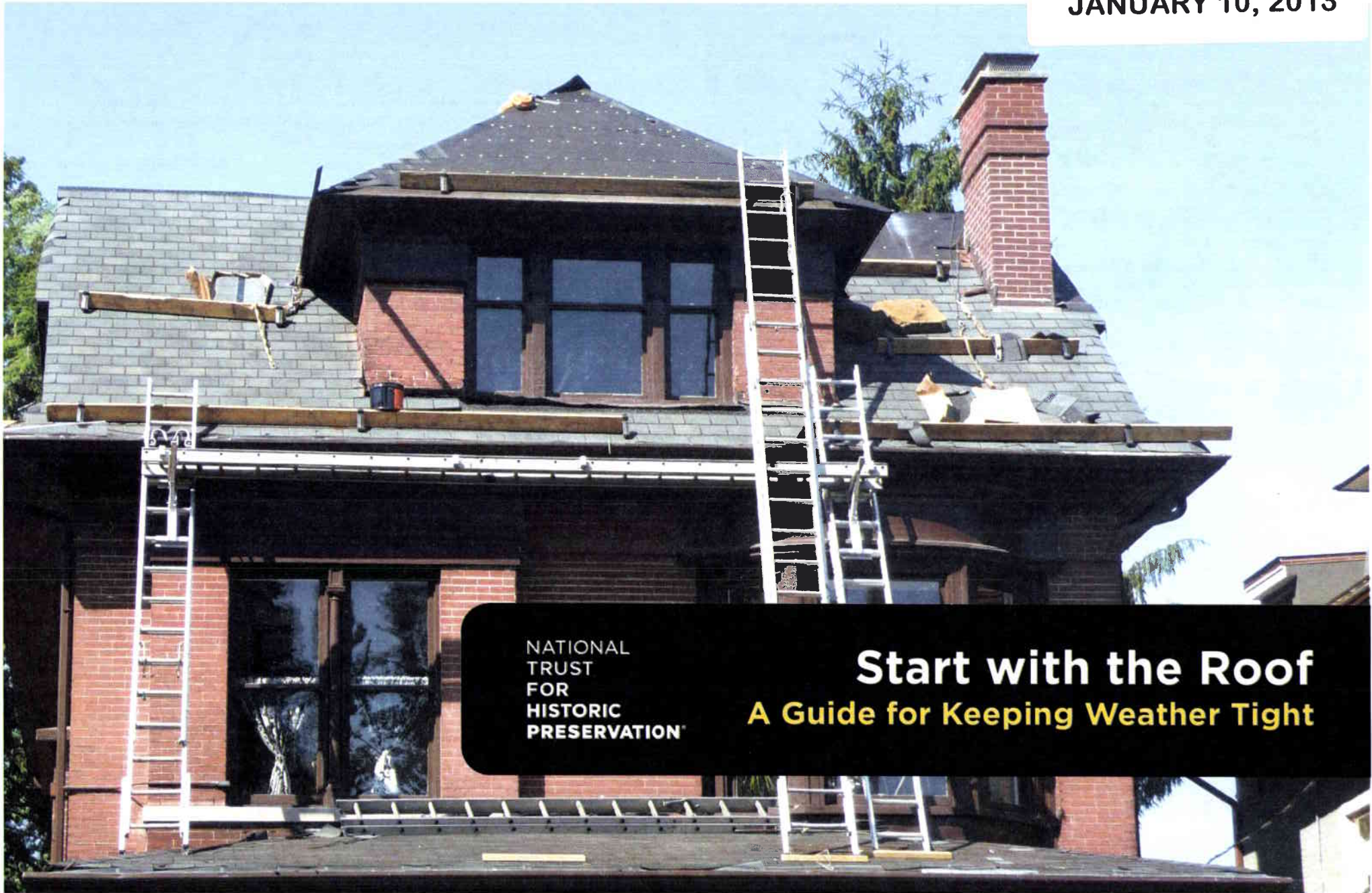


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JANUARY 10, 2013



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Start with the Roof

A Guide for Keeping Weather Tight

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A Guide for Keeping Weather Tight

The roof of your older and historic building is ground zero for providing a weather-tight defense against the elements, and central in any strategy for weatherization and increasing energy efficiency. The roof type and materials affect your building's heating and cooling abilities. And with an estimated 30 percent of heat loss occurring through the walls, ceiling and floors, it makes good sense for building owners to focus on their roofing and ensure it is doing the best possible job. Once roofing is let go, even for a season or two, damage and deterioration can set in. The longer it is neglected, the more expensive it will likely be to repair. Older and historic buildings are inherently designed to address heat loss and cooling. But they can always be made more energy efficient and perform using new technology, such as through solar access. Whole house weatherization may start with the roof but should not end there. Assess all parts, from windows and mechanical systems to insulation and air leaks. This resource, divided into the following sections, is intended to help you look at your building's roof and its parts, and think about all options.

Is My Roof Energy Efficient?

How Do I Know if My Roof is Failing?

What Type of Roof Form is On My Building?

When Replacing My Roof, Do Materials Matter?

