of a chimney

Gutter systems

The gutter system is the utilitarian component of the roof. The system is designed to collect water from the roof and divert it away from the building by means of leaders (downspouts) and splash blocks. Early gutter systems were most commonly either of timber or cast iron, but into the twentieth century advancing technologies allowed for gutters to be created out of copper, steel, and aluminum, and most recently vinyl and fiberglass.

Common sources of deterioration

Water. Water can pose a problem if it is allowed to collect in clogged systems. Wooden gutters may begin to rot if not properly coated, and metal gutters or fasteners may rust.

Wind. Strong winds may pull fasteners loose, causing gutters to sag, or may knock gutters and downspouts out of alignment.

Lack of maintenance. Gutter systems generally do not deteriorate if well kept. However, inadequate maintenance can lead to damage from clogged components, water retention, and improperly installed components.

Common gutter system repairs

Patching gutters and downspouts. Metal gutters can be patched with a new piece of metal soldered to the existing metal. Likewise, any gaps in joints can be resoldered. Wooden gutters should be patched with epoxy consolidants, which are then primed and painted to match existing finished surfaces.

Replacing gutters and downspouts. When gutters have deteriorated beyond repair, new historically appropriate gutters should be installed. Profiled PVC K-profile gutters are not appropriate and should be avoided, as should any corrugated downspouts. In their place, use half-round gutters and plain round or rectangular downspouts.

Maintaining your gutter system

Clean gutters regularly. Clean gutters and downspouts regularly to ensure that water flows through unimpeded. Install leaf guards at downspouts if necessary.

Check joints and connections. Ensure that all joints and connections are tight and properly aligned. Maintain fasteners that secure the gutters and utilize splash blocks at the termination of all downspouts.

Gutter systems that are clogged with debris or bow will not function correctly and can lead to water pooling down the side of your house or seeping under roofing materials

CHANGING ROOF MATERIALS AND CHARACTERISTICS

Maintaining roof shape and elements. The roof is a significant element of any house, both in terms of function and in terms of appearance. Changing the slope, color, or orientation of a roof can severely impact its historic character, as can altering any chimneys, dormer windows, or eave and cornice details. As such, it is recommended that any roof repairs or replacement be sensitive to the original design of the roof system and leave any design elements intact.

Using comparable materials. Generally, complete re-roofing is not necessary unless more than 20% of existing materials are damaged. When roofing materials must be replaced, it may not always be possible or feasible to replace with historic materials such as slate or wooden shakes. In such cases, using comparable materials that retain the scale, color, and visual aesthetic of the historic materials may be appropriate. Replacement roof materials such as asphalt and some fiberglass can often even replicate historic materials such as slate, wood, and some tiles. This is often accomplished by using multiple layers of shingles to increase the thickness of materials, and then coating with a special texture.

If you must change your roofing materials, consider alternatives that can be recycled into other materials once they are removed or materials that use recycled materials as their base. Many roofing companies now operate recycling programs that have made some asphalt shingles a very sustainable option. These companies turn used asphalt shingles into base material for road repair projects.

In addition, many composite shingles are now on the market that can contain up to 95% recycled rubber materials.

Walls and Foundations

Masonry

Masonry materials include natural and man-made materials such as brick, stone, stucco, tile, and concrete. Materials like brick and stone are among the oldest and most durable building materials. In fact, although the myth often permeates that historic masonry (particularly brick) is soft and should be replaced or covered, masonry is extremely durable when well maintained and can last indefinitely. Masonry is also a significant character-defining feature of the house that adds depth and creates a sense of strength and permanence.

Masonry also has substantial thermal mass properties. Thermal mass is the ability of a dense material to store heat and then slowly release it. This means that during the summer a brick home stays cool during the hottest part of the day. During the winter, brick walls store the home's heat and radiate it to the interior. In comparison, vinyl, aluminum, and EIFS (artificial stucco) are all thin, light materials that do not possess good thermal mass properties.

Common sources of deterioration

Symptom	Possible source of deterioration						
	Moisture infiltration	Settling/ differential movement	Weathering/ freeze and thaw cycles	Pollution	Salt buildup	Plant and organic growth	Damaged/ improperly pointed mortar
Spalling	X	X	X		X		X
Loose, cracked, or dislodged brick	X	X	X	X	X	X	X
Soft, cracked, or broken mortar	X	X	X	X	X	X	X
Mildew, mold, and other growths	X					X	
Efflorescence	X				X		
Stains and Discoloration	X			X	X	X	

Moisture infiltration. Excessive moisture penetration can break down non-maintained masonry surfaces.

Settling and building movement. Buildings naturally settle over time, but at different rates in different places. This can often lead to cracked or damaged masonry and mortar.

Weathering. Fluctuations in temperature and weather cause materials to expand and contract; these excessive pressures can cause inflexible materials to break down.

Pollution. Environmental pollutants can stain masonry or scar and chemically break down masonry surfaces.

Salt buildup (Efflorescence). Subsurface salt deposits can discolor masonry and can cause cracking as it leaches to the surface.

Plant and organic growth. Organic growths trap damaging moisture that deteriorates masonry. Root systems will also destroy mortar.

Improper repair. Inappropriate repairs are often worse than not repairing a material and are one of the most common causes of masonry damage.

Moisture is the most significant cause of decay in masonry. Seen here are examples of spalling, efflorescence, and organic growth, all caused by excessive moisture.

Maintaining your masonry

Inspect your masonry. Masonry should be examined every 12 to 60 months for possible deterioration, including cracks, spalling, and loose or damaged materials. Mortar that has deteriorated more than ¼" will likely need to be replaced.

Remove organic growths and vegetation. Plant matter traps damaging moisture, which can cause the materials to break down. To remove growth, scrape it from the building with a non-metallic spatula. Then apply a solution of four parts water to one part bleach to kill spores. Rinse with water and repeat as necessary, but leave a few days between treatments.

Clean masonry as needed. Cleaning brick will help retard deterioration since the building up of dirt and growths can destroy brick, stone, and masonry over time. Cleaning also helps create a clean surface before repairing damaged or deteriorated masonry. There are 3 methods of cleaning masonry: water, chemical, and abrasives. Water is the gentlest method and can typically be performed by the homeowner. Trained professionals should handle chemical cleaning, and abrasive methods are never recommended.

- **Water washing**. The gentlest and most common method of cleaning masonry. Start with a low pressure (100 psi or below) and progress higher (but no higher than 300 psi) as needed to wash away surface dirt. If needed, masonry can be scrubbed with a soft natural or synthetic bristle brush.
- **Water washing with detergent.** For tougher adhesions, a non-ionic detergent (such as Tergitol) can be mixed with water. Unlike acid-based cleaners, a non-ionic detergent will not destroy masonry. Always rinse the building with water following cleaning with detergent.
- **Steam washing.** Using hot water at low pressures, water will condense into steam after leaving the hose. Steam settling on the building can help remove heavy buildups, especially oily dirt deposits.

Never sandblast or use high-pressure power washing to clean masonry. Doing so can compromise the building structure by scarring masonry surfaces beyond repair, which will allow excessive moisture into the masonry.

Masonry is among the most maintenance free building materials available. Masonry is one of the oldest materials in the world, and its continued use today is largely because of its sturdiness and ease of upkeep. Masonry never needs to be painted and will never be destroyed by bugs or other pests. In addition, unlike vinyl and aluminum sidings, masonry will never fade, dent, bend, or tear.

RECOMMENDED

- ✓ Only cleaning masonry that needs to be cleaned; needlessly cleaning masonry can unnecessarily inject water into materials
- ✓ Ensuring that mortar joints are sound and that the building is watertight before introducing large amounts of water to your building
- ✓ Starting with the gentlest cleaning means possible
- ✓ Cleaning masonry starting at the bottom of the building and progressing towards the top, keeping surfaces below the cleaning area wet. Dirty water and cleaning solution runoff from above will not streak a clean surface that is kept wet, whereas if you start at the top instead, dirty water and cleaning solution runoff will leave streaks on the dirt masonry below
- ✓ Controlling water runoff so that it is directed away from the building foundation

NOT RECOMMENDED

- × Using regular household detergents. These detergents can leave a solid residue or film on the building surface
- × Using a metal bristle brush. Metal will degrade masonry surfaces and leave behind metal particles that will stain the masonry
- × Cleaning masonry during cold weather. Water introduced into the masonry through cleaning may freeze and lead to spalling
- × Using water with traces of iron or copper; this can stain masonry

- **Acidic and alkaline chemical cleaners**. Acid-based products should only be used on non-acid sensitive surfaces, including unglazed brick, concrete, slate, unglazed terra cotta, and cast stone. Alkaline cleaners are for use on acid-sensitive surfaces such as glazed brick or tile, limestone, and sandstone. Masonry should be pre-wetted prior to applying cleaner and should be kept wet while the cleaner reacts. After the cleaning, the solution should be rinsed with water. If using alkaline cleaners, masonry should be given a diluted acidic wash before rinsing with water.
- **Paint, stain, and other coating removers**. Alkaline cleaners are most common for removing oil and latex paints and can remove multiple layers. Organic solvent removers are another option. Removers should be carefully matched to the type of adhesion and should be tested in an inconspicuous location before applying to large areas. In most instances, the removal of adhesions involves applying the remover by brush, roller, or sprayer.

