SRCA Seminar Series

Basic Slate Roof Repair, Restoration, and Maintenance

SLATE ROOFING CONTRACTORS ASSOCIATION OF NORTH AMERICA, INC.
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Most existing American slate roofs originated from quarries on the east coast of the US. Newer roofs may have slates imported from other countries.
Vermont and NY slates at 100 years of age: purple, red, semi-weathering green.
Many old Pennsylvania black slate roofs are beyond repair and must be replaced.
PA Chapman slate should last about 125 years.
PA Bangor slate can last from 75 to over 100 years.
PA Cathedral Gray slate at 100 years shows no wear.
Peach Bottom (PA/MD) slates are dark and long-lasting.
Buckingham (Virginia) slates are very long-lasting and sparkle in the sunlight when closely examined. This roof is 132 years old.
Original slates on this roof had to be replaced with salvaged slates of the same size and type (VT semi-weathering gray-green).

The original slates that were removed from this side were used to restore the back side.
CONTRACTORS

- Contractors should have a minimum of five years experience in slate roof restoration.
- Contractors must be able to provide an acceptable resume.
- Contractors must be able to furnish all necessary insurance, permits, labor, materials, etc.
- Workmen must be experienced specifically in slate roof repair and restoration.
- Workmen must otherwise be under the full-time supervision of an experienced foreman.
PROTECTION OF ROOF SURFACES

- Workers must not damage slates by carelessly walking on them.
- The roof must be properly staged to prevent damage from foot traffic.
- Roof ladders, hook ladders, and other such devices can also be used to protect the roof from foot traffic.
Hook ladders allow safe access to steep roofs while protecting the roof from damage.
Hook ladders, roof brackets, and ladder jacks allow for versatility when working on steep slopes.
GENERAL MAINTENANCE

- Replace broken, missing or defective slates.
- Remove and replace old faulty repair work.
- Paint, repair, or replace flashing metal.
- Conduct emergency repairs when needed.
Tinner’s Red paint and Tinner’s Green paint are traditional roof metal paints, but any good metal paint can be used to preserve flashing metal.
Note how rusting metal permanently stains the roof.

Regular painting of “tin” flashings will prevent this from happening.
REPAIR OF FLASHING

- Existing flashings may be sealed with a high-grade caulk/sealant where needed.
- Loose flashings must be riveted or refastened.
- Missing flashings must be replaced with compatible flashing metal.
<table>
<thead>
<tr>
<th>MORE ELECTROPOSITIVE (Anodic)</th>
<th>MORE ELECTRONEGATIVE (Cathodic)</th>
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<tbody>
<tr>
<td>Zinc</td>
<td>Stainless steel (Types 304 and 316 passive)*</td>
</tr>
<tr>
<td>Aluminum***</td>
<td>Still stainless steel (Types 304 and 316 active)</td>
</tr>
<tr>
<td>Galvanized steel (Avoid copper)</td>
<td>Lead-tin solder</td>
</tr>
<tr>
<td>Cadmium</td>
<td>Lead</td>
</tr>
<tr>
<td>Mild steel, wrought iron</td>
<td>Brass, Bronze</td>
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<tr>
<td>Cast iron</td>
<td>Copper**</td>
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* This stainless steel is chemically treated, usually with an acid solution, to be made passive. **(Avoid uncoated aluminum, steel, zinc, or galv. steel). ***Anodized aluminum is considered compatible with all other metals.

Incompatible Metals:

Copper will “eat” steel.
TEMPORARY EMERGENCY REPAIRS
Temporary emergency repairs can be conducted on flashings when:

Painting no longer preserves the metal.

The property owner can’t afford to have the flashings replaced immediately.

Entire roof replacement is neither desired nor needed.
MASTIC REPAIRS

Flashing metal can be coated with a trowel-grade roof cement, brush grade mastic, or other sealant. A warranty may not be included.

Reinforcing membrane, such as fiberglass mesh, is recommended to be used in all mastic repairs.

Avoid applying mastic or sealant over the exposed surface of slates, bricks, or other surfaces to be preserved.
Emergency Chimney Flashing Repair

Use trowel-grade roof cement and a fiberglass mesh backing.

1. The original flashing is rusty and leaking.

2. Trowel over the flashing with roof cement.

3. Cover the cement with fiberglass mesh.

4. Trowel on another layer of cement.
MASTIC REPAIR:

Note the temporary roof cement and fiberglass repair on the left chimney, painted for aesthetic purposes. This kept the chimney from leaking until it was rebuilt and reflashed (as shown in photo on right).
Examples of unacceptable mastic repairs on chimneys.
Use trowel grade roof cement and fiberglass mesh reinforcement. Do not apply any roof cement or fiberglass on top of any slates! Tuck cement under the valley slates using a pointed trowel.

Emergency Repair of Valley Flashing

1. Valley is old and leaking.
2. Trowel on roof cement.
3. Apply fiberglass membrane.
4. Trowel 2nd layer of cement.

NEVER apply roof cement on top of slates. Tuck cement under slates when coating valley.
TEMPORARY REPAIR OF BUILT-IN GUTTER LININGS

Built-in gutters can be temporarily preserved with a brush-grade roofing compound layered with a reinforcing mesh membrane.

Built-in gutters can also be temporarily preserved with a self-adhering membrane.