- Asphalt, Flat, Metal, Slate, Tile, and Wood

Case Studies:

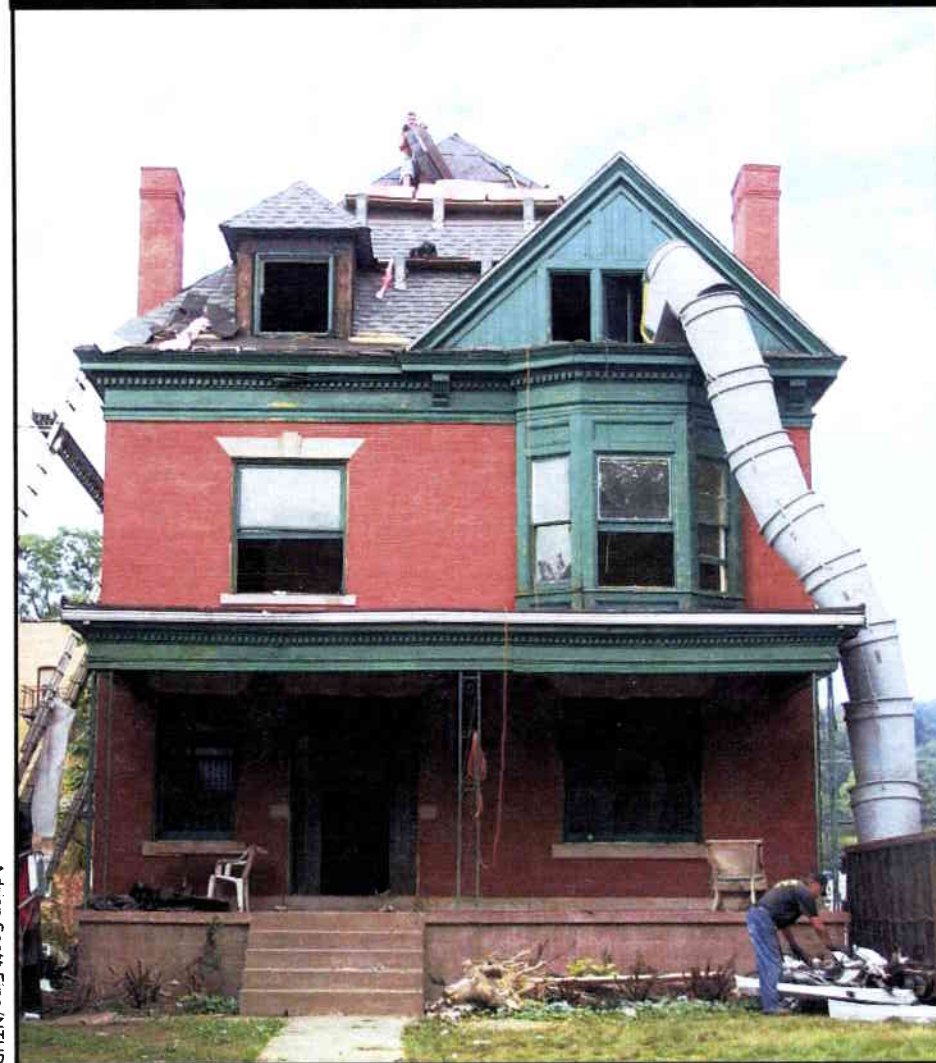
- Altering the Roof Line
- Anatomy of a Roof
- Early Intervention is Key
- Keep the Porch
- Letting the Light In
- Tapping Solar Power

For more information...

Go to www.PreservationNation.org/Weatherization to find additional resources on roofing and much more for your older and historic building.

Start with the Roof

American Foursquare house undergoing rehabilitation
Pittsburgh, Pennsylvania



Adrian Scott Fire/NTHP

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Is My Roof Energy Efficient?

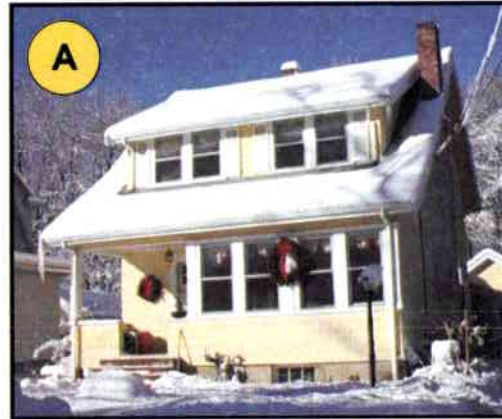
Your roof is only one part of the energy efficiency equation, though often a major source for heat loss through the attic and other locations. Diagnosing whether or not your roof is performing well, in terms of energy efficiency, can be done through a whole house energy audit as well as simple, easy-to-do tests.

For owners of older and historic buildings in colder climates, try the melt test. Is snow melting more quickly on your roof in comparison to nearby buildings? Different patterns of snow melt and the formation of icicles and ice dams may be indications of large air leaks, lack of attic venting, and inadequate insulation. HVAC ductwork, often located in the attic of an older home, is another source allowing for heat loss. When ducts leak, which is often, this allow large amounts of valuable heat into the attic.

Diagnosing the problem with your roof and keeping a tight 'lid' on your building is only the first step. What follows should be a strategy to address water and moisture infiltration, sealing air leaks and ductwork, and the appropriate installation of insulation where needed.