Monitor for masonry cracks. Due to the many forces acting upon it, masonry may develop cracks. There are two types of cracks, dormant and active. While dormant cracks are not continuing to worsen, active cracks are still reacting to forces and may continue to widen or lengthen. Active cracks may need professional attention, while dormant cracks can likely be safely repaired. Although professional inspection is recommended when reviewing cracks, there are three ways that a homeowner can monitor if cracks are dormant or active:

- Mark the end of the crack with a charcoal pencil. If the crack moves beyond the mark, it is still active.
- Use gridded tracing paper to outline the crack. Measure the width and length of the crack. At a later point, retrace the crack for comparison.
- Place a piece of paper tape across the crack. Any significant movement in the crack will cause the tape to break.

In addition to being either dormant or active, cracks may also pass through just the mortar or through both masonry and mortar. Cracks that pass through only mortar, stepping along the joint lines, are usually a sign of settling and can typically be repaired safely. Cracks that pass through both masonry and mortar may be indicative of more serious problems and should be evaluated by a qualified professional to determine the cause.

For cracks that do not represent serious structural concerns, patching the cracked masonry with an adhesive or epoxy, colored to match, may be appropriate for sealing the masonry and protecting it from water, insects, and organic growth. For active cracks, a professional should determine and remediate the cause of the crack before any repair.

RECOMMENDED

- ✓ Testing a small area with the cleaning compound before applying to large areas
- ✓ Following the manufacturer's recommendations when preparing the cleaning area and applying the compound

NOT RECOMMENDED

- × Using hydrochloric or hydrofluoric acids, which can leave salt deposits and lead to discoloration and mottling
- × Using sodium hydroxide or full strength ammonia, which will destroy lime-based mortars and stain masonry
- × Applying cleaners in ways other than directed. Not applying cleaners as directed, leaving on applications too long, or failing to rinse can cause significant problems. Some may etch or burn the brick face, and others may deposit damaging salts within the masonry surface.

BEING GREEN

- ❖ Refrain from using chemical cleaners and paint removers that may damage trees, shrubs, grass, and other plants near the work area
- ❖ When possible, avoid using chemicals that may release volatile organic compounds, which damage the environment and can be harmful to your health

Cracks that have settled and have been inspected by a professional can safely be patched, but they should be patched in a manner that does not detract from the historic masonry

COATING AND PAINTING YOUR MASONRY

Although it may be tempting to coat your masonry with a waterproof sealant or to paint your masonry to protect it from further deterioration and mask any existing problems, such practices are hardly ever necessary or advisable.

Masonry sealants should be avoided. Unless in the presence of extensive previous damage from sandblasting or heavy spalling, masonry should not be sealed with waterproof coatings. Applying a sealant may seem appropriate to minimize deterioration from water, but using a non-porous waterproofing or water repellent is more likely to trap moisture in the building, leading to further deterioration, rather than preventing it. Such coatings may also become hazy over the years and leave the brick looking discolored. And sealants are incredibly difficult, and sometimes impossible, to remove if circumstances ever require its removal.

Painting masonry is not recommended. Historic masonry that was not intended to be painted should not be painted. Paint (in some instances irrevocably) disguises the historic character and qualities of the building and also increases the long-term maintenance of the masonry. Once masonry is painted, it must be repainted over time to repair surfaces that are flaking, peeling, or discolored. Paint can also create a non-porous surface that traps water, leading to spalling and other moisture related problems. Furthermore, should an owner ever want to remove paint from the masonry, it will prove a difficult and problematic task. Paint that has adhered to a masonry surface for long periods may mask areas of deterioration. When removed, paint may pull masonry away from the building, leading to further deterioration. The compounds for removing paint may also cause damage by scarring, pitting, or discoloring the masonry. If extreme circumstances necessitate the painting of masonry, the owner is recommended to choose a color closely matched to that of existing masonry.

Common masonry repairs

Repointing mortar. Repointing or replacing the mortar in joints is the most common masonry repair, but it is best left to a qualified mason experienced with historic masonry. Mortar deterioration is natural and is actually a sign that your building is functioning correctly. Mortar is designed as a temporary material that not only holds masonry together, but also absorbs moisture and movement to keep such things from damaging surrounding masonry. As such, mortar will naturally deteriorate and need repair or repointing over its lifespan.

The repointing process

① Document the mortar joint profile to be recreated by the newly pointed joint
② Using hand tools when possible, remove deteriorated mortar to a depth of 2 ½ times the height of the mortar joint (typically ½" to 1" deep)
③ Remove stray particles from the joint with a soft stream of water
④ Prepare repointing mortar mix of matching color, composition, and compression to the original mortar; use within 30 minutes of mixing
⑤ Prehydrate the mortar and pack into the cleaned joint in thin ¼" layers
⑥ After mortar is thumb-print hard, tool the joint to replicate the original profile
⑦ Once mortar has dried, clean excess mortar with a nylon or natural bristle brush

RECOMMENDED

- ✓ Only repointing when mortar has deteriorated or is very loose. Historic mortar, if sound, should not be removed
- ✓ Removing mortar by hand chisel to minimize damage. If necessary, skilled craftsmen may also use a thin carbide blade on some joints.
- ✓ Using mortars of matching color, composition, and hardness to ensure materials function correctly. Historic mortars are typically softer than modern mortars and have low levels of Portland cement. Using a cement-rich replacement may lead to future damage through spalling and cracking.

NOT RECOMMENDED

- × Overraking the mortar joint. Doing so will deteriorate the face of the surrounding masonry.
- × Using power tools
- × Leaving excess mortar on the masonry; this can cause the masonry to spall or break apart
- × Installing mortar in a single layer

Repairing damaged masonry. In general, masonry should only be consolidated when severely deteriorated or when it threatens the structural stability of a house. The repair of masonry can prove to be a complex procedure and should only be undertaken by professionals.

- Consolidating masonry with epoxy-resin.
  1. Remove damaged areas with hand tools
  2. Clean loose materials and debris from the area
  3. Rinse the area to be repaired with water and allow to dry
  4. Install patch anchor to secure repair to existing materials
  5. Build form work around area to be consolidated
  6. Prepare the epoxy-resin grout to be used as the consolidant and fill the form
  7. After consolidant has dried, repoint mortar to match surrounding historic materials

Replacing damaged masonry. Replacing masonry is a significant change and should only be considered when no other options are feasible.

- Replacing masonry.
  1. Remove damaged masonry with hand chisel
  2. Fit with masonry matching characteristics of historic materials
  3. Test for fitting without mortar
  4. If it fits, insert new masonry unit and tap into place with a wooden or rubber mallet
  5. Repoint surrounding mortar joints

Before beginning any repairs, be aware of any historic masonry treatments, such as penciling, limewashing, or colorwashing, which should be replicated after repairs.

When masonry is repaired or replaced, new materials should match the existing historic materials. Failing to match materials can severely detract from the visual aesthetic of the building.

GENERAL GUIDELINES FOR MASONRY REPAIRS

RECOMMENDED

- ✓ Repairing, stabilizing, and maintaining masonry to prevent moisture infiltration and deterioration
- ✓ Matching work to the characteristics of original materials so that it is unobtrusive and structurally and chemically compatible
- ✓ Cleaning repair areas after they have set
- ✓ Only removing damaged masonry when absolutely necessary. Replacing when unnecessary may cause additional damage; repair and stabilization is always preferred
- ✓ Documenting the building before repairing
- ✓ Keying replacement materials into existing materials

NOT RECOMMENDED

- × Removing masonry that is sound and where deterioration is strictly superficial
- × Attempting work if you are not confident of the knowledge and skills of the person performing work. Improper repairs cause additional and intensify deterioration
- × Removing masonry that can be otherwise repaired, stabilized, or conserved
- × Ignoring problems or attempting to conceal them behind a synthetic cladding
- × Removing decorative masonry

Stucco

Historically, stucco was an inexpensive method of applying a finish to a masonry or frame building at the time of construction. Over time, applying stucco also became a common means of masking deterioration. Stucco is similar to mortar in three ways: it is composed of many of the same elements, lime, water, sand, cement, and sometimes straw; stucco should be flexible to avoid cracks; and stucco shares many of the same sources of deterioration – water, building movement, weathering, and improper repair and maintenance.

