

Chapter 3

Guidelines for the Preservation, Rehabilitation, & Restoration of Historic Exterior Building Materials



Chapter Overview

This chapter contains broad guidelines for the treatment of historic exterior building materials: masonry, stucco, woodwork, roofing, and metal. It also addresses the treatment of historic windows and doors, which combine multiple materials including wood, glass, and metal. More detailed material-specific recommendations are found in Appendix C - Material Inspection Checklists.

Use This Chapter If..

- You own a historic property and its building materials have deteriorated and are in need of repair or replacement.
- You are undertaking a restoration of your historic building to bring it back to its former glory.
- You are interested in replacing some of your building's historic materials in a way that is compatible with the building's historic character.

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Historic Building Materials

General Treatment Guidelines

This section addresses the treatment of historic building materials, including wall cladding and roof material at the exterior of a building and materials used in architectural trim. In Redlands, masonry (i.e. stone, brick, concrete/ cast stone, terra cotta, adobe), stucco, wood, roofing, and metal are common materials used in historic residential, commercial, industrial, and institutional architecture. Windows and doors with wood, glass, and metal components are also ubiquitous, and present their own challenges. The use of these materials, individually or in combination, in addition to their scale, texture, tooling, and finish, help to convey the style, craftsmanship, and development period of a building. Proper treatment of these materials is important to preserving the character and integrity of Redlands' historic buildings.



Preserve

- Preserve historic building materials that contribute to the overall historic character of the building.
- Retain historic materials that are in good condition, rather than replacing.
- Avoid covering historic materials with new materials.
- Prioritize the preservation of rare and unique building materials such as adobe or arroyo stone.
- When non-intervention best serves to promote the preservation of the cultural property, it may be appropriate to recommend that no treatment be performed.



Maintain

- Maintain historic materials to prolong their life and protect investments made in their construction and repair. Preventive conservation, (proper routine maintenance) is the most effective way to promote the long-term preservation of historic materials and of historic properties in general.
- Maintenance may include: cleaning by hand; low-pressure washing; caulking; scraping and repointing joints; scraping, priming, and repainting; polishing; applying protective finishes; or other light treatments.

Maintain or Repair?

In general terms, the items listed under Maintain are typically minor work; most may be completed by a non-professional, though if your building is designated, please consult with Planning staff for guidance.

The items listed under Repair are typically work that should be conducted by a professional, and for designated buildings, requires Planning staff review. Always seek the gentlest maintenance and repair solutions possible. Consult with a professional conservator as needed.

Historic Building Materials

General Treatment Guidelines

Repair

- Repair historic materials when the physical condition warrants additional work.
- Repair work may include chemical cleaning or high-pressure washing, patching, splicing, consolidating, chemical paint stripping, scraping and repointing joints or other treatments, in order to repair and stabilize the historic materials.
- All repairs should be carried out to match existing historic materials in texture, composition, size, durability, appearance and overall character. Where possible, reversible treatments and methods are preferred.

Replace

- Replace historic materials only when they are deteriorated beyond repair.
- Replacement materials should match the existing historic materials in kind, including the texture, composition, size, durability, appearance, and overall character.
- Use of alternative compatible materials may be appropriate on secondary façades, not readily visible from the public right-of-way.
- During installation, match the grain, joints, orientation, and attachment method of the existing materials.



Investigation

Simple scientific investigations can ensure accuracy and appropriateness when it comes to replacing or restoring historic building materials.

For example, a historic finishes analysis can determine the original paint color and recommend a match using modern paint, while stucco and mortar analysis can do the same for original mixes.

Health and Safety

Work in historic buildings may present potential hazards, such as lead paint, asbestos-containing materials, biological activity (mold or fungi). Some treatments may themselves involve the use of materials or methods -that could endanger the health and safety of workers and the public. Owners and professionals carrying out substantial work must comply with all relevant federal, state, and local standards and regulations (e.g. OSHA, NIOSH), and take the necessary steps to protect and mitigate risks to health and safety.

Exterior Masonry

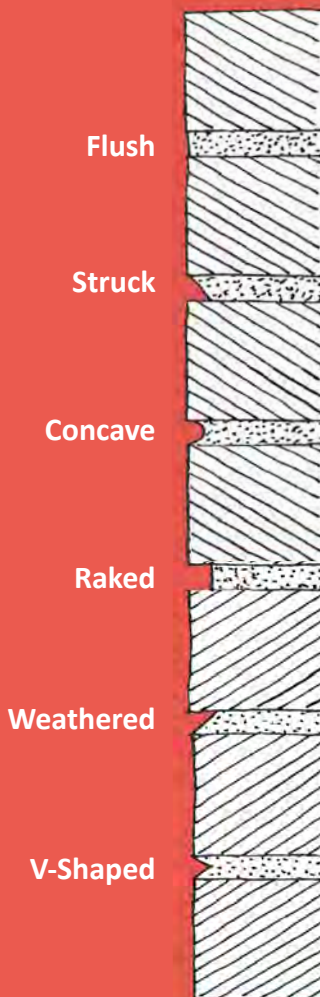
Types & Components

Exterior masonry materials in Redlands include stone, brick, concrete (including cast stone, which is simulated stone made of concrete), terra cotta, and adobe. Masonry is commonly used for building walls or piers, or as architectural details and accent trim. Most buildings include some masonry, whether as a wall material, foundation element, or a chimney. Redlands is notable for its widespread use of local arroyo stone (natural rounded river rock), as well as cut and faced stone from both local and remote sources.

Typical Joint Profiles

There are numerous joint profile types, each producing different shadow lines and highlights.

When repointing an area of exterior masonry, it is important to tool the mortar joint to match the existing joint profile for a consistent appearance.



Brick and Stone

Masonry walls and piers were traditionally constructed of either bricks or stones, stacked on top of each other, and bonded together with mortar. The construction type is load-bearing, meaning it carries its own weight to the ground, as well as the loads of other building elements, such as walls, floors and roofs. In more contemporary construction, the masonry became a non-load-bearing facing material, installed over other types of structural framing, such as wood studs.

Mortar

Mortar was traditionally composed of sand, lime, and water, and occasionally some additives. From the mid-19th century on, Portland cement was added to the mix to improve workability, hasten the setting time, and provide a more robust material. Most mortars in Redlands are likely Portland cement-based mixes.