- A A bungalow with uniform buildup of snow may indicate good insulation and an overall weather tight roof.
- B A Second Empire building with combination of mansard and flat roofs, as well as dormers, creates lots of areas for potential air leaks.
- C As snow melts more quickly on a roof in comparison to others, it may indicate a source for large amounts of heat loss.
- D Weatherization can help tighten up a building for greater energy efficiency and comfort so occupants do not have to resort to make-shift ways for sealing up air leaks.
- E Most older buildings, even modernist houses like this one from Phoenix, AZ, were designed with energy efficiency in mind. Wide overhangs provide shade and protect the interior from heat gain.

Start with The Roof



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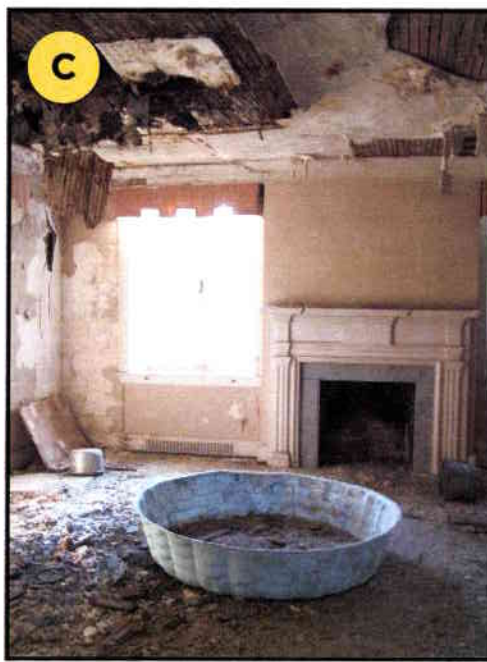
How Do I Know if My Roof is Failing?

All roofing materials deteriorate and eventually will fail over time, depending on the quality of the material, appropriate installation, routine inspection, and ongoing maintenance. Roofs are subject to natural forces like rain, snow, sun degradation, wind and pollutants. Roofs are also commonly damaged by falling tree limbs, small animals, foot-traffic and insect infestation. In general, when roofing has failed, replace using in-kind materials where possible and only consider substitute materials when technically or economically not feasible.

- A Detail near dormer showing asphalt fiberglass roof shingles that are completely failing — delaminated, curled, worn, frayed — and likely allowing water to enter the building. Typically, asphalt shingles last between 15 to 25 years before needing replacement.
- B Asphalt shingles that are puckered like this may indicate problems with the underlying sheathing deck or felt movement often caused by varying moisture levels in the material under the shingles. Possible strategies include improving attic ventilation to eliminate excess humidity and refastening the distorted shingles.
- C By the time your roof failure has reached this point — collecting water in buckets and, in this case, a children's swimming pool — damage is readily apparent with saturated ceilings, loose plaster and lath, and holes. Fixing the roof and drying out the house is still an option, as well as repairing damaged ceilings. If let go long-term, serious structural issues will form.
- D Slate roof shingles are a strong and durable material that typically last between 60 to 125 years. During the winter, slate may be damaged by ice or ice dams and daily freeze-thaw cycles. Before slates themselves fail, roof fasteners and nails might corrode or loosen which requires regular inspection.
- E A properly ventilated and insulated roof should have no signs of ice damming or icicles. Heat loss melts snow which then travels to gutters, cools off and forms ice. Locate sources of air leaks, insulate and seal to prevent roof damage.

Adrian Scott Fine/NTHP

Start with the Roof



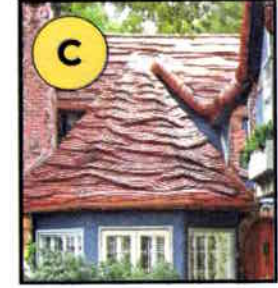
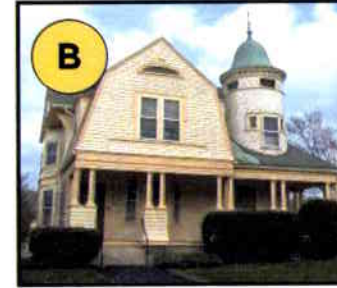
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What Type of Roof Form is on My Building?

Older and historic buildings have a variety of roof types, starting with the overall shape. As you maintain your building, and consider ways to weatherize, think about the architectural character too.