☐ Common stucco repairs

Patching stucco. Over time, stucco surfaces will need to be repaired. Due to the complex nature of appropriately mixing and applying stucco, this work should be left to professionals.

Hairline cracks can typically be patched by applying a thin slurry coat to the crack. Never use caulk to repair cracks in stucco. Larger cracks and soft spots should not simply be patched. These areas should be cut out from the wall and replaced with a new stucco coating that mimics the color, composition, and texture of the historic coating.

DEALING WITH STUCCO REPAIRS

- ✓ Apply stucco coatings in layers of approximately ¼" thickness
- ✓ Wet the underlying structure before applying new stucco
- ✓ Mix only as much stucco as can be used in 1 hour to 1 ½ hours
- ✓ Key the stucco to existing masonry joints or wood lath
- ✓ Allow each coat to dry before applying the next coat
- ✓ Only make repairs when there is no chance of extreme temperatures, either heat or cold
- ✓ If the coating is to be painted, match the paint color to the materials and historic colors on surrounding stucco
- ✓ Keep wet stucco shaded and damp

Timber goods

Timber goods include sidings, shingles, cornices, trim, and other decorative features. Timber goods are among the oldest of building materials and not only perform as part of a building's weather-tight seal, but also contribute to the building's style, sense of depth, massing, and scale and often differentiate one part of the house from another. Historic timber goods are much different from modern timber materials in that the old growth wood is much more dense and sturdy than recently harvested woods, which means that they can last for centuries when well maintained.

☐ Common sources of deterioration

Moisture penetration. Excessive moisture is extremely problematic for timber goods because it can cause wood to rot or splinter, increases the likelihood of pests, and fosters the presence of fungi or other organic growths.

Pests. Insect infestation can be particularly damaging for timber goods. Insects chewing through wood substrates will not only leave materials looking deteriorated, but they also compromise the structural integrity of timber elements.

Weathering. Over time, timber that is not well maintained and properly coated will naturally chip, crack, and splinter due to weathering and environmental impacts.

Plant matter. Plant matter and organic growths near or on timber goods can trap moisture in materials. In addition, root systems may attach themselves to moisture-rich timber.

Fungi. Fungi growth can deteriorate the structural composition of timber goods. Fungi are also the principal cause of dry and wet rot in timber.

If not regularly maintained, timber goods will deteriorate as a result of weathering, moisture, and pests.

On the other hand, regular maintenance can help timber goods withstand deterioration and last for hundreds of years.

Maintaining your timber goods

Inspect regularly. Inspect timber goods regularly for signs of moisture infiltration, rot, or pests. The stability of timber goods can be tested by using a thin ice pick to penetrate the surface of the wood.

Clean when necessary. Dirt buildup and organic growths can necessitate the cleaning of timber goods. Wooden elements should only be cleaned in warm weather and at low pressures. Never power wash timber because it can force large amounts of water into the wood.

Keep painted or stained surfaces intact. Paints and stains help repel moisture and weather. Keeping painted or stained surfaces intact will reduce the amount of wood exposed to inclement conditions. Timber goods should be hand-sanded whenever possible to reduce damage from power tools. Primers, paints, and stains should only be applied to clean, dry surfaces.

Treat with preservatives where appropriate. Much like paint, chemical preservatives can help deter rot, insect infestation, and organic growths. Treating areas that are not historically painted but still susceptible to decay can help minimize deterioration. However, only use treatments compatible with your wood species, and never use preservatives that may change the appearance of the wood.

Common timber goods repairs

Repairing cracks. Simple cracks and splits can be repaired by cleaning any debris from the crack and then sealing with an exterior wood glue.

Rebuild deteriorated elements. Some timber elements can be rebuilt using either an epoxy consolidant or by a Dutchman, piecing-in a new piece of timber for the deteriorated piece. See the “Windows & Doors” section for an example of the process.

Securing loose elements. Loose timber elements can simply be re-secured by corrosion-resistant fasteners to prevent deterioration and damage.

Replacing deteriorated elements. Timber goods should only be replaced when they cannot be repaired, and only the deteriorated piece should be replaced. Replacement elements should match the historic element in terms of size, profile, texture, and finish, and if possible wood species.

Using salvaged timber goods is a viable and sustainable option, especially as replacement clapboard. Previously used timber cladding of old growth materials can be found in some architectural salvage yards and can be reclaimed as replacement siding. To prepare the salvaged timber, remove all paint and finishes and sand to a smooth, feathered edge. Then, fill any holes or cracks with epoxy filler. The siding can then be reinstalled and finished to match the existing cladding.

RECOMMENDED

- ✓ Keeping timber surfaces painted or stained to prevent deterioration
- ✓ Keeping at least 8” between any timber goods and the ground
- ✓ Piecing in or selective replacement of materials when possible instead of complete replacement
- ✓ Using corrosion-resistant fasteners and nails; do not use galvanized materials as they can stain timber
- ✓ Matching replacement materials to the size, profile, texture, and finish of historic materials

NOT RECOMMENDED

- × Using chemical preservatives that change the appearance of the wood
- × Sandblasting or power washing timber elements
- × Using commercial caulking to make repairs
- × Removing or encapsulating sound
- × wooden siding or decorative elements behind artificial sidings
- × Using unenclosed heat sources (i.e., torch) to remove deteriorated paint

SELECTIVELY REPLACING DETERIORATED SIDING

① Use a utility knife to score the damaged clapboard its entire length; do not cut all the way through as this may damage building paper
② Use a pry bar to gently loosen any nails from the wood; rock the pry bar back and forth slowly. Fast movements may crack surrounding clapboard
③ Pry out any remaining nails or fasteners
④ Use the deteriorated piece of siding as a template for the replacement by placing it on top of the new piece and scoring the replacement siding where it needs to be cut to match
⑤ Caulk the ends of the area where the replacement cladding will be installed
⑥ Push the replacement piece into place, making sure it is aligned with others, and nail into place
⑦ Caulk any nail holes
⑧ Finish wood to match existing

Artificial claddings

Many homes have been clad in artificial materials, including sidings of asphalt, asbestos, fiber-cement, aluminum, vinyl, and fiberglass. Often, these claddings were installed because homeowners wanted an updated look or because they thought that these sidings would minimize any maintenance issues. In reality, not only do such claddings disrupt the historic character of a house, but just like historic materials, they have to be maintained to last their full life, and in many instances they may actually cause additional problems.

Common problems associated with artificial claddings

Traps moisture. Artificial claddings are often non-permeable materials. Although this keeps most moisture out, it also means that any moisture that gets behind the cladding will be trapped and unable to dry out. When the water condenses, it will run along and penetrate building materials.

Difficult to repair. Whereas timber or masonry elements can be patched and repaired on a piece-by-piece basis, artificial claddings cannot easily be repaired. So when a piece fails, the entire piece typically needs to be replaced, and in many instances, the changes in a company's products means that the replacement will not match the existing cladding.

Masks deterioration. Installing artificial claddings may hide deterioration of historic materials, but it does not make problems go away. In reality, it can often cause problems to worsen. Installing artificial claddings places problems out of mind. This means that the homeowner may not address the cause of deterioration, which will then continue behind the siding. If the homeowner eventually wants to correct the problem, artificial claddings prohibit easy access to materials that need to be repaired.

Changes the historic appearance. Artificial claddings destroy the visual character of an historic house. Scale, textures, depths, and colors are all changed by the presence of artificial materials. In addition, historic and architectural details are often concealed or removed when artificial claddings are installed, damaging the character of the house.

ARE ARTIFICIAL CLADDINGS MAINTENANCE FREE?

Maintenance-free does not mean the material will not deteriorate; it simply means that it cannot be easily repaired. Just like all materials, artificial claddings will deteriorate and must be maintained. Common deterioration includes:

- Denting
- Warping
- Bending
- Fading
- Sagging
- Cracking
- Discoloration

Installing and removing artificial sidings

If artificial siding must be installed…

- only install where materials are not repairable
- avoid siding over masonry materials
- repair underlying woodwork before installation
- match siding color and size to historic cladding
- do not conceal decorative elements
- provide for ventilation behind the siding
- minimize nailing into historic or decorative features
- avoid textured sidings

When removing artificial sidings…

- be careful to minimize damage to underlying materials
- be prepared to repair or replace materials that have deteriorated behind the siding
- expect to find some trim and details removed

Installing artificial sidings on historic houses can easily and drastically change the character of the house.