Portland cement-based mortars are harder than traditional lime-based mortars and far less elastic. When cracks develop, or the mortar pulls away from the masonry, it leaves gaps for water to enter. Also, in some cases, the mortar is much stronger than the masonry it is bonding together, resulting in chipped edges and spalls on the masonry units. Selecting the proper mortar for repointing and repairs is important, for matching the historic appearance, long-term performance and preventing damage in the future.

Terra Cotta

Architectural terra cotta is a high-fired ceramic product, usually hollow cast in blocks and finished with a glaze. It was historically used primarily as an exterior decorative material, both for wall cladding and trim, and sometimes as part of a traditional load-bearing masonry wall (in modestly scaled buildings). Terra cotta is known for its elaborate molding, rich color, easy maintenance, and durability. When used as cladding or trim, terra cotta units are attached to wall framing systems with an extensive metal anchoring system.

Exterior Masonry

Types & Components

Adobe

Traditional adobe construction typically consists of adobe brick, molded from sand and clay, often with straw or grass as a binder, and sun-dried; stacked and “mortared” together with a similar mud mixture; and covered with a traditional mud render (plaster). In some cases, the mud render is also white-washed with lime. The mud and lime renders are the sacrificial material, and meant to be maintained and renewed after each rainy season. Over time, many of these traditional renders were replaced with cement-based stucco, which is much harder and less permeable than the adobe, causing deterioration of the mudbrick walls below.



Adobe house in Redlands.

Concrete and Cast Stone

Concrete is a mixture of fine aggregate (sand), coarse aggregate (gravel, crushed stone, or other coarse material), a binding agent (typically Portland cement since the early 1900s), and water. Concrete can either be cast in place, where it is poured, molded, and cured on site, or it can be precast off site. The introduction of reinforcement (metal bars/rods) in concrete in the mid- to late 19th century substantially increased the range, size, and types of buildings that could be constructed with the material. Concrete is extremely versatile, used for structural as well as ornamental purposes. Cast stone is a form of ornamental concrete or concrete veneer that is molded and sometimes pigmented to resemble a variety of natural building stones.



Damaged terra cotta detail.



Redlands' former City Hall (1941) features concrete cladding and details.



Stone house in Redlands.

Exterior Masonry

Typical Problems



Efflorescence on a historic brick wall.

Damage to masonry walls may be caused a number of ways, including the following:

- Ground movement from uneven settlement
- Ground movement from seismic activity
- Thermal movement (temperature cycling from hot to cold)
- Roof or floor movement, or shifting loads from other areas of the building
- Weathering from rain, wind or pollution
- Fire or flood damage
- Corrosion of embedded metal anchors or steel
- Salt damage (efflorescence)
- Poor drainage and rising damp
- Defective original materials or design
- Insufficient maintenance
- Poor previous repairs

Refer to Appendix C - Material Inspection Checklists for information regarding common masonry problems and recommended solutions.

Efflorescence

Efflorescence is water-soluble salts that have leached out of the masonry, evaporated, and deposited on the surface, usually as a white, powdery substance. The salt crystals expand as the water is evaporated, leading to surface damage, and in some cases, sub-surface damage (sub-florescence).



Inappropriate concrete repairs to cut stone curbing.

Exterior Masonry

Maintenance & Repair

Regular inspection and maintenance are key to keeping historic masonry intact and in good condition. Repairing damaged individual masonry units and repointing with an appropriate mortar mix will ensure survival of cladding, structural components, and trim. Regular cleaning is key— it goes a long way toward enhancing the character and overall appearance of a building. However, improper cleaning can be very damaging. The goal should be to remove surface soiling and staining using the gentlest means possible, and without damage to the masonry. Adobe should be treated differently than other masonry types.

For more detailed information on treating adobe and the other types of masonry, refer to Appendix C - Material Inspection Checklists.

- Inspect and maintain masonry regularly.
- Review for possible sources of moisture, and correct/repair where possible to prevent efflorescence and cracking.
- Perform masonry repairs and repointing work prior to cleaning, to ensure building is water-tight.
- Repair individual masonry units as needed, by infilling cracks, pinning cracked units, patching, or resetting loose units with new mortar.
- Replace heavily damaged or missing individual masonry units with matching new or salvaged materials.
- Test cleaning products and methods first, in small inconspicuous areas.
- When using water cleaning, minimize water pressure to prevent surface damage (generally no more than 100 psi).
- When detergents are needed (for removal of stubborn or oily soiling), use a mild non-ionic detergent, such as a hand dishwashing detergent, diluted in water, and scrub with a natural bristle brush.
- Clean efflorescence from wall surfaces with low pressure water and a soft, natural bristle brush. A gentle detergent may also be added if needed.
- Where present, maintain existing paint coatings.



Matching Historic Mortar

Most pre-mixed mortar available from hardware stores is inappropriate for historic masonry. It is too hard, and contains too much cement. In general, you want to select a mortar with a lower compressive strength than the surrounding masonry (typically Type N or the slightly weaker Type O are used for historic masonry). Laboratory analysis of original mortar can tell you the ingredients (sand, lime, etc.) and the mix recipe (i.e. one part lime, six parts sand, etc.), the type of sand, and if any colorants or additives were used. This will provide the best match. However, a skilled mason can provide a good approximation, using the strength types suggested above, to provide a close match.



How Not to Clean Historic Masonry

Do not use abrasive blasting (sandblasting) or high pressurized water washing that can damage masonry surfaces.

Do not use metal brushes or grinders that can damage masonry surfaces.

Do not use harsh chemicals. Chemical cleaners can etch, stain, bleach or erode masonry surfaces.

Consult a professional with specialized knowledge of historic masonry cleaning when gentler cleaning methods are not successful.

Stucco

Types & Components

Stucco is commonly used on the exterior of many buildings in Redlands, in particular those in the Spanish Colonial Revival and Mediterranean Revival styles (though it is far from limited to those styles). The term stucco is generally used to describe a type of hard exterior plaster, traditionally a mixture of hydrated lime, water and sand, sometimes with additives to strengthen it. Most late 19th to early 20th century stuccoes included Portland cement for workability, fast curing, and durability, and most stuccoes in Redlands are likely Portland cement-based mixes.



Smooth stucco on a Spanish Colonial Revival house.



Textured stucco on a Redlands church.