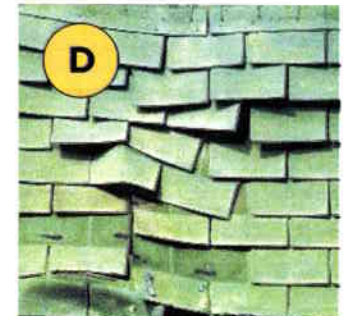
- A GABLE. The most common roof shape is found on all types of buildings, in this case, a 1910s Craftsman Bungalow in Phoenix, AZ, with front-facing paired gables. Roof is formed by two sloping planes rising from side walls and meeting at central ridge line. Typical features include overhanging eaves, sometimes with exposed rafter tails or wood bargeboards.
- B GAMBREL. Instead of having a single barge at the peak, gambrel roofs have three ridges, one at the peak and two along sloping sides. This roof type is often found on Dutch Colonial Revival or sometimes Queen Anne houses, such as this example in Manchester, New Hampshire.
- C THATCH. Curved edges, artificial sags and undulating shingles are often devices to simulate Storybook architecture design.
- D HIPPED. Formed by four sloping roof planes extending from the walls to a ridge, usually with overhanging eaves.
- E CROSS GABLE. Usually found on T, L or cross-shaped buildings, formed by the intersection of two gables, typically at the center of the roof.
- F FLAT. Rarely entirely flat and usually gradually sloped to drain water away, sometimes featuring a low wall or parapet along the edges.
- G JERKINHEAD. A ridged roof with gable ends with the ends 'sliced off' to give the appearance of a fold, turndown and truncated gable.
- H MANSARD. Steeply sloping planes extending from a flat roof, often found on Second Empire architecture.
- I GOOGIE, MODERNIST. Exaggerated, experimental roof forms and soaring shapes found on Mid-Century buildings, breaking all the rules, such as this building in Asbury Park, NJ.
- J SAWTOOTH. Composed of series of parallel roofs in succession, resembling a saw. Often found on industrial buildings providing optimal daylighting.

Start with the Roof



Adrian Scott Fine/NTHP

When Replacing My Roof, Do Materials Matter?



Asphalt Roofing

Now the most popular roofing material, asphalt came into prominence in the late 19th century. Today asphalt is made with fiberglass. Generally asphalt is cost effective and easily installed with a lifespan of approximately 20 years. Homeowners can choose from a variety of colors, patterns (rectangular, diamond and hexagonal), as well as between 3-tab plain, flat and dimensional 'architectural' shingles that create a 'shadow' and imitate the look of wood and slate shingles.

Keep a look out for these problems:

- Moss or mold forming on surface
- Shingles are delaminating
- Mineral granules and coating appears completely worn
- Edges are frayed, curled
- Nails are popping out

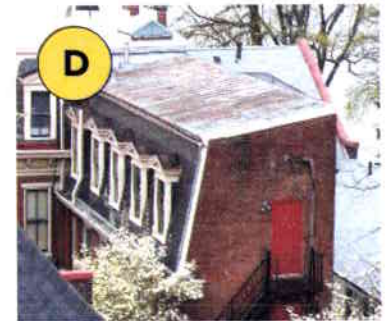
- A Second Empire house with mansard roof and stained and deteriorating asphalt shingle roofing. Water runoff, likely along with some chemical composite, is responsible for stains.
- B Delaminated and worn asphalt roof needing replacement.
- C Early signs of asphalt single break down. Generally if 20 percent or more is deteriorated, replacement might be warranted.
- D Loose shingles with nails popping out indicate failure, in this case, with underlying structure and sheathing.

Adrian Scott Fire/NTHP

Tudor Revival home with dimensional asphalt shingle roof
Cincinnati, Ohio



When Replacing My Roof, Do Materials Matter?



Flat Roofing

Flat and slightly sloping roofs are common on many older and historic buildings, from row houses to modernist homes dating to the mid-1950s and 60s. Rarely are flat roofs entirely flat, instead usually gradually sloping in one direction of the building to drain water. Flat roofs are often not visible, sometimes featuring a low parapet or pent roof at the edges of the flat roof. Usually a built-up or rubber membrane system is used to cover flat roofs and should be regularly inspected and maintained. Flat roofs present a risk that sloped roofs do not. Any slight imperfection in the slope can create a low spot where water collects. Internal drains and scuppers are often used and must be cleaned regularly.

Keep a look out for these problems:

- Water ponding, clogged drains and scuppers
- Cracked, brittle membrane
- Bubbles, separation and cracking of the asphalt or roofing felt

- A 1950s ranch house in a neighborhood of similar designs.
- B Row houses in Washington, DC, with uniform roof appearance where rooftop additions (decks, additions, HVAC) are difficult to achieve without altering the character.
- C Gradual-sloping roof on modernist house in Tulsa, OK.
- D Italianate house with combination of flat and mansard roofs.

Adrian Scott Fine/NTHP

Art Moderne 1940s apartment house with flat roof and porch
Santa Monica, California



Start with the Roof

When Replacing My Roof, Do Materials Matter?



Metal Roofing

Sheet metal roofing, usually copper, lead, tin plate, tern plate, zinc or galvanized iron, requires ongoing maintenance and inspection to ensure it holds up, sometimes as long as 60 years or more. The type of metal used often dictates the appearance, such as how it is finished and the method for joining sections. Some metal roofing is left exposed and uncoated (copper). Two types of commonly-used joints for metal roofing are flat-seam and raised or standing-seam. Deterioration can occur from corrosion, galvanic action and rust.