Also, as exampled by these two images, installing artificial claddings has the tendency to result in the removal of character-defining features and the altering or covering of door and window openings.

Windows and Doors

Windows

Window style, configuration, size, and materials have always been a significant element in the design of buildings. Historically, windows not only provided for proper ventilation and natural lighting, but they also served as stylistic elements that emphasized the design and construction of a residence. Windows also create a visual pattern in a neighborhood, and the continuity and rhythm of window styles and openings are just as collectively important along a street as they are to the character of the individual residence. As such, window openings and characteristics of the historic window itself should be maintained as unique and significant elements of a given building's design.

Common sources of deterioration

Moisture. Just like any building material, moisture can deteriorate a window over time if it is allowed to penetrate materials or enter a building through gaps between the frame and sash. Moisture can break down wooden components, cause metal elements to rust, and can lead to condensation on interior surfaces. In addition, moisture penetration can easily damage interior finishes surrounding windows.

Dirt and debris. Dirt, debris, and paint can easily compromise the operation of a window unit if it is allowed to build up. Debris buildup can also retain damaging moisture.

Building movement. Settling and other building movement can cause window sashes to shift within their openings, leading to rattling sashes or glass that are difficult to operate. Movement may also expose gaps between window units and the frame, which will allow moisture penetration.

Weathering. Weathering will naturally degrade window components, especially those that are not well maintained. Wood can crack and splinter, paint can deteriorate, and metal hinges and other components can corrode.

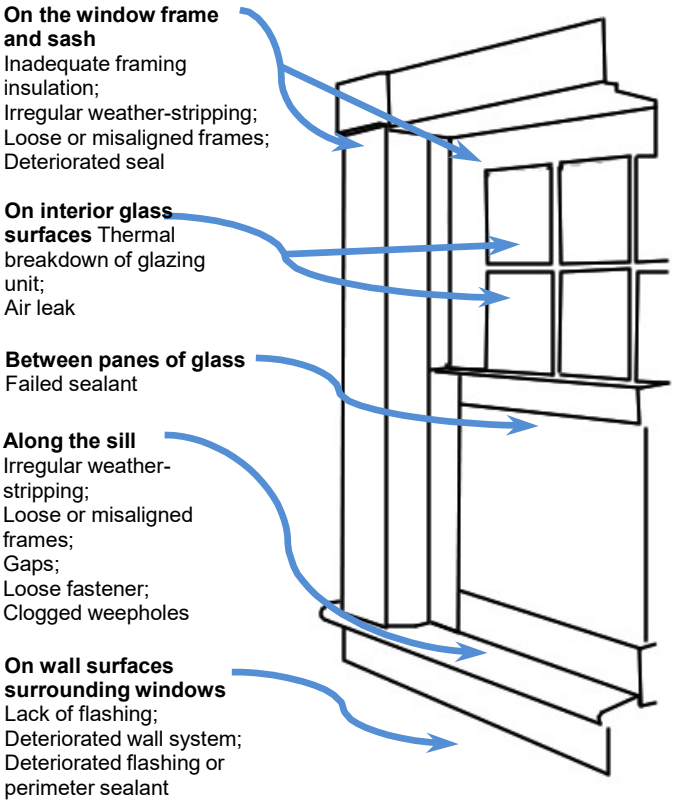
Age. Over time, some window components will naturally begin to deteriorate. Glazing putty will dry out and crack over a period of time, and seals between frames and sashes or upper and lower sashes will break down.

Improper or inadequate maintenance or repair. Failure to maintain window units is the primary cause of deterioration. When well maintained and repaired correctly, historic windows can function for hundreds of years. On the other hand, failure to maintain windows will lead to their rapid deterioration.

SIGNS OF WINDOW DETERIORATION

- Cracked, splintered, or broken stops, rails, or stiles
- Cracked, dry, or broken glazing
- Rattling sashes or glass panes
- Cracking, peeling, or blistering paint
- Sash has difficulty opening, closing, or remaining open
- Joint separation or cracks between the window and the opening
- Fungi or organic growth
- Air infiltration
- Corroded metal
- Broken seals between frames and glass

Why does water appear on a window?



Maintaining your windows

Regularly inspect your windows. Regular inspection and maintenance is key to ensuring that windows last for many years. Windows should be monitored to see if water is penetrating the window or deteriorating the exterior surfaces. In addition, homeowners should inspect for air infiltration, broken or loose frames, sashes, and glass, and non-functioning elements such as cords or locks.

Clean dirt and paint buildup. Keeping movable surfaces free of dirt, debris, and paint buildup will allow for their smooth operation and prevent sashes from becoming stuck in their frame.

Replace glazing putty when necessary. Glazing putty will naturally break down over time by drying out and cracking. Replacing putty when necessary will maintain the weather tight seal between the glass and wooden frame.

Do not force open windows. Forcing open stuck windows can damage sashes and frames. Instead, use a putty knife by gently sliding it along the entire length of the window's perimeter between the frame and sash to break the paint seal.

Maintain painted window surfaces. Paint is key to deterring moisture penetration, organic growth, and pest infiltration. Flaking, peeling, or deteriorated paint should be removed, and surfaces should be recoated to minimize the area of surfaces exposed to inclement damages.

Caulking, weather-stripping, and flashing. Caulking, weather-stripping, and flashings around windows should be maintained to prevent moisture and air infiltration.

REPAINTING WINDOW UNITS

RECOMMENDED

- ✓ Using repainting as an opportunity to replace any deteriorated glazing around a window
- ✓ Removing deteriorated paint from windows with a wet abrasive paper that will not damage the surface
- ✓ Using heat guns to appropriately remove paint without destroying wooden surfaces

NOT RECOMMENDED

- × Using chemical dips to remove paint. This will deteriorate the wooden structure and joints
- × Painting windows without first addressing any damaged or deteriorated materials
- × Using inelastic primers and paints.
- × They will deteriorate faster as materials expand and contract with temperature

BEING GREEN

- ❖ If possible, use natural paint and primers derived from plants or high-solid alkyd. These paints are the least harmful to the environment
- ❖ Avoid using environment-damaging oil based alkyd paints whenever possible

WINDOWS & SHUTTERS

Only use shutters where they historically existed. Not all historic buildings had shutters. Installing shutters where they did not historically exist can drastically alter the character of a house.

Shutters should be appropriately fitted to the window. Shutters should be fitted to the window so that they are the same height as the opening and cover the entire opening when closed.

Shutters should not be attached directly to the building. Shutters should not be attached directly to the face of a building. They should remain operational by being secured to the building by fasteners.

Shutters should only be installed where they were historically found. They should also be installed as a functional building element that covers the entire window opening, not simply as a decorative element as they are on this house.

Windows and energy efficiency

Weatherizing your existing historic windows and using basic practices can provide a much more affordable alternative to buying replacement windows and can even make them more energy efficient than a brand new, insulated window. In addition, it minimally impacts the historic characteristics of your window and building.

Joint fillers, caulking, and weather stripping. Making sure that joint fillers such as glazing putty and sealants are in good condition around non-movable parts such as glass and frames will help minimize air and moisture penetration in these areas. Likewise, maintaining the caulking that seals the jamb, head, and sill to the window opening will also minimize infiltration.

By adding or replacing the weather stripping on your window, you can reduce infiltration by as much as 50%. Weather stripping comes in a variety of materials and sizes and is an inexpensive way to increase energy efficiency.

Lock your windows. Not only does locking your window increase security, it also creates a tight seal between the sashes and helps reduce air infiltration.

Install storm windows. Installing a storm window grants historic windows the greatest energy efficiency. In fact, the combination of an historic window and a storm window provides better insulation than a brand new, double-pane window. Exterior storms are operational and can easily be removed. They also help maintain the historic window by protecting it from environmental impacts, and profiles can even be matched to minimize their visual impact.

STORM WINDOW CONSIDERATIONS

Match the opening, color, and divisions. Storm windows should match the size of the window and should perfectly align with the opening and any divisions between sashes and glass panes so that they do not detract from the visual aesthetic of existing windows. Any storm window trim should be matched to existing trim.