Types of Stucco Finishes in Redlands

Stucco is typically trowel-applied, either directly onto a masonry wall, or with wood-framed structures, onto wood or metal lath support. It is applied in either a two- or three-part coating, consisting of a brown coat, scratch coat and finish coat. The finish coat can be textured a number of ways, depending on the aesthetic desired and the skill of the craftsman. Some common finishes include smooth, scored, raked, pebble-dashed, dry-dashed, fan and sponge, reticulated and vermiculated, roughcast (wet dash), and sgraffito. Stucco was often originally unfinished/unpainted; some were even integrally colored (pigmented). Today, stucco is most often painted with an elastomeric coating, which provides color and some water resistance.



Pre-Mixed and Synthetic Stucco

Pre-mixed stucco available from hardware stores is inappropriate for historic buildings. It is too hard, and contains too much cement – it will cause more problems than it solves.

Exterior Insulation and Finish System (EIFS) is a modern synthetic stucco system. It must be installed with control joints or grooves to allow for expansion and contraction, often resulting in odd wall patterns that do not match historic stucco. Also, it does not “breathe” and can trap moisture within the wall thickness, which can deteriorate historic wall materials, wood windows, etc. and encourage mold growth.

The City of Redlands discourages the use of pre-mixed stucco, EIFS, or similar synthetic stucco for use on historic buildings.

Stucco

Typical Problems

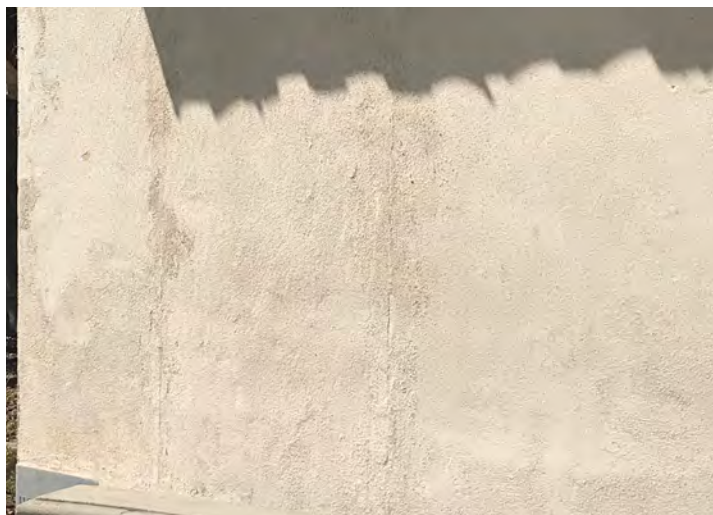
Damage to stucco walls may be caused a number of ways, including the following:

- Ground movement from uneven settlement
- Ground movement from seismic activity
- Thermal movement (temperature cycling from hot to cold)
- Roof or floor movement, or shifting loads from other areas of the building
- Weathering from rain or wind
- Fire or flood damage
- Corrosion of embedded metal anchors or steel
- Salt damage (efflorescence)
- Poor drainage and rising damp
- Poor original materials or design
- Poor previous repairs, including patching with non-matching stucco mix or synthetic stucco
- Lack of maintenance

Refer to Appendix C - Material Inspection Checklists for information on common stucco problems and recommended solutions.



Weathered stucco at a porch.



Incompatible stucco at an infilled door.



Void and spalling around stucco wall pipe intrusion.

Stucco

Maintenance & Repair



Matching Historic Stucco

The type of stucco finish on a historic building is integral to its appearance and character – a smooth stucco finish should not be replaced or covered with a heavily textured stucco finish.

- Refer to areas of the building likely to have original or early stucco, in particular in protected/ non-weathered locations. Select a compatible new stucco or stucco patching material.
- A skilled plasterer can provide a good approximation to the original stucco, and can provide a close match to the original. To ensure a match, consider a laboratory analysis that will provide the original ingredients, mix recipe, and sand type, and will tell you if any colorants or additives were used.
- There are some pre-bagged stucco products available from specialty suppliers. These may be a comparable product for your property; consult a professional for options. However, for a higher standard of care, we recommend matching the original stucco mix, color, and finish, including the traditional two- or three-coat application system.

Regular inspection and maintenance are key to keeping historic stucco intact and in good condition. Performing minor repairs like filling cracks, patching spalled and missing areas, and maintaining existing paint (where present) will prevent major problems and prolong the life of stucco cladding. As with masonry, regular cleaning is key to maintaining historic stucco, but improper cleaning can be very damaging. The goal should be to remove surface soiling and staining using the gentlest means possible, and without damage to the stucco.

- Inspect and maintain stucco regularly.
- Review for possible sources of moisture, and correct/ repair where possible to prevent efflorescence and cracking.
- Perform repairs and prior to cleaning, to ensure building is water-tight.
- Repair as needed, by infilling cracks or patching spalls and damaged areas.
- Test cleaning products and methods first, in small inconspicuous areas.
- When using water cleaning, minimize water pressure to prevent surface damage (generally no more than 100 psi).
- When detergents are needed (for removal of stubborn or oily soiling), use a mild non-ionic detergent, such as a hand dishwashing detergent, diluted in water, and scrub with a natural bristle brush.
- Clean efflorescence from wall surfaces with low pressure water and a soft, natural bristle brush. A gentle detergent may also be added if needed.
- Where present, maintain existing paint coatings.

For more detailed information on treating historic stucco, refer to Appendix C - Material Inspection Checklists.

RELEVANT SOURCES

[NPS Preservation Brief 22:
The Preservation and Repair
of Historic Stucco](#)

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Exterior Woodwork

Types & Components

Wood is used extensively in the architecture of Redlands, across a wide range of architectural styles. Its exterior applications include structural elements, wall cladding, and decorative trim (wood shingles and shakes are addressed in the Roofing Materials section). Exterior woodwork serves both a functional and aesthetic purpose, supporting and establishing a weather-tight enclosure, and acting as an important design feature. It is considered to be an important feature of historic buildings, and should be preserved. Paints and stains are crucial to the lifespan of woodwork, and are addressed in their own section below.



Wood shingle wall cladding.