Keep a look out for these problems:

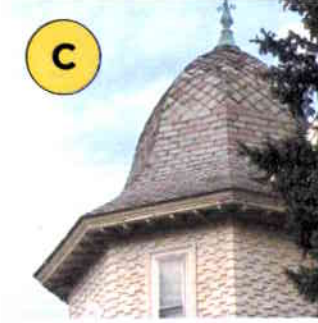
- Rust, pitting, streaking and corrosion
- Previous tar patches
- Punctures in the metal
- Broken seams, joints

- A Red-painted metal roof with cupola on row house in York, PA.
- B Lustron homes from the late 1940s have a roofing system of interlocking, stamped, metal roofing tiles, gutters, and downspouts. The tiles are stamped metal sheets finished with a protective porcelain enamel coating.
- C Early 20th century American Foursquare house in Louisville, KY, with metal roofing that is well-maintained and properly coated to ensure a long life span.



Adrian Scott Fine/THP

When Replacing My Roof, Do Materials Matter?



Slate Roofing

Widely used throughout the early 20th century, slate is a durable roofing material that typically lasts 60-125 years. It was often used to create decorative patterns, in many shapes, including rectangular, hexagonal and diamond. A variety of slate colors are often common, sometimes to create a uniform appearance, other times a more variegated look. Some slate material is better than others, depending on the source.

Keep a look out for these problems:

- Missing, loose or broken slates
- Delaminated slates
- Brittle to touch, flaking apart
- Exposed sheathing

- A Philadelphia, PA, duplex with missing slates and holes in roof. If approximately 30 percent or more of slates are missing or failing, complete roof replacement might be warranted.
- B Irregular-patterned slates on 1920s row house imitate the quaint and aged appearance of Cotswold, England. To keep water out, it is important to maintain metal ridge caps.
- C Queen Anne style homes often used slates to continue intricate patterns from walls to roofing.
- D Fish scale slate shingles and dormer indicate some material deterioration, including flashing.

Adrian Scott Fine/NTHP

Tudor Revival house with swept valley slate roofing
Los Angeles, California



When Replacing My Roof, Do Materials Matter?



Tile Roofing

Terra cotta clay and concrete (AKA cement) tile roofing comes in a variety of shapes, sizes, colors and finishes. They typify many architectural styles, from Romanesque Revival and Mission to Prairie School. Tile is heavy and often requires structural reinforcement, usually found on sloping roofs. Typically tile roofing lasts for well more than 50 years, up to around 80 years.

Keep a look out for these problems:

- Missing, loose or broken tiles
- Crazed or spalling tiles
- Brittle to touch, breaking apart
- Exposed sheathing

- A Installation of new barrel-shaped red clay tile roof on 1930s house.
- B Inspect for missing tiles at ridge caps and other primary sources of water entry, such as the exposed fascia on this house.
- C Concrete tile can be tinted for various colors and appearances, sometimes used for in-kind replacement as a closely-matching substitute material.
- D The bright blue color of the roof tile is a character-defining feature of this Tudor style house in New Orleans, LA.

Adrian Scott Fine/NIHP

Mediterranean style cottage with variegated terra cotta tile roof
Phoenix, Arizona



When Replacing My Roof, Do Materials Matter?



Wood Shake and Shingle Roofing

Wood is an early roofing product, often using white pine, cypress and oak, red cedar and redwood, and has lifespan between 30 to 60 years. Shingles are generally tapered with smooth surface, while shakes are less uniform in thickness with more of a rustic appearance. It is important to choose wood carefully to ensure durability and resistance to decay (rot). Other causes for failure and deterioration are detachment and insect infestation. Shingles are often left to weather naturally, turning the wood silver, dark gray or dark brown. Too much weathering from sun erosion, wind, debris and precipitation can be a problem.

Keep a look out for these problems:

- Thin from erosion
- Split and warping of wood
- Moss or mold forming on surface

- A 1940s house with wood shingle roof and clay tile ridge caps.
- B New, replacement wood shingle roof on 1840s house.
- C Ranch house with rustic wood shake roof that has been left to weather naturally.
- D Deteriorated and failing wood shingle roof.
- E Treated (stained) roof shingles on this former lifesaving station in Lewes, DE, can sometimes last longer than those left untreated.

Vernacular 1840s farmhouse with new wood shingle roof
Georgetown, Delaware

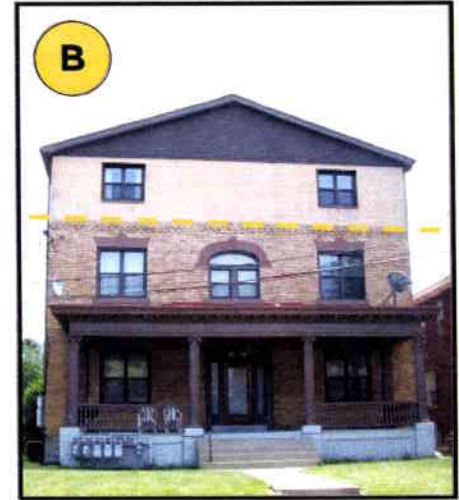
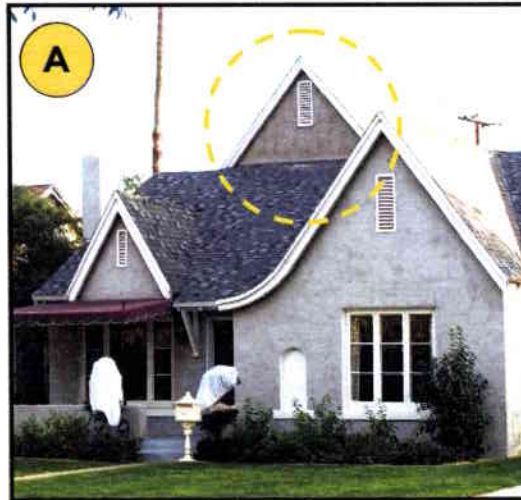