Interior or exterior storms. Consideration should be given to whether interior or exterior storms are appropriate. Both have advantages and disadvantages that should be evaluated by the homeowner. For example, exterior storms may require more maintenance than interior storms, but interior storms may cause damaging condensation on the historic window.

Many people blame old windows on high energy bills and often replace them to save on future bills. However, replacing windows may make very little difference to the overall performance of the building, and your money may be better spent elsewhere.

Windows are not designed to be great insulators and do not play as large of a role in resisting heat flow as do walls. For example, a single pane non-insulated wooden window has an R-value (resistance to heat flow) of about 1. A brand new, mid-range double-hung insulated window is not much better, with an R-value of 2.08. Even the most expensive windows have an R-value of only 3.57. So the difference between a top of the line replacement window and an historic wooden window is approximately R-2.5. In comparison, most walls have a composite R-value of at least R-20 to R-30. In fact, the cheapest insulation available has an R-value of R-11. In this context, the difference between an historic window and a replacement window hardly seems worth the cost when money could be spent elsewhere to increase energy efficiency.

Still, some may see this as a substantial difference, so let's look at this in context of the entire wall. Imagine a 100 square foot wall with an R-value of R-30 and a combination of windows accounting for 30% of the total area. If these windows are the historic wooden windows with an R-value of R-1, the average R-value per square foot equates to R-21.3. What difference will installing a new double-hung insulated window make? By replacing with the window that has an R-value of 2.08, the average R-value only increases to R-21.6. If you opt for the most expensive windows with a value of R-3.57, the R-value per square foot averages to R-22.13. That is a difference of only R-.83 between the historic wooden window and the top of the line replacement.

These exterior storm windows are perfectly fitted with the historic windows so that the meeting rail on the storm window aligns with that of the historic window. In addition, the trim color and scale is appropriate for the window openings

Repairing your windows

Historic wooden windows benefit from the fact that they can easily be repaired when damage or deterioration is present, alleviating the trouble and expense of completely replacing the window system when problems arise, as is the case with replacement windows.

Replacing broken glass.

① Remove the sash from the opening, removing window stops and parting beads if necessary
② Carefully loosen and remove the glazing with a putty knife
③ Loosen push points and remove them, making sure to set them aside
④ Remove broken glass pane
⑤ Remove any paint or glazing residue from wood with sandpaper and then prime exposed wood
⑥ Add a thin line of glazing into the grooves where the new glass is to be inserted
⑦ Press the glass firmly into the glazing and re- insert push points
⑧ Add finishing putty by drawing a straight line with a putty knife along the joint between the glass and wood
⑨ Remove excess glazing
⑩ Once the glazing is dry, paint the glazing to create a weather-tight seal

Repairing weathered wooden materials free of serious deterioration.

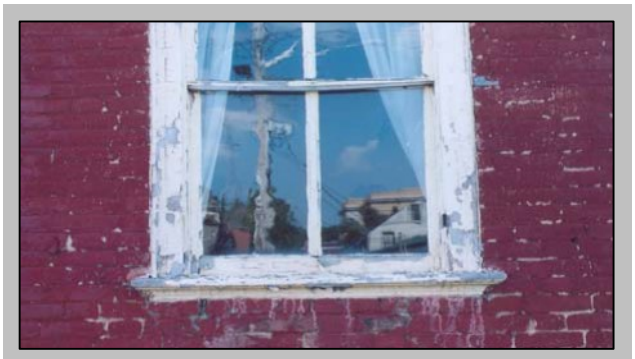
① Dry damaged surfaces and scrape away paint and loose surfaces
② Sand surfaces to be smooth and feathered
③ Paint with one coat of boiled linseed oil and allow it to dry for 24 hours; this will recondition the wood and form a water repellant
④ Fill any cracks with putty
⑤ Paint surfaces with primer and top coat

Consolidating deteriorated or damaged wooden components.

① Scrape away paint and loose surfaces
② Remove deteriorated wood down to sound wood
③ Saturate deteriorated areas with epoxy consolidant to fill voids
④ Apply an epoxy glue to the surface, which creates a bond between the consolidant and the existing material
⑤ Shape the stiffened epoxy to match the profile of existing materials
⑥ Sand to a smooth finish
⑦ Paint with one coat of boiled linseed oil and allow it to dry for 24 hours
⑧ Paint surfaces with primer and top coat

WHEN REPAIRING HISTORIC WINDOWS

- ✓ Address the cause of the problem before repairing or replacing parts of a window
- ✓ Mark and record the components of a window before dismantling for repairs
- ✓ Remove as little historic material as possible
- ✓ Use timber that closely matches the grain and density of existing materials
- ✓ Use only glass that is clear or has minimal tinting from low-e coatings
- ✓ Ensure that replacement glass is the same thickness and weight as original glass so that the sash can support it
- ✓ Use professional assistance to repair specialty windows such as stained or leaded



To ensure a long operating life, windows should be regularly maintained, and deterioration should be addressed before it compromises the structural stability and efficiency of the unit.

Replacing sash cords.

① Remove the window sash from the window
② Locate the weight pocket cover inside the frame and remove it, making sure to set it aside to be reinstalled
③ Feed the new sash cord over the top roller and tie it to the sash weight
④ Cut the replacement sash cord to an appropriate length, making sure not to cut it too short or leave too much slack, both of which can compromise the operation of the window
⑤ Connect and secure the cord to the sash and replace the weight pocket cover
⑥ Rub the sides of the sash with paraffin wax to reduce friction
⑦ Reinstall the sash into the opening

Repairing damaged or deteriorated wooden components with a Dutchman.

① Remove loose deteriorated wood
② Using a square and utility knife, mark smooth, straight lines to cut out deteriorated wood
③ Use a hand chisel and mallet to remove deteriorated wood and create a straight edge
④ Trim the replacement piece and test the fit to make sure joints are straight and tight
⑤ Dampen unpainted surfaces and then spread polyurethane glue on both the cut out area and the piece to be patched in
⑥ Make pilot holes in the patch and then secure with corrosive-resistant fasteners
⑦ Smooth out joints by sanding away any excess glue
⑧ Cover fasteners with glazing putty and then prime and paint the patch to match existing materials

Replacing your windows

Maintaining and repairing historic windows is always preferable to replacing windows with modern units. However, an historic window may sometimes be beyond the point of being economically or technically feasible to repair. In this instance, replacement might be the only viable option.

Before replacing a window, consider… what needs to be replaced. Does the entire assembly, including sash and frame need to be replaced, or is it only the sash that needs to be replaced? Does the window just need to be resealed or re-hung?

Effort should be made to replicate the style, size, light configuration, and profile of any element being replaced. If historic windows were originally wood, it is recommended that replacement windows be of wood. New wooden windows can easily be built to replicate the existing profile and configuration. Vinyl, aluminum, and fiberglass are prefabricated and typically have wider, flat profiles and shallow settings, both of which can drastically alter the character of an historic building. Looking at old photographs can often discover original window design and configuration, but if you are unsure of the original design, it is recommended to install windows that are compatible with the historic character and period of the building.

Openings should never be made smaller or larger. Likewise, openings should not be partially or completely bricked in. Doing this can cause serious structural damage to a building and will alter ventilation patterns facilitated in the original design. This also creates a visual deterrent to the historic character of the building.

Stabilizing a sagging or deteriorated joint.