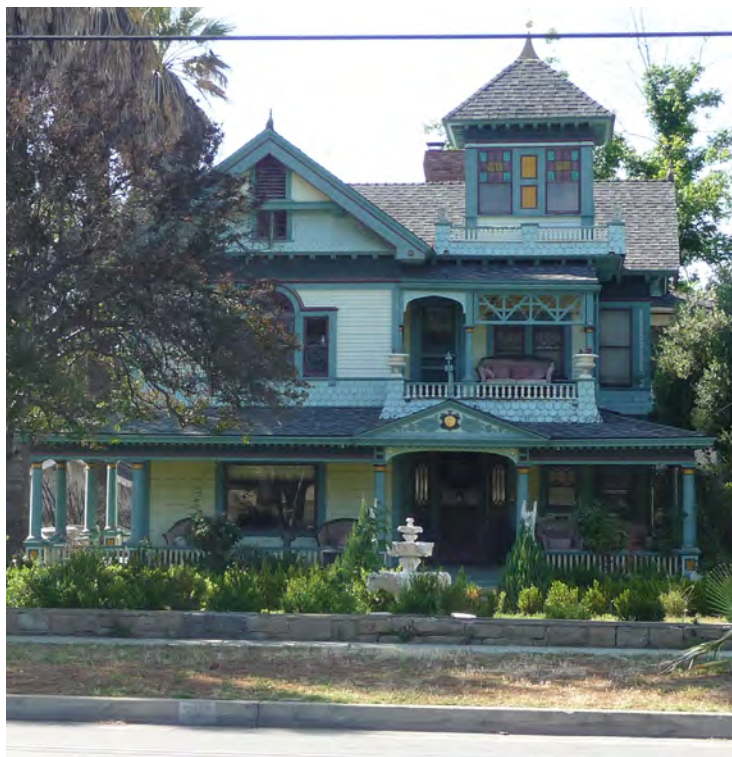
Wood roof details on a Craftsman duplex.



Vertical board cladding on a ca. 1908 blacksmith shop.

Types of Exterior Woodwork in Redlands

Historically a widely available and relatively affordable building material, wood was key to the construction and ornamentation of most of Redlands' residential buildings during the late 19th and early 20th centuries. Builders also used it in commercial, industrial, and institutional buildings, though the City's preference for brick and other substantial masonry types resulted mostly in brick and stone non-residential buildings. Internal framing aside, wood is prominent on the exterior of many historic buildings in Redlands. Structural elements, such as half-timbering, columns, exposed rafters, and porch and entry components are highly visible. Wood is a common wall cladding material, ranging from clapboard siding to elaborate shingles, and is put to good use in decorative trim like corner boards, spindlework, railings, and moldings.



A Queen Anne style house with multiple types of wood cladding and decorative trim.

Exterior Woodwork

Typical Problems

Damage to exterior woodwork may be caused a number of ways, including the following:

- Weathering from cyclic wetting or drying, exposure to ultraviolet light, and erosion from wind-blown debris
- Structural overloading causing sagging, racking (skewing), or warping
- Mechanical damage
- Decay due to moisture infiltration or leaks, causing warping, stains, and peeling paint
- Decay due to fungal growth
- Decay due to insect attack – termites, carpenter ants, and various other wood-boring species
- Covering with synthetic siding
- Ground movement from uneven settlement
- Ground movement from seismic activity
- Fire or flood damage
- Poor original materials or design
- Poor previous repairs
- Lack of maintenance

Refer to Appendix C - Material Inspection Checklists for more information on common woodwork problems and recommended solutions.



Direct contact with the ground can lead to wood decay.



Poorly maintained wood cladding and trim.



Avoid covering or replacing wood siding with synthetic siding.



Deteriorated woodwork at a porch.

Exterior Woodwork

Maintenance & Repair



Decay-Resistant Wood

Some wood species are naturally more decay-resistant or have been treated in some manner during manufacture to increase their resistance, making them preferable for use as replacement material. These can include: cedar; mahogany; redwood; air-dried, pressure-treated southern yellow pine; new growth or salvaged cypress; and pressure treated wood (for framing members).



Alternatives for Trim and Siding

Wood trim and siding alternatives can include cellular PVC, wood waste composite material, fiber cement, asbestos, asphalt, steel, aluminum, and vinyl. When artificial siding is installed over original wood siding, it can cause damage by trapping moisture. Wood composite materials, such as MDF (medium density fiberboard composite, also called pressboard or hardboard) are prone to swelling, buckling, rotting, mildew, and insect damage.

The City of Redlands strongly recommends the removal of any artificial siding, particularly if installed over original wood siding.

If an economical alternative is needed, in particular for a new addition or outbuilding, a fiber-cement siding may be considered. It is visually more compatible with wood than other artificial materials.

In most instances, selective repair or replacement of damaged or deteriorated wood components, in conjunction with regular inspection and maintenance, is all that is required for exterior woodwork. In general, the simplest ways to control decay and insect damage are by keeping the materials dry.

- Inspect and maintain woodwork regularly.
- Review for possible sources of moisture, and correct/repair where possible. Provide drainage control elements, such as gutters and downspouts, to carry roof water away from the building.
- Fix any roof or plumbing leaks quickly, and take measures to dry out the materials.
- Redirect sprinkler heads or relocate them away from the building.
- Reduce dense vegetation around the building.
- Inspect the foundation and crawl space regularly, and clear away any accumulated debris or soil buildup from erosion.
- Apply borate-based wood preservatives to protect against decay and insect attack.
- Apply water repellents with mildewcide additives that will kill active fungi and guard against future growth.
- Maintain protective paint coatings.
- Consult with a qualified pest management company regarding insect issues.
- Conduct minor repairs (splitting and cracking) with a compatible exterior wood filler or wood epoxy consolidant, sand smooth and paint to match.
- Where replacement is necessary, use in-kind wood that matches the original in size, profile, and visual characteristics.

For more detailed information on treating historic woodwork, refer to Appendix C - Material Inspection Checklists.

Exterior Woodwork

Exterior Paints & Stains - Typical Problems

Exterior paints and stains provide a layer of protection to wood by adding a barrier that limits moisture infiltration, sun damage, and pests. They are typically composed of three elements: pigment(s), solvent(s), and a binder. In stains, the amount of pigment varies depending on opacity. Traditional paints and stains have a lower percentage of solvents and higher percentage of pigment compared to their modern counterparts. Whereas traditional coatings include natural, protein-based and plant-derived oil (i.e. linseed oil) paints, contemporary coatings use synthetic polymers, binders, or pigments, such as acrylic latex and alkyd oil. Modern coatings also contain additional chemicals that are intended to improve the workability, durability, resistance to mold, and drying speed of the paint or stain.

In general, oil-based coatings adhere better to wood surfaces than latex paint. Additionally, repeated layers of latex paint can form an impermeable barrier, preventing exterior wood from drying as it would have historically. Thus, the use of latex paints on historic wood exteriors should typically be avoided.