CASE STUDY: Altering the Roof Line

Older and historic buildings are, in part, defined by their roofs, in terms of form, elements and materials. Changing the roof to accommodate new additions or other features such as roof decks, pent-houses or the installation of HVAC equipment can be challenging. When changing the roof form and overall shape of a roof, consider ways to minimize the visual impact, especially from prominent front-facing facades that are highly-visible. Think about ways to screen changes and also consider how alterations can affect a roof's drainage patterns and water runoff.

- A An addition at the rear of this small Tudor Revival house in the F.Q. Story Historic District in Phoenix, AZ, attempts to match the pitch and scale of the gable roof forms on the original portion of the house. It also carries over a similar wall material and attic vent. In this case, the addition allows the owner to expand a small home with additional square footage while keeping the expansion largely confined to the less-visible rear portions of this property.
- B On a street lined with large, early 20th century two-story homes, this house now stands out from the others. The oversized third-floor addition dramatically alters the character of the house and street with its new height. The roofline and form of the house have been completely changed through this addition. Before it likely had a hipped roof with dormers. Now it has a shallow-pitched front-facing gable roof. Roof additions of this scale are difficult to achieve without causing damage.
- C A large third floor addition on this Tudor Revival house attempts to maintain the original roof form and overall character of the house. The addition was achieved by extending the roof upwards. Two dormers match the roof pitch and mimic the front-facing gable entrance. Where this roof addition is less successful is the overall scale and proportions. The front facing entrance gable was original in scale to the original roof line. Now with the addition it appears too small. The house also stands out dramatically from neighboring homes which all have a consistent roof height that is much lower in scale.

Start with the Roof

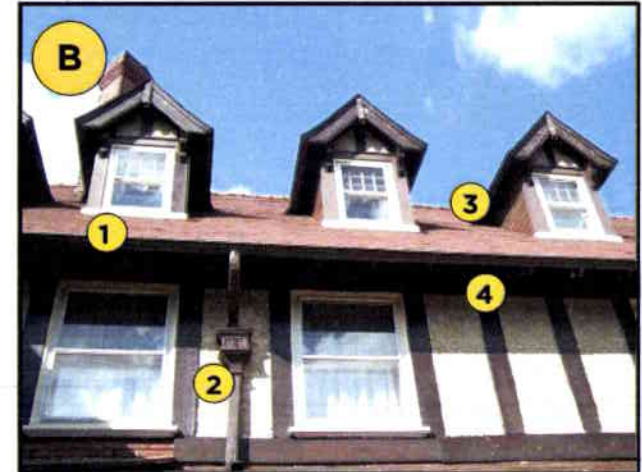
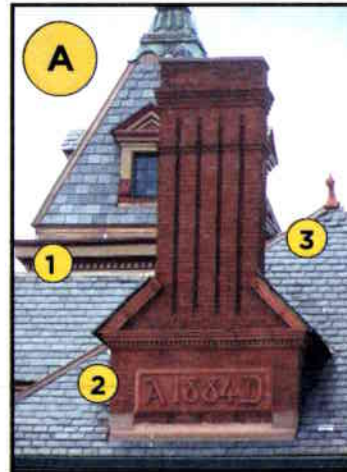


Adrian Scott Fine/NTHP

CASE STUDY: Anatomy of a Roof

Older and historic buildings have lots of parts and elements. They help define them architecturally and also serve functional needs in shedding water, providing ventilation and shade, and keeping the interior dry, comfortable and energy efficient. Just as the roof needs maintenance and attention so do these integral parts.

- A
1. Integral, built-in gutter. Usually these are hidden from view and concealed behind architectural features, such as cornices. Built-in gutters may be lined with metal or rubber membrane system.
 2. Chimneys are often highly decorative as well as functional.
 3. Metal ridge caps are important in sealing gaps and keeping water from entering the building.
- B
1. Half-round gutters hanging from anchors attached to the building just under shingles and fascia. Copper and steel have a longer lifespan, followed by aluminum gutters. Monitor for any rips or tears, blockages and galvanic action.
 2. Downspout mounted to the exterior wall to collect the rainwater and deliver it to the ground, where it can drain away from the building.
 3. Front gable dormers should have appropriate flashing along the sides, at roof intersections and valleys to prevent water from penetrating.
 4. Wide eaves provide shade and help cool the house.
- C.
1. Engaged rounded dormer with metal roofing should have flashing in place at the intersection between the two roofing materials.
 2. Metal roofs on the bay and entrance porch should be painted to prevent further degradation.
 3. Cornices are architectural and serve as a ridge intersection between the sloping mansard roof and the flat roof at top.
 4. Flashing should installed here as well, typically placed underneath the slate roofing.
 5. Call in a roofing specialist at the first signs of loose or missing slate shingles.