① Tape any glass to secure it and brace the joint to be repaired
② Remove any loose debris from the area with a putty knife and wire brush
③ Inject a borate preservative into the joint to be stabilized; do not use a penetrating water repellant
④ Use a caulking gun and removable sealant to seal any gaps in the joint or between the glass and sash
⑤ Clean any excess sealant from the face of the sash
⑥ Let the sealant cure for proper adhesion
⑦ Drill pilot holes and install a corner brace using stainless steel screws

RECOMMENDED

- ✓ Replacing only historic windows that are beyond repair
- ✓ Matching replacement windows to the original or historic window's size, profile, and trim
- ✓ Using wood as the replacement material. If possible, choosing timber from sustainably managed forests.
- ✓ Properly recessing new windows into the opening to protect the window, maintain water runoff, and retain the house's character
- ✓ Reusing historic hardware whenever possible

NOT RECOMMENDED

- × Replacing sound or repairable windows that can be made just as energy efficient as new windows
- × Using vinyl or aluminum windows that detract from the historic appearance of the house
- × Using windows that are not of the same period or style as the house
- × Altering window openings to make them smaller or larger, or enclosing them

If historic windows on the façade are beyond repair and must be replaced, consider moving sound windows from the rear or side elevations to the façade and installing the replacement windows out of public view

	COMPARISON WINDOW REPLACEMENT OPTIONS					
	Retain the original or historic single-pane wooden window	Replace the single-pane window with new double-pane wooden window	Install storm window over historic window	Replace historic window with double-pane vinyl window	Replace historic window with low-e glass double-pane vinyl window	Replace historic wooden window and storm with double-pane low-e window
Historical Use	Wood used for windows since 1400s		Storm windows popularized as an alternative to shutters after the 1880s	Vinyl introduced in 1959; Insulated glass invented in early 1970s	Vinyl introduced in 1959; Low-e glass invented in 1979	
Life Expectancy	200 years or longer, if well maintained	40-60 years, if well maintained	20-40 years (storm); 200 years or longer (window)	20-25 years		
Maintenance	Regular repainting and preventative maintenance (typically every 5 years)		If wood, regular repainting; if aluminum, maintain baked on enamel finish; if needed, repair scratched or cracked surfaces	Should be cleaned every 6 months to stop discoloration. Must be monitored for warping or bending that will allow air and water infiltration.		
Repair	Individual elements of the window can be replaced as needed		Individual elements of the window can be replaced as needed	Very difficult to repair; bent, warped or damaged units typically require total replacement		
Thermal performance (U-value)*	1.1	.52	.5	.58	.38	.38
Cost of 3'x5' window, installed**	-	$600	$90	$480	$580	$580
Annual energy savings***	-	698,144 Btu	722,218 Btu	625,922 Btu	902,772 Btu	132,407 Btu
Annual savings per window****	-	$18.62	$19.26	$16.70	$24.09	$3.53
Payback*****	-	32.2 years	4.6 years	29 years	24.1 years	164 years
Environmental Impact	Retaining historic windows makes use of existing old growth materials; no landfill waste	Historic window discarded; New timber must be harvested; may not be from renewable resource	Retaining historic windows makes use of existing old growth materials; No landfill waste	Historic window discarded. Composed of non-renewable resources such as natural gas and petroleum. Contains six of the most harmful industrial pollutants- dioxins, furans, cadmium, lead, mercury and organic tin. Manufacturing requires large expenditures of energy and produces large amounts of carbon dioxide and acidic sulfur dioxide		

* U-value is a measure of how well a window insulates heat. Simply, how efficiently does it keep heat out of the home in the summer and keep heat in the house in the winter. A lower U-value is better.
** Cost based on average price for a high quality replacement. Lower quality, higher quality, and custom window prices would vary.
*** Savings compared to retaining a single-pane wooden window. Btu is a measure of thermal energy. One Btu equals the amount of energy necessary to heat one pound of water one degree.
**** Savings based on heating cost of $1.07 per therm, the typical measure of natural gas usage
***** Payback is how long it would take you to recoup the money spent on a new window through annual energy bill savings. Payback is figured by dividing cost of installed window by the annual savings. For example, $600 / $18.62 = 32.223 years

The truth about replacement windows

Replacement windows have long been marketed as an efficient, maintenance-free alternative to historic windows. However, much of the information that has been perpetuated in the public's mind is based on faulty and inaccurate information. Below are some basic facts about replacement windows.

All windows need to be maintained. Every window must be maintained to make sure that they are functioning correctly by insulating heat and preventing air infiltration. Failing to properly maintain a replacement window will cause it to break down just like an historic window.

Maintenance-free does not mean that the window won't deteriorate; it simply means that the window cannot be repaired when damaged. Despite claims by salesmen, all windows deteriorate. Vinyl will discolor and easily warps in high temperatures. Vinyl expands and contracts more than other materials, causing sagging, twisted, or bent frames. Aluminum is a poor insulator and can cause high levels of condensation, and the baked on enamel finish on most windows is easily scratched, exposing the metal to damaging weather. While a broken piece of a wooden window could be repaired if necessary, modern windows cannot be repaired. Any damage effectively means that the window must be completely replaced, and since window companies frequently change their product line, future replacement windows may not match earlier replacement windows on the rest of the house.

Cost and payback. Replacing historic windows with modern, insulated windows is not the most economical choice. Replacement windows have a considerable expense. You must pay to remove and dispose of existing windows, to purchase and deliver new windows, to modify or replace existing frames, and to install the new windows. It can take upwards of 30 years to recover the cost of installing new windows through any energy savings you may receive. Installing a storm window over an historic window only has a payback of about 5 years and is just as energy efficient.

Not sustainable. In addition, some replacement windows have a very high environmental cost that makes them one of the least sustainable options. Materials such as vinyl are composed of non-renewable resources such as natural gas and petroleum and contain six of the most harmful industrial pollutants – dioxins, furans, cadmium, lead, mercury, and organic tin. Also, manufacturing requires large expenditures of energy and produces large amounts of carbon dioxide and acidic sulfur dioxide. As such, installing replacement windows is among the least sustainable choices.

COMMON REPLACEMENT WINDOW DETERIORATION AND PROBLEMS

Vinyl
- Discoloration
- Chalking
- Twisted, bent, or warped frames
- Sagging
- Thermal seal breakdown
- Difficult to paint

Aluminum
- Thermal seal breakdown
- Scratching and denting
- Insulating deficiency
- Prone to condensation

Fiberglass
- Thermal seal breakdown

If historic windows must be replaced, the best choice is a fiberglass-clad solid wooden window. These windows offer great insulating value and are extremely durable. In addition, they are not as environmentally damaging as vinyl. Fiberglass can also mimic historic trim profiles, can be painted, and comes in a variety of colors and widths.

When replacing windows, you should always choose a replacement that matches the historic characteristics of the original. Failing to do so, as in this rehabilitation example, can compromise the aesthetic of the house.

Doors

Historically, doors have not only played an important role in allowing light and ventilation into a house, but they have also served as the threshold between interior and exterior spaces, providing the gateway for those entering a home and often dictating the formality of a welcoming into the home. Doors can vary widely in composition and design, and much like windows, doors should be maintained as important features in defining the character of a house.

Common sources of deterioration

Aging. Since doors are regularly used, they are typically subjected to more deterioration than other building elements. Over time, elements such as thresholds may wear from foot traffic, hinges may loosen, and doors may get scuffed or dented.

Dirt and debris. Like on windows, dirt, debris, and paint buildup can compromise the smooth operation of doors.

Building movement. Settling and other building movement can cause doors and frames to shift, resulting in doors that sit crooked in their frames.

Moisture and humidity. Moisture and humidity levels affect historic doors like any other material and can lead to deteriorated paints, stains, and wood. In addition, since wood expands as it takes on moisture, doors may swell and become difficult to open or close in times of high humidity, and some doors may ultimately warp. Metal doors may corrode with excessive moisture if they are not properly coated.

Weathering. Being constantly exposed to weather and environmental impacts, doors will naturally deteriorate over time if not maintained.

Signs of door deterioration

- Cracking, peeling, or blistering paint
- Doors that sit crooked or have difficulty opening or closing
- Cracked or splintered trim panels or thresholds
- Fungi or organic growth
- Air infiltration
- Corroded, loose, or worn hardware

Door components are especially susceptible to deterioration from constant exposure to weather and foot traffic. Elements such as thresholds and the bottom of frames are particularly vulnerable.

Maintaining your doors

Keep hardware operational. Hinges, handles, and knobs should be kept tight and oiled to ensure proper functioning.

Clean dirt and paint buildup. Dirt, paint, and debris should be cleared from doors since it can retain moisture and can
hinder the smooth operation of doors.

Replace deteriorated components individually. If deterioration is localized, individual components or pieces can likely be replaced. This will keep the door functioning while deterring deterioration from affecting the rest of the door.

Maintain painted surfaces. Paints and stains protect historic wooden doors from rot and insect infiltration. Doors should be maintained so that any coatings are impervious. If paint has significantly deteriorated and doors need to be refinished, it is recommended that both the interior and exterior be refinished since only refinishing one side can cause the door to warp.

Weather-stripping and caulking. To prevent moisture and air infiltration, doors should be properly weather-stripped and caulked. Weather-stripping should be installed where the door joins the meeting rail, and caulking should be installed between the doorframe and wall surfaces.

Storm or screen doors. Installing a storm or screen door can be a viable way of increasing efficiency while minimizing a door's exposure to the elements. If a storm door is to be installed, it should match the existing opening. Solid panel wooden doors with a large, single glass pane are most recommended because the transparency will largely retain the visual aesthetic of the historic door.