Typical Paint & Stain Problems

Common paint failure problems include:

- Weathering and deterioration due to sun exposure or improper application (for example, when the top coat dries before the underlying coat), causing chalking or fading; peeling, wrinkling, or blistering; cracking, crazing, or alligating; and areas of paint that are weathered away with bare wood showing.
- Damage due to moisture infiltration or leaks, causing blistering, cracking, or peeling

Refer to Appendix C - Material Inspection Checklists for more information on common paint and stain problems and recommended solutions.

RELEVANT SOURCES

[*NPS Preservation Brief 10:*](#)
[Exterior Paint Problems on Historic Woodwork](#)



A brightly painted Victorian-era Vernacular cottage.



Weathered paint on exterior woodwork.



Paint samples from "The Master Painter's Partner" catalog, 1932.

Exterior Woodwork

Exterior Paints & Stains - Maintenance & Repair

Lead-Based Paint and Paint Removal Safety

Lead-based paint is a toxic material that was widely used on both exteriors and interiors of buildings well into the 1950's. Most historic buildings at least 50 years old will contain some lead-based paint. In its deteriorated form, it produces paint chips and lead-laden dust particles that are a known health hazard, particularly to children. In most cases, the lead-containing paint has been covered with newer paints, and any toxic materials are fully encapsulated and considered safe. However, during paint removal and surface preparation work, these earlier paint layers may be exposed. Consult a professional for potentially unsafe work, and follow these general guidelines when performing any paint removal work:

- Keep children and pets clear of work areas.
- Always wear safety goggles and a dust mask.
- Avoid open food or beverage containers in work areas.
- Thoroughly clean exposed skin, and thoroughly launder work clothes at the end of each day.
- Test painted wood in work areas first with lead test kits (obtained from hardware stores).

Exterior paints and stains should be inspected and renewed regularly (every five to eight years, with potential touch-ups at heavy wear areas during that time). This maintenance is crucial to the survival of exterior woodwork. When performing any repainting work, proper surface preparation is key to ensuring that the new paint will adhere and last. Surfaces should be clean, dry, and free of any loose dirt or peeled paint.

- Wash surfaces with a mild detergent solution and scrub with natural bristle brushes. Carefully hand-scrape to remove any old paint that is not tightly bonded to the surface, and hand-sand to smooth out any rough areas.
- Fill gaps, joints and holes over countersunk nails with putty or caulk.
- Use a high quality, exterior grade paint or stain; for staining, use a clear finish with some UV-resistance.
- Avoid encapsulating paints (for example “liquid siding”) and clear waterproof coatings that can trap moisture in the wood and promote rot.
- Application methods and steps will vary, but in general, spot prime any bare wood areas first, followed by two coats of finish paint or stain (e.g., wait 24 hours and allow first coat to completely dry).

For more detailed information on treating paints and stains on historic woodwork, refer to Appendix C - Material Inspection Checklists.



How Not to Prepare Surfaces for Repainting

The City of Redlands strongly recommends the following:

- Do not use strong, toxic chemical paint strippers, such as Jasco.
- Do not use open flame devices, such as torches, which can create sparks or fire, and will vaporize paint into highly toxic fumes. Minimize use of heat guns/devices (if used, limit to hours of cooler weather, water-down surface to be heated before/during/after, and monitor for smoke, etc.).
- Do not sandblast (it can be very damaging to the wood grain).
- Do not clean with high pressurized water, as it forces water into open joints (potentially causing leaks and damaging the framing and interior finishes).

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Roofing

Types & Components

Historic roof types and materials found in Redlands vary greatly depending on building type and architectural style. They include terra cotta (clay) tile, wood shakes and shingles, asphalt and composition shingles, metal roofs, and flat or membrane roofs. As a highly visible component of historic buildings, roofing material contributes to the overall appearance and character of a property and should be preserved. Roofing material obviously serves a purpose beyond aesthetics – namely, providing shelter and preventing water intrusion—and requires routine maintenance and, in many cases, periodic replacement to ensure the longevity of a building.



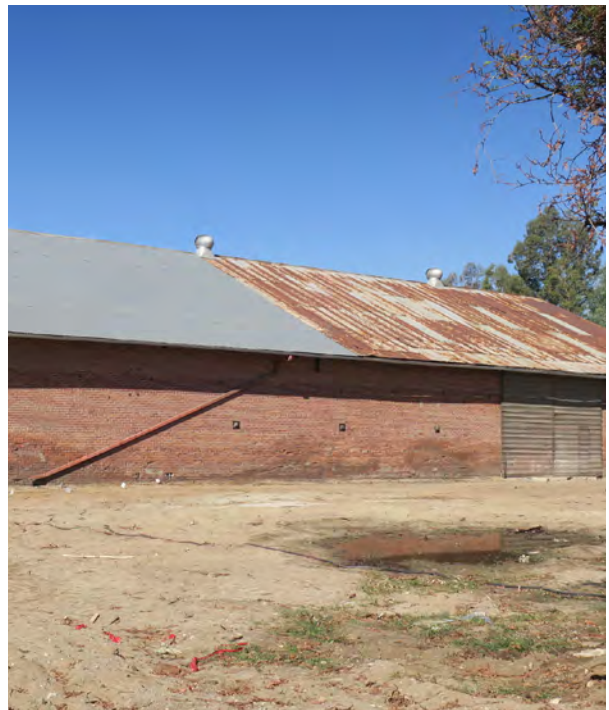
Clay tile (terra cotta) roofing on the Santa Fe Depot.



Wood shingle roofing on a Redlands Queen Anne house.



Composition shingle roofing.



Metal roof on a ca. 1906 warehouse building.

Roofing

Typical Problems

Maintaining the roof is key to keeping the building watertight, and avoiding potential interior damage from leaks. Traditional roofs achieve their weather-tightness mostly by overlapping elements such as shingles. The steeper the roof pitch, the less the length of overlap needed. Other roofs, such as flat membrane roofs or flat-seamed metal roofs, rely on the integrity of the roof material itself, and its proper installation, to remain watertight. Where roofs meet other elements, such as vertical walls, chimneys, or plumbing vents, they rely on flashings to redirect water or prevent water from entering critical joints. These are typical areas where leaks can occur.

We recommend inspecting your roof at least twice a year, and in particular after a heavy rainstorm. Keep an eye out for problem areas that may need repair, and clean out debris from drains or gutters. Consult a professional when needed. As typical roofing problems vary by material, they are grouped by material below.