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CASE STUDY: Early Intervention is Key

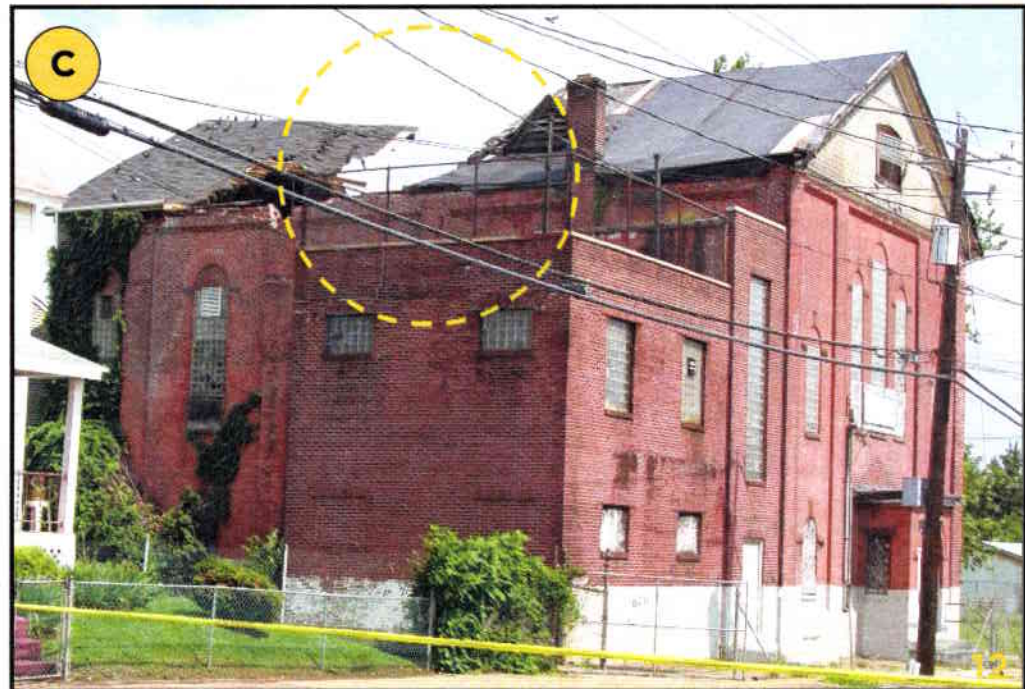
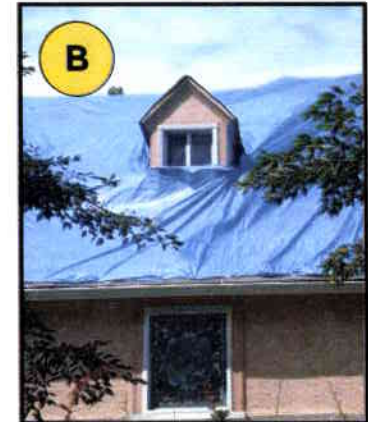
Assessing the condition of your building's roof is critical, requiring routine inspection and ongoing maintenance. When this does not occur, little problems can quickly turn into big issues, such as complete roof failure. With many older and historic buildings it is difficult to determine the condition of the roof because it is not readily visible. This is often the case with row houses and others that have flat, shallow pitched roofs. Once a roof has been compromised and no longer doing its job at keeping the elements out and the building dry, the structure itself (and possibly of nearby buildings, if attached) will begin to fail. Early and immediate intervention is important to try and step in and remedy the problem, even if through temporary measures, such as tarping a roof. This can allow enough time to develop a long-term strategy and solution, such as raising funding for repairs or finding a new owner for an endangered building.

- A A view from above clearly shows the damage and severe deterioration of the roof on this row house. Let go, the likelihood of saving the interior is much more challenging. Immediate stabilization is called for in this case by securing the roof.
- B Tarping can be a really effective, short-term strategy for securing a storm-damaged and/or failing roof system. This will buy you time to decide on repair options, to reduce costs by arresting damage, and to allow the interior of a building to dry out. Generally the standard plastic tarp last about 90 days, perhaps longer, depending on the season and climate. Installation should be done by a professional so it is firmly secured and does not cause damage to remaining roof materials and elements.
- C When the roof collapsed on this important historic church building, water had been entering the structure for some time. Following the complete failure of a roof, although not impossible, it is much more difficult and costly to stabilize and salvage a building. Early intervention with a method for stabilizing the roof and keeping the water out might have helped prevent this roof failure.

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City of Wilmington, DE

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CASE STUDY: Keep the Porch

The front porch is perhaps one of the most important features of older and historic homes. In many cases, the front porch helps define a house. It creates a strong connection between the resident and the street activity directly outside. As a focal point and integral element, it provides scale and helps transition between the outside and the interior. And not only does a porch provide protection from the elements, it also serves an important function as an energy savings device. Porches provide shade to help cool interior spaces and block heat gain as well as offer natural ventilation to escape the heat and cool off. With wide roof overhangs, deep porches and two-story verandas are inherently energy saving elements and should be retained as part of any weatherization strategy. All too often, the porch is the first to be let go with failing roofs and inadequate systems for drainage of water that can quickly lead to structural instability. Rather than 'rip off' your porch, repair it or, if necessary due to deterioration, replace it with a porch that matches the original as closely as possible.