Porches and Awnings

Porches

Porches are a prominent feature of any house and contribute to the unique character and style of that particular home. Historically, porches also served as an extension of the home where homeowners could relax under shelter from the elements and talk amongst neighbors and friends. Over time, many porches have taken on another function by being enclosed and converted into an additional interior living space.

Deterioration, maintenance, and repair

Porches are typically comprised of multiple materials such as timber and masonry and often have a dedicated roof. As such, porches are susceptible to deterioration from the same agents of decay found when these materials are present elsewhere, and maintenance should follow those suggestions found in the chapter on the respective material.
Common repairs may include:

Replacing flooring. Porch flooring is susceptible to damage from extensive foot traffic, moisture collection, and structural failure. Flooring may need to be replaced when it begins to sag, rot (in the presence of wood), or crack (in the presence of concrete). For sagging floors, porches should be inspected for structural deterioration before repairing the floor.

Repairing foundations and framing. Foundations and framing are typically comprised of timber and masonry and may deteriorate due to any number of causes. Particularly of concern are any support beams that have begun to sag due to structural loads or walls and foundations that have begun to crack and separate from the main structure of the house due to isolated settling.

Repairing structural or decorative columns and walls. Columns, especially at the top and bottom, are susceptible to deterioration because water has a tendency to run down from the roof along the face of the column. Balustrades and knee-walls in between columns are also vulnerable to decay from moisture settling on materials. These areas should be regularly inspected and appropriately treated and repaired according to their composition.

Replacing structural or decorative columns. Occasionally, columns may be too deteriorated to selectively repair materials. When a column must be replaced, a column that is identical to the historic column should be located or created. If the element is structural, always support any overhanging roof with a jack to support it while removing and replacing the deteriorated element. While the deteriorated column is removed, take the opportunity to remove debris and any deterioration from areas where it was connected to the roof or flooring.

GENERAL GUIDELINES FOR PORCHES

- Localized deterioration should be addressed and repaired before it compromises the structural integrity of the porch
- Replace only historic elements that cannot be repaired
- Do not remove decorative materials without replacing with in-kind materials
- Do not remove elements such as support brackets that may compromise the structural integrity of a building
- Use appropriate and tested maintenance and repair procedures for addressing the various materials and elements of a porch
- Where historic porches have been removed or destroyed, and the homeowner wishes to construct a replacement porch, use historic photographs to recreate the design of the historic porch. If photographs are not possible, create a simplified design based on the historical period and architectural style of the building
- When repairing or reconstructing a porch, be careful not to damage existing historic materials

Enclosing porches

The open nature of porches is a key aspect of their character, and enclosing a porch will dramatically alter the visual aesthetic of the house. As such, it is generally not recommended that a porch be enclosed to create additional living space. Although still detrimental to the appearance of a house, it is typically more acceptable for a side or rear porch to be enclosed than a porch on the façade. If a porch is to be enclosed for any reason, the following guidelines may be of assistance.

Construct porch framing behind existing railings and columns. Structural elements for enclosing the porch should be installed behind any existing columns and railings. Doing so will still allow for enough room to enclose the space while retaining the most character-defining features of the porch. In addition, doing so will help minimize damage to existing components.

Make it reversible. Porches can be enclosed while ensuring that the undertaking is reversible and non-damaging to existing building materials. Historic materials should not be punctured or altered for the fastening of porch framing materials. Existing openings should not be made smaller or larger to accommodate windows or doors. Likewise, openings should not be enclosed behind masonry or any other cladding. Any doors or windows that are to be installed should conform to existing spaces.

Large window spaces. When enclosing porches, it is preferable to use large window spaces rather than solid materials such as masonry, timber, or other claddings. These materials will dramatically alter the feeling of the porch by solidifying the mass. On the other hand, using large window areas will create the illusion of an open space, retaining the visual aesthetic of the porch, although the area has in fact been enclosed. Likewise, any doors to be installed should be solid core wood with a single, large glass inset.

If enclosing a porch, using large single pane windows or single panels of screening are most appropriate, especially when the original porch framework is left exposed. This treatment maintains the illusion that the porch is still an open space.

AWNINGS AND HISTORIC HOUSES

Most historic houses did not feature awnings. Instead, solar protection was offered through porches, operational shutters, and surrounding shade trees. Where awnings were present, they were made of solid-colored cloth and were installed so that they did not damage or remove decorative features.

Over time, many homeowners have added awnings to windows and porches to provide additional shade, but many of these awnings are of modern metal materials. However, metal awnings are never appropriate for historic buildings. Where present, these should be exchanged for cloth awnings. If a new awning is to be installed, it should also be of cloth, and should be installed within existing openings so as not to destroy or conceal historic features of the house. Retractable awnings are most appropriate.

Landscapes

The landscape surrounding an historic house contributes to the character of the house just as much as any porch, window, or other building element. Elements such as setback, curbing, ratio of lawn to impervious covering, and the relationship of the house to the landscape also help maintain the perception of the house's scale and proportions. In addition, many accessory buildings, landscaping features such as walls or fences, mature trees, and cultivated plantings can be considered historic resources in and of themselves. Failing to maintain such elements can detract from the visual aesthetics of the house, as well as compromise the historic association between the house and its surroundings.

Elements of the landscape

Walkways and driveways. Moisture and fluctuations in temperature can cause sidewalks and driveways to crack and buckle. Certain materials will also spall from freeze and thaw cycles. Materials should be well sealed to prevent moisture penetration, and any soil erosion near walkways or driveways should be corrected to prevent water from seeping under materials and wicking to the surface. Where possible, use permeable materials to reduce water runoff.

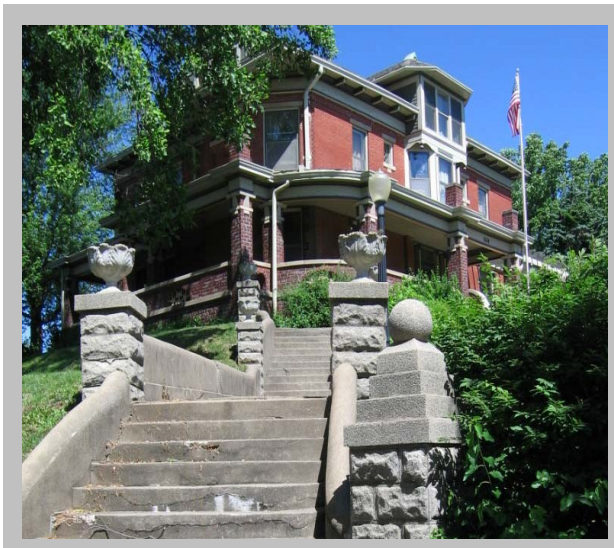
Plantings. Care for trees and remove deadwood as needed. Trees with branches overhanging the roof should be trimmed back. Plantings at the perimeter of a building should be avoided since they may trap moisture in masonry and timber, and large root systems can destroy materials. Avoid invasive plantings that will crowd a building as they grow.

Fences, walls, and gates. Historic fencing and wall materials include stone, timber, and some cast metals. Timber materials should be inspected for rot, masonry should be inspected for spalling and other deterioration, and metal should be inspected for corrosion. All elements should be inspected for loose components.

Site grading and drainage. Sites should be graded to keep water away from building foundations. Homeowners should maintain a positive slope away from all buildings, and downspouts should properly direct all water away from the building. Any drains or covers on well windows should be properly maintained so that debris and water cannot collect and infiltrate the foundation.

Lighting and utilities. All utilities and lighting fixtures should be checked for exposed or damaged wires. Where fixtures are attached to a structural unit, make sure the joints are properly sealed to prevent moisture and air infiltration. Any utility lines running into a building should have a drip loop to prevent water being carried along the cable and into the building by surface tension.

Accessory buildings. Structures like garages and sheds should be maintained just like the house itself. Use appropriate maintenance and repair techniques to address any deterioration of building materials.



Landscape features are important in retaining an historic house's sense of place, character, scale, and mass and should be maintained just like any component of the house itself.

BEING GREEN

Cutting your lawn. Refrain from bagging the grass clippings, which will then be put in a landfill. Instead, leave them on the lawn. The clippings will decompose and add nutrients to the soil. Or consider starting a compost pile and use the clippings as part of the compost materials.

Harvesting rainwater. Consider converting your gutter and downspout system into a rainwater harvesting system. Downspouts can be modified to send runoff into rain barrels that can then be used for tasks like watering the plants or washing cars.

Salvaged materials. Fences and walls on your property are ideal places to use recycled materials for repairs or new installations. Using salvaged timber and masonry are economic, sustainable, and appropriate choices on these non-structural elements.