Refer to Appendix C - Material Inspection Checklists for more information on typical roofing material problems and recommended solutions (grouped by roofing material).

Terra Cotta Tile

Terra cotta or clay tiles are one of the most distinctive and decorative roofs due to the variety of shapes, colors, profiles, patterns and textures available. They are typically used in the Spanish, Mediterranean, Mission, and Pueblo Revival styles. Clay tile has an exceedingly long lifespan (100+ years), but regular maintenance and repairs are necessary.

Common terra cotta tile problems include the following:

- Broken tiles
- Deteriorated fastening system (from weathering or improper installation)
- Manufacturing defects
- Water damage from deterioration or improper installation of underlayments and flashings

Concrete Tile

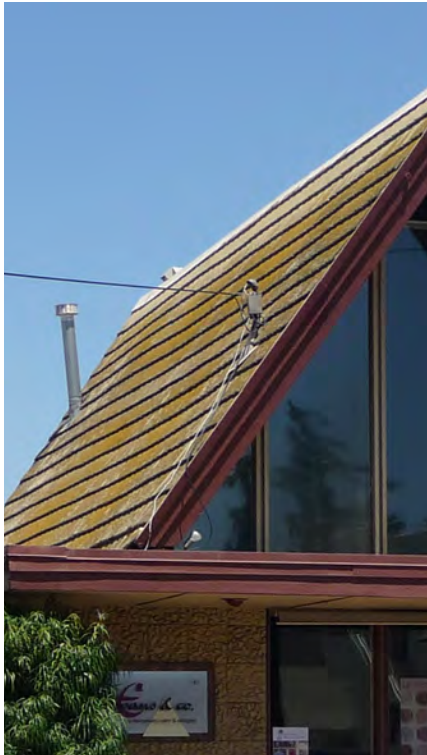
Concrete roofing tile was developed as a modern substitute for other roof materials, such as clay tile or wood shingles, and is increasingly common in Redlands in new construction and as a clay tile replacement material. Concrete tiles (including cement fiber composite) have a similar lifespan to clay tile, and have good fire-resistance and hail-resistance. Unfortunately, they are difficult to install correctly, prone to moisture problems, and tend to fade in color. The profile, color impermanence, and overall appearance make them inappropriate for use on historic buildings. The City of Redlands does not recommend the use of concrete tile on historic buildings.

RELEVANT SOURCES

[NPS Preservation Brief 30:
The Preservation and Repair of
Historic Clay Tile Roofs](#)

Roofing

Typical Problems



Biological growth on a wood shake roof.

Wood Shakes and Shingles

Wood shakes and shingles can be used for pitched roofs, as well as siding. Western red cedar, Alaskan yellow cedar, and redwood are the most common wood species used. The differences between shingles and shakes is based on wood grade and size. Shakes are often larger, thicker at the butt-end, and offered in many surface textures, including handsplit (split on face with sawn backs), straight or tapersplit (split on both sides), and tapersawn (sawn on both sides). Shingles are typically sawn on both faces, with thinner butt-ends (about 3/8- to 1/2-inch thick).

Common wood shake and shingle problems include the following:

- Loose or slipped shakes/shingles
- Missing shakes/shingles
- Splits through the wood
- Surface erosion
- Rust stains from corroded fasteners
- Moss or biological growth



Deteriorated asphalt shingle roofing on the former Harbert Residence (1907).

Asphalt and Composition Shingles

Composition shingles are very common in residential roofing, and many historic buildings originally had composition shingle roofs; it is also a common replacement material for buildings that originally had wood shingle/shake roofs, and even clay tile. Composition shingles are manufactured from various materials, such as asphalt, fiberglass, and recycled paper products. They are fire-resistant, and some are also resistant to mold growth and algae. Asphalt shingles are similar to composition but heavier in weight (due to larger asphalt content), and typically carry shorter warranties. Asphalt roofs can typically last up to 20 years; whereas composition roofs can last 30+ years, with good maintenance.

Common asphalt and composition shingle problems include the following:

- Loose or slipped shingles
- Missing shingles
- Surface erosion
- Damage from impact or weathering

Roofing

Typical Problems

Flat Roofs

Flat roofs are covered with a variety of materials, some of which date to the historic era and some of which do not; historic buildings with flat roofs typically have a parapet that conceals the rooftop, so materials tend to be utilitarian and do not contribute much, if anything, to the building's appearance. The most common types of historic flat roofs include: built-up roofs, consisting of hot-applied asphalt and covered with gravel or decorative ballast; modified bitumen roofs, consisting of a base sheet and cap sheet that are either hot-applied with asphalt, cold-applied with adhesive, torched-down, or self-adhesive (peel-and-stick) sheets; and rubber roofs, consisting of rubberized sheets that are either glued down or weighted down with decorative stone. A roofing professional can assist you with determining what type of roofing system you have, and provide information on the best ways to maintain or repair it.

Due to their flatness, these roofs generally rely on the integrity and installation of their membrane or coating to ensure the building remains watertight. In some cases, the system has 2 or even 3 layers overlapped, so there may be some redundancy for controlling leaks; whereas others are a single ply membrane only, and can be easily damaged. Depending on the system, flat roofs can last anywhere from 15-30 years, but should be replaced when the damage or deterioration exceeds 20% of the roof area.

Common flat roof problems include the following:

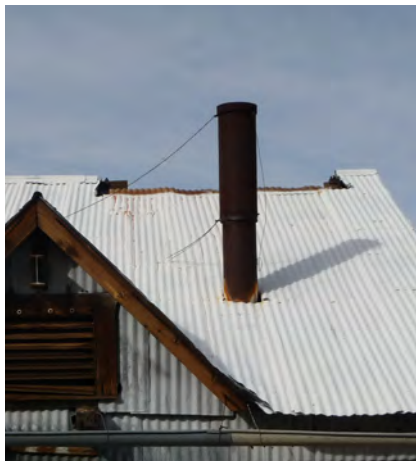
- Bubbles, blisters, or wrinkles in the membrane
- Cracking, tears, splits, and punctures
- Damaged or missing fasteners or plates
- Water ponding due to low spots or poor drainage
- Surface erosion
- Weathering of reflective paint or coatings
- Water intrusion

Roofing

Typical Problems



Corroded and warped corrugated metal roof.



Corrugated metal roof with open hole.



Exterior stone chimney.