- A This Queen Anne house in Pittsburgh, PA, suffered years of neglect, deterioration and inappropriate alterations, including the removal of the original frame porch. An oversized masonry addition replaced the porch and obscured the character of this house and entire neighborhood block for decades. The house was acquired by a local community development corporation, the addition was removed, and rehabilitation initiated, shown here in progress.
- B Following the rehabilitation, the house is restored to its original character. The newly-constructed porch was designed to match the original as closely as possible, in scale and materials.
- C Porches are easily susceptible to failure when roofing and foundation support have severely deteriorated. Intervention is key, even if by temporary measures providing additional support, like this example. Once a porch completely fails or collapses, the costs to repair and replace can be far greater. You also lose a very important character defining feature.

Start with the Roof



Adrian Scott Fine/NTHP

CASE STUDY: Letting the Light In

Skylights are more common than you might think in older and historic buildings. In attached row houses and duplexes, they are often used to help bring in natural light in locations that would otherwise be without. Places like dark bathrooms and enclosed stairwells are examples. In historic commercial buildings, large skylights have been a useful device for letting in natural light. Depending on their size and location, they can help save energy by daylighting an interior that otherwise would need to rely on electrical sources. Traditionally they have been used for this function as well as ventilation (if operable) and, in some cases, for access to the roof. Older skylights are usually metal framed in various forms (hipped, gabled and domed) on flat roofs or flat on sloped roofs. Skylights, then and now, can pose problems if not properly installed and maintained, leading to leaks. A lot of older skylights have been removed, concealed or painted over. In general, when repairing or adding a new skylight to an older and historic building, keep the following in mind:

- Locate skylights on roofs that are not highly visible, at the rear for instance, so they do not detract from the building's character.
- Hire a professional to help you properly install or restore a skylight to avoid damaging the roof or cutting into a roof truss.
- Ensure your skylight has appropriate flashing so water is directed away from the opening and to avoid leaks.

- A Metal framed, flat skylight on sloping roof with twelve separate panels of glass emitting light into the interior. It is important to maintain a secure and weather tight connection using appropriate flashing between the raised walls of the skylight and the metal roofing.
- B The interior of a domed skylight is a dramatic focal point for this room. Ensure glass is clear of any debris, there is no moisture infiltration between panels, and repair broken glass.
- C Grand houses of the late 19th and early 20th centuries sometimes featured leaded and stained glass skylights as a decorative element, often in a entryway or grand stair hall. Usually panels are protected by a secondary skylight located above that can withstand the elements.

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Girard College



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CASE STUDY: Tapping Solar Power

Increasingly solar powered systems and roof installations are being rediscovered, adapted with new technology and considered as energy costs rise. Generally there are two types: photovoltaic and thermal. Photovoltaic or PV systems (solar panels) generate electricity from sunlight using solar cells made up into modules and arrays where each cell produces one or two watts of electricity from sunlight. Thermal systems use the energy from the sun to produce heat, not electricity, which is then usually tied to a building's water system. The method and size of installations for both systems vary, though each needs optimal sunlight conditions and placement. A new development is Building Integrated Photovoltaic Systems (BIPV) which integrate the PV or thermal systems directly into the building's materials, such as the roof shingles. If installed appropriately, BIPVs may minimize the visual impact of traditional 'solar panel' applications, difficult to detect from standard shingles.

Older and historic buildings may present unique challenges and require creative approaches, but often can be part of the solar powered solution. Some general factors to consider are:

- Irreversibility of installations
- Location and public visibility
- Mounting installations that do no harm building materials
- Size of systems
- Appearance (color, finish, glare and overall shape)

- A Raised panel system at an angle on rear roof elevation of an historic home.
- B The mounting of solar panels on highly visible views, such as front facades, is problematic as it greatly alters and contrasts with the character of the house. In addition, mounting on roofing, such as clay tile and other fragile materials, should be avoided so as not to cause damage.
- C The installation of this system is very visible and incompatible with the character of this large Dutch Colonial Revival house. Where possible, systems like this should be placed in less visible locations or perhaps ground-mounted.

Start with the Roof



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The National Trust for Historic Preservation (www.PreservationNation.org) is a non-profit membership organization bringing people together to protect, enhance and enjoy the places that matter to them. By saving the places where great moments from history—and the important moments of everyday life—took place, the National Trust for Historic Preservation helps revitalize neighborhoods and communities, spark economic development and promote environmental sustainability. With headquarters in Washington, DC, nine regional and field offices, 29 historic sites, and partner organizations in all 50 states, the National Trust for Historic Preservation provides leadership, education, advocacy and resources to a national network of people, organizations and local communities committed to saving places, connecting us to our history and collectively shaping the future of America's stories.

1785 Massachusetts Avenue, NW
Washington, DC 20036

www.PreservationNation.org/Weatherization

Start with the Roof

**Shotgun house with hip roof and asphalt shingles
Louisville, Kentucky**