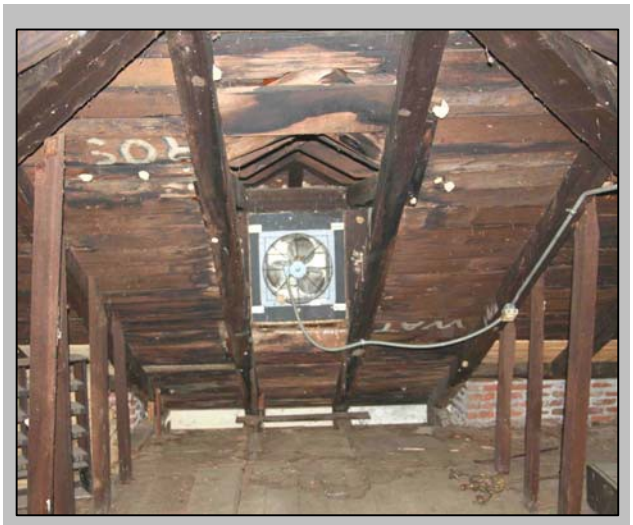
Sustainability and Energy Efficiency

Many homeowners may not be aware that historic homes are quite sustainable and have many inherent energy-efficient and saving qualities. The most common materials in historic homes, brick, wood, stone, and glass, were used because of their durability and longevity. Such materials can last for hundreds of years when well maintained and thus reduce the need to produce new materials while throwing the historic materials into a landfill. Thick materials such as these also retain heat in the winter and repel it in the summer. In addition, homes were naturally sited to take advantage of prevailing winds, natural light, and insulating barriers such as hills or groves of trees. Large windows, transoms, and high ceilings allow for efficient cross-ventilation and help cool the interior, while shutters and central fireplaces provide efficient heating. Such considerations were implemented as a matter of necessity before the invention of automated temperature control systems in the middle of the twentieth century. In comparison, although many newer homes or replacement materials may be just as energy efficient, they do not posses the same durability as historic materials and will have to be replaced over time, reducing their sustainable nature.

☐ Steps that every homeowner can take

Air-sealing. Air-sealing works directly with insulation. While insulation increases resistance to heat loss, air-sealing actually minimizes holes or leaks in the building envelope to reduce heat loss during the winter and to prevent air-conditioned air from exiting the building. Air-sealing should always be completed before insulating to reduce the unwanted infiltration and exfiltration of air.

- Caulking should be used to seal any gaps of less than ½" thick in the immediate environment. Use a paintable, acrylic caulking compound to seal cracks between walls and ceilings, as well as any openings between walls and doors and near any trim panels
- Spray foams can be used to seal gaps where wires and pipes travel through floors and ceilings, electrical outlets, and recessed lighting. High-expanding foams should be used for these environments. Spray foams can also be used between window and door frames and the walls, but only low-expanding foams should be used.
- Weather-stripping should be used around all windows and doors.



Make sure to properly seal around any openings in spaces like your attic, where air and moisture infiltration and exfiltration is likely to be the most intense. In addition, any exhaust fans should be fitted with louvers so that the opening can be enclosed for an air-tight seal in the winter.

Insulation. Adding insulation to your home will help increase the building's resistance to heat loss. There are a variety of ways to insulate a home, and each has an appropriate application. Likewise, every type of insulation has different thermal values, which should be matched to the area being used.

- Loose-fill cellulose can be installed in attic spaces. Cellulose is made from recycled newspapers and is thus one of the most sustainable options. Cellulose is also efficient at reducing the rate of air infiltration and has the ability to absorb and release some moisture.

ENERGY AUDITS

Historic homeowners may benefit from an energy audit by a utility company or an energy contractor. Through inspection, infrared photography, and a blower door test, in which a powerful fan is set up at an exterior doorway to create a strong draft inside the house, making it easy to identify air leaks in the building envelope, specialists can pinpoint trouble spots in your home and give you the most cost-effective recommendations for improving overall energy efficiency.

- Fiberglass batts are another option for attic space and are likewise a sustainable option made from sand and recycled glass. These are among the easiest types of insulations to install, although users must be careful to ensure that batts are installed tightly to avoid gaps. The downside to fiberglass is that it has a tendency to hold moisture.
- Cotton batts are similar to fiberglass batts in that sheets of the material are cut to fit certain spaces, and users must be careful to avoid gaps. Made from recycled waste products, cotton won't irritate the skin like fiberglass.
- Polyurethane spray foam is best used in accessible wall cavities between joists and studs. These spray foams are not made from recycled materials but have the best sealing properties.

Vapor Diffusion Retarder. Vapor diffusion retarders should be installed in crawl spaces to reduce moisture from infiltrating the house. Using at least a reinforced 8-mil plastic retarder is recommended. When installing, seal all sides to the foundation with foam or other sealant.

Upgrade your furnace. While this can be applied to any home, it is of particular importance in an historic home where the furnace may not have been updated for several decades.

Turn back thermostats. Adjust thermostats that control your hot water heaters, refrigerators, furnaces, and air conditioners. Doing so can save between 1% -3% on your annual energy bills.

Regularly service mechanical equipment. Having all ventilation, heating, and cooling systems inspected, cleaned, and serviced regularly will cut down on energy expenditures.

Regular maintenance. As discussed, regular maintenance will not only preserve materials and maintain the historic character of your house, but it will also keep your house energy efficient by reducing the number of exposed surfaces, gaps, and failing elements that may allow air and moisture infiltration.

INSULATING YOUR ATTIC

In terms of base energy savings, insulating your attic is the most cost-effective way of reducing your energy bills since more air and moisture is moved through here than any other location in the house. By insulating your attic floor and sealing any air leaks, you can save as much as 15-30% on your annual energy bills.

AVOIDING DAMAGE AND IRREVERSIBLE CHANGES

While improving energy efficiency is important, you should not sacrifice the historic character of your home. Some upgrades, such as wall cavity insulation, may prove expensive and difficult in historic homes since they may require removing claddings, cutting holes in walls, or removing decorative elements.

Often, there are more cost-effective methods of improving efficiency which will not compromise the historical integrity of your home.

BEING GREEN

Some insulations are more environmentally friendly than others. For example, cellulose is very sustainable, being composed of recycled newspapers. Fiberglass is a somewhat sustainable choice since it is partly comprised of sand and recycled glass. Cotton and wool- based insulations provide another very sustainable option.

Spray foams can also be sustainable choices. While the most common foams are polyurethane-based, and as such are from non-renewable petroleum resources, there are other options. An increasingly popular option for spray foam insulations are those that replace petroleum products with soy bean oils. These foams not only improve the thermal resistance of building components, but they also provide a healthier, more sustainable alternative to traditional products.

For additional information

If you would like additional information about specific building materials and maintenance techniques or information about building materials that may not be covered in this guide, please contact:

Historic Preservation Section
Delaware County Planning Department
1055 E. Baltimore Pike, First Floor
Media, PA 19063
610.891.5200

Or email the Preservation Department at Planning_Department@co.delaware.pa.us

Additional resources

The **DCPD Preservation Section** has further information on the website about historic resources, organizations and preservation.
https://www.delcopa.gov/planning/programsandinitiatives/HistoricPreservation.html

The National Park Service has published 50 **Preservation Briefs** that provide extensive guidance on preserving, rehabilitating and restoring historic buildings. These briefs are freely available at the National Park Service website and may provide additional guidance to owners of historic properties.
https://www.nps.gov/tps/how-to-preserve/briefs.htm

Traditional Product Reports from the publishers of Traditional Building Magazine features checklists, directories, buying guides, case studies, stories, articles, primers, installation tips, and more.
https://www.traditionalbuilding.com/product-report

The National Trust for Historic Preservation has developed several guides on **Preservation Tips and Tools** regarding preservation basics, for communities and homeowners.
https://savingplaces.org/story-categories/preservation-tips-and-tools-stories#.WnnwlY-cGUk

Windows Energy Efficiency Facts and Myths by Shanon Peterson Wasielewski is hosted on the Department of Archaeology and Historic Preservation of Washington State. This document breaks down common misconceptions and falsehoods about the differences between historic and replacement windows.
https://dahp.wa.gov/sites/default/files/Windows%20Energy%20Efficiency%20Facts%20and%20Myths.pdf

The Old House Journal has an online archive of the same name, which is described as the premiere resource for restoring old houses. Find products and services for homes built before 1950 and everything you'll need for your old house restoration projects**.**
https://www.oldhouseonline.com/

In addition, your local historical commission, HARB, or historical society might be able to point you in the right direction.