Metal Roofs

Metal roofs can include various types including standing seam, flat seam, and corrugated or ribbed panels; they are most common on historic industrial buildings, but are sometimes seen on residential, commercial, and institutional properties as well. Standing seam roofs are used for pitched roofs. The edges of the metal sheets are crimped together, providing a watertight seam, and leaving the edges standing up to provide regular ridges down the roof slope. Flat seam roofs are used for very shallow or flat roofs. With these, the edges of the sheet metal are crimped together, but hammered flat to provide a watertight seam and flat walking surface. Prefabricated metal roof panels, such as corrugated roofing, are provided in larger sheets, and rely on sheet overlap and underlayment materials to provide watertightness.

Common metal roof problems include the following:

- Deterioration when protective painted or galvanized surfaces break down
- Corrosion from water intrusion and galvanic action (when dissimilar metals chemically react against each other)
- Inappropriate or improperly installed fasteners
- Slipping, buckling, or warping of metal sheets due to building movement (uneven settlement or seismic activity)
- Loosening and tearing of seams or edges
- Damage from impact or weathering

Chimneys

Chimneys are often a highly prominent feature of a historic building, designed to complement the architectural style. They are traditionally constructed of brick or stone masonry, and some styles feature stucco-covered chimneys. Due to their vertical height and exposure, along with exposure to heat, chimneys are prone to leaks and other problems, and should be regularly inspected and maintained. Consult a professional to assess the structural stability of your chimney.

Common chimney problems include the following:

- Falling or leaning due to seismic activity or structural problems
- Deterioration and damage due to water intrusion
- Deterioration and damage of component materials (brick, stone, stucco) as addressed above

Roofing

Typical Problems

Drains, Gutters and Downspouts

Roof drains, gutters, and downspouts are an equally important part of any roofing system, working to carry collected roof water away from the building, and often protecting and prolonging the life of the architectural materials. They are a regular maintenance concern for any property owner, but when properly inspected, cleaned, and maintained, they will work well into the future; twice-yearly inspection and cleaning is recommended.

Drains at flat roofs are most often “area drains”, installed at low spots to collect surface water, which run through the building in concealed pipes. Some flat roofs may also have overflow scuppers (small openings in the parapet walls) as a backup in case drains become blocked. Gutters and downspouts typically drain and carry roof water to the ground along the outside of the building (although they can also be internal drains in the exterior walls, depending on the installation). These elements can vary in material and style. Some may be original to the building, or added later for water control. Depending on the style, gutters may be visible, and attached or hung from eaves; or they may be non-visible, built-into the eaves and concealed behind decorative cornicework. Downspouts may also be simple tubes or quite decorative with stamped sheet metal collection boxes (conductor heads) or decorative cast iron boots. Scuppered openings often have these conductor heads and downspouts as well.

Common problems with drains, gutters, and downspouts include:

- Clogging with leaves, trash, or other debris
- Loose or missing pieces
- Denting or crushing
- Open seams and broken welds
- Deterioration and corrosion due to weathering and moisture
- Water ponding or splashback at ground discharge area



Corroded downspout.



Drain with uneven grate panels.



Integral gutter at Santa Fe Depot.

Roofing

Typical Problems



Roof with multiple penetrations and flues.



HVAC equipment atop a commercial building.

RELEVANT SOURCES
[NPS Preservation Brief 4:
Roofing for Historic Buildings](#)

Roof Appurtenances

Roofs can have any number of penetrations or equipment, such as vent stacks for plumbing, exhaust flues for cooking or mechanical equipment, air conditioning equipment, and solar panels. While some of these are historic, most are modern upgrades; nevertheless, they should be regularly inspected, maintained, and repaired to prevent problems with the overall roof system. For smaller penetrations and flues, these often are flashed into the roof system, or have some other type of integral flashing around them. Larger equipment, like solar panels and HVAC condensers are typically supported on their own framing or equipment curbs, which are attached to the roofs. For larger equipment, consult a roofing professional to ensure that the equipment is properly supported and attached to the structure, without damaging the roof.

Common problems with roof appurtenances include:

- Unstable attachments
- Loose or missing pieces
- Open seams and broken welds in integral flashing
- Deterioration and corrosion due to weathering and moisture



Solar panels on a composition shingle roof.

Roofing

Maintenance & Repair

Regardless of material type, roofing material should be regularly inspected (twice a year) and maintained. It is important to keep roofs and drainage systems dry and free of debris (like leaves, pine needles, and dirt). The recommended treatments below are broadly applicable to most roofing materials and roof types.

- Review for possible sources of moisture, and correct/repair where possible. Provide drainage control elements, such as gutters and downspouts, to carry roof water away from the building.
- Maintain underlayments and flashing
- Re-attach loose clay tiles, shingles, or shakes
- Treat wood shakes and shingles with biological growth inhibitors
- Replace individual clay tiles, shingles, shakes, or metal sheets where broken or missing; match existing in size, profile shape, and color
- When replacing large areas or a whole composition shingle roof, match existing shingles in size, shape, pattern, and color. Over-roofing (installing a new layer of shingles over existing) is not recommended due to added weight and installation issues.
- Patch damaged areas of flat or membrane roofs using compatible materials
- Clean, prepare, and repaint metal surfaces (with zinc-rich paint coatings for galvanized surfaces)
- Repair open or damaged seams and panels in metal roofs by re-soldering or patching
- Brace or reinforce chimneys
- Professional inspection, cleaning, and re-lining of chimney flues
- Seal or patch small voids or breaks in flashing or gutters with a bituminous paste (roofing tar) or sealant
- Repair damaged or open flashing or gutter seams by re-soldering, re-creating, or riveting
- Use mesh screens on gutters and strainers on roof drains to catch larger debris
- Clean drainage system regularly, keeping free of debris
- Trim back overhanging tree limbs

For more detailed information on treating specific historic roofing materials, refer to Appendix C - Material Inspection Checklists.



Remove debris from roofs and gutters.



Reattach or replace loose or missing shingles.



Brace or reinforce chimneys.

Windows & Doors

Types & Components

Windows and doors present special issues when it comes to preservation because they often combine multiple material types in complex assemblies. Doors are often simpler than windows, with common examples including wood slab or paneled types without glazing. But glazed doors are also common in Redlands, ranging from paneled wood doors with partial glazing to wood French doors (narrow paired multi-light doors) to fully glazed aluminum doors. Windows by definition comprise multiple materials, with glass panes held in place by wood, steel, or metal components. Glazing variations can include stained, leaded, or diamond-paned glass.



Grouped multi-light wood windows at the Santa Fe Depot.



Door with arched opening, flanked by casement windows.



Picture window on a Tudor Revival house.

Types of Windows and Doors in Redlands

In Redlands, the most prevalent window types are single and multi-light double-hung windows; casement and fixed windows with multi-light configurations; aluminum sliding windows; bay windows; picture windows; and special windows (round, round-arch, pointed-arch, leaded, stained glass). Wood windows are the most common, but steel and aluminum are also present.

The most prevalent door types are rectangular paneled doors (either solid or partially glazed); solid doors (plain surface, not paneled); round or pointed-arched doors (either solid or paneled); fully glazed doors (one large full light); and French doors (paired multi-light doors). Wood doors are the most common, but steel and fiberglass composites are also present.

Refer to Ch. 2 - Guidelines for the Preservation, Rehabilitation, and Restoration of Historic Resources for more information on window and door types.



The tall wood doors and clerestory windows on this Contemporary Ranch house are integral to its character.

Windows & Doors

Typical Problems

Windows and doors can have a number of problems, most often related to the deterioration of the materials themselves from a lack of maintenance or over-use. Common problems with doors and windows include:

- Wood decay, rot, and deterioration due to moisture (in particular at window sills and door thresholds)
- Wood insect damage
- Racking (skewing) of window and door frames due to ground settlement or seismic activity
- Overpainting of window sashes and frames so they become difficult to open and close
- Steel corrosion and deterioration
- Aluminum oxidation
- Glass breakage from impact, vandalism, or cyclic temperature changes
- Broken, damaged, or corroded/deteriorated hardware
- Drafty openings

Refer to Appendix C - Material Inspection Checklists, for more information on common door and window problems and recommended solutions.



Cracked glazing in a stained glass window.



Weathered doors with corroded and missing hardware.

RELEVANT SOURCES

[*NPS Preservation Brief 9:
The Repair of Historic Wooden Windows*](#)

Windows & Doors

Maintenance & Repair



Weathered and racked window needing repair.

As with other historic building materials, routine maintenance of historic windows and doors is key to ensuring their survival. Gentle cleaning, oiling hardware, and other preventive maintenance will head off major issues. In general, replacement of an entire window because of a deteriorated piece is not necessary. Most often the damaged part can be either repaired or removed and replaced in kind. The type of repair will vary depending on the material (see “wood” and “metal” sections above). To maintain and prolong the life of the materials, it is important to control unwanted moisture by maintaining paint coatings, sealants, and putties. When these materials begin to peel, age or crack, water can get inside and propagate wood rot or metal corrosion.

- Inspect doors and windows for racking, damage, and problems with operation
- Clean surfaces regularly and repaint as needed
- Replace window putties and sealants regularly
- Clean and oil hardware as needed
- Remove built-up paint that may restrict movement
- Re-caulk perimeter joints and install weatherstripping between moving parts to reduce air infiltration
- Replace broken glazing in kind

For more detailed information on treating window and door materials, refer to Appendix C - Material Inspection Checklists.



A well-maintained door.

Metalwork

Types & Components

Exterior metalwork in Redlands is generally limited to decorative architectural items, such as grilles, finials, weathervanes, awning supports and other miscellaneous hardware; and non-architectural items, such as decorative metal handrails and fences. Metals can generally be divided into two categories: ferrous and non-ferrous. Ferrous metals can include iron, cast iron, wrought iron, steel and other ferrous alloys. Non-ferrous metals can include bronze, copper, aluminum and zinc. Ferrous metals are the predominant type found in Redlands, and will be discussed here..



Decorative metal awning supports.



Decorative metal finials and weathervane at roof ridge..



Decorative metal gates at entrance.



Decorative metal fencing.

Metalwork

Typical Problems

Galvanic Corrosion

Galvanic corrosion can occur between two or more dissimilar metals. When in contact with an electrolyte, such as water, one of the metals will corrode at a faster rate than it normally would. This is the principle behind galvanizing of steel. The steel is typically coated with a layer of zinc, which will corrode preferentially to the steel, and thereby protect it.

For decorative metal items and metal flashings, galvanic corrosion can occur when dissimilar metals are used together, such as fasteners. It is generally good practice to use the same or similar metals for fastening metalwork or flashings.

Metalwork when exposed to the elements will slowly oxidize over time, essentially breaking down and reverting back to its core elements. For ferrous metals, this is typically a reddish iron oxide corrosion product, commonly referred to as rust. This process can be accelerated by air pollutants, acid rain, salts, lack of paint coatings, and the presence of dissimilar metals (see “galvanic corrosion”). Rust typically begins as a surface condition, and over time will erode the metal to the point of loss of strength and breakage. Rusted metal can also damage adjacent materials, such as masonry. Rusted metal embedded in masonry can expand up to ten times its normal size, putting immense pressure on the surrounding masonry and causing cracks or spalls. It is important to address rusted metalwork in the early stages before the problem progresses.

Refer to Appendix C - Material Inspection Checklists for more information on common metalwork problems and recommended solutions.



Example of rust at a painted metal fence.

Metalwork

Maintenance & Repair

Exterior ferrous metalwork is best preserved by maintaining exterior paint coatings. These should be inspected and renewed regularly (every five to eight years, with potential touch-ups at heavy wear areas during that time). When performing any repainting work, proper surface preparation is key to ensuring that the new paint will adhere and last. Surfaces should be clean, dry, and free of any rust, loose dirt, or peeling paint. *See above for more detailed information on treating paint coatings.*

- Wash surfaces with a mild detergent solution and scrub with natural bristle brushes. Remove loose soiling and peeling paint. *See above for discussion on lead paint safety.*
- Remove surface rust by hand with Scotchbrite pads and steel wool. Sand surfaces to smooth out any rough areas. When rust cannot be removed, stabilize rusted surfaces with a tannic-acid based rust converter.
- At areas of moderate rust where metal is pitted, fill gaps with a compatible metal putty.
- At areas where the metal component is heavily rusted, broken or strength is compromised, replace in kind.
- Replace heavily deteriorated fasteners and fasteners of dissimilar metals.
- Use a high quality, exterior grade primer and paint coating. Zinc-rich paints and primers are recommended for ferrous metalwork. Consult your local paint supplier for products suited to your application.

For more detailed information on treating paints and stains on historic woodwork, refer to Appendix C - Material Inspection Checklists.