Larger holes in gutter linings may first need to be patched with trowel-grade roof cement and reinforcing membrane.
An example of a temporary repair of a built-in gutter using a brush grade waterproofing compound.
An example of a temporary repair of a built-in gutter using EPDM. This can last about 10 years.
EPDM-patched box gutter correctly relined with 20-ounce soldered copper.
TEMPORARY SLATE REPAIR

Temporary repair of a missing or damaged slate can be accomplished by sliding a bib flashing {
underneath} the defective slate.

Broken or missing slates are not to be repaired with mastic or caulk applied on the {
exposed} slate surface.
Slide metal flashing *underneath* slates to stop leaks.
DO NOT apply caulk to the exposed surfaces of roofing slates.

DO NOT use exposed strap hangers.
Never apply mastic on the surface of roof slates!
REPAIRING EXPOSED FASTENERS

Exposed nail or screw heads can be sealed with a high-grade caulk/sealant.

They can also be replaced with gasketed non-ferrous nails or screws.

They can possibly be soldered.

They can possibly be replaced with galvanically compatible rivets.
An example of a poorly installed flashing riddled with exposed nail heads. They should have used cleats or clips.
Cleats or clips can fasten flashings without leaving exposed nail heads.
Remove nails with exposed heads and replace them with gasketed fasteners. This is better than just caulking them.
SLATE REPAIR

All roof surfaces must be inspected for defective or leaking slates.

Defective slates should be removed using appropriate tools such as a slate ripper.

The handle of the ripper must be held down parallel to the roof surface when hammered on.

If the handle of the ripper is lifted off the roof during use, it can break the overlying slates.
BASIC REPAIR SEQUENCE

1. Broken slate needs to be replaced.
2. Slate ripper hooks slate nails and pulls them out, removing slate.
3. The slate has been removed and the roof is now ready for a replacement.
4. Replacement slate is slid into place and fastened with a nail in the slot.
5. The roofing nail is tapped down and a bib flashing is slid under the slate but over the nail head.

SLATE HOOK REPAIR

Use a stainless steel or copper slate hook instead of a nail and bib. Pound it in, slide the replacement slate over it and hook it into place.

DON'T STRAP REPAIR

Don't do this
Replacement slates must match the existing slates in type, length, width, thickness, shape, color and, if necessary, age.

Refer to the SRCA website for a list of salvaged roofing slate sources:

http://slateroofers.org/sources_salvaged_slate.html
Bad repairs. These must all be removed, and the roof repaired correctly.
NAIL AND BIB REPAIR

Replacement slates can be fastened with copper or stainless-steel smooth-shank roofing nails installed through the top of the slot between the two overlying slates.

A bib flashing (minimum 16-ounce copper, minimum 4 inches wide, minimum 6 inches long) is slid underneath the overlying slates and over the replacement nail head.
The repair nail before the bib is installed.
The bib should extend below the nail head by a minimum three inches and extend under the overlying slate by a minimum three inches.

The bib can be bent slightly lengthwise to allow for a friction fit, and/or barbs may be cut into the sides of the bib to improve retention.
Bib Flashings for Slate Repair

Copper Bibs

Aluminum Bibs
The same type of slating nails as on the existing roof can also be used to fasten the replacement slates (e.g. hot-dipped galvanized, which are common on older roofs).

Painted aluminum bib flashings (dark side facing out), minimum .019 gauge, are suitable for slate repair when the roof only has an estimated 50 or less years of life remaining.

Use copper bibs, or slate hooks, on new roofs.
SLATE HOOKS

- Replacement slates may also be installed using either copper or stainless-steel slate hooks.
Slate Hooks

- Standard Copper 3 inch Headlap
- Oversize 4 inch Headlap
- Standard Stainless Steel Black
Slate Hook Repair

Use a stainless steel or copper slate hook instead of a nail and bib. Pound it in, slide the replacement slate over it and hook it into place.
Exposed sheet-metal strap hangers should not be used to fasten replacement slates.
Strap hangers open over time and the slates slide out. Note also the poor practice of using non-matching slates.
CAULKING, MASTICS, AND ADHESIVES

Caulking, mastic, or adhesives should not be used to repair the exposed face of slates.

Adhesives are not to be used to fasten slates without additional mechanical fasteners.

Adhesives may be used to help fasten slates in limited circumstances.

Adhesive is to be applied only underneath slates, and in conjunction with mechanical fastening.
Replacement slates must not be “face-nailed” leaving exposed nails or screws.

No exposed nails or screw heads, including gasketed or sealed heads, should be visible on any repaired or replaced slate.
Examples of Face-Nailed Slates
When a slate is split lengthwise or has a small hole in it, it can be repaired with a bib flashing slid underneath the defective slate.

A slate with a vertical crack can be repaired by slipping an oversized bib flashing underneath the slate.

A slight lengthwise bend in the bib flashings, or else barbing the sides, will help to friction fit the bib into place.
SIDE LAP REPAIR

Insufficient side lap can be repaired by sliding an oversized bib flashing underneath the defective joint, thereby extending the lap.

The bib should be a minimum of 6 inches in width and approximately the length of the slate exposure plus three inches.

A slight lengthwise bend, or else barbing the sides, will help to friction fit the bib into place.
Sidelaps should be 3” minimum

Inadequate sidelaps must be corrected.
Slide bib flashings underneath these defective sidelap joints to prevent leakage.
Capillary attraction can draw water uphill underneath the slates. Therefore, the overlying slates should be butted as close to the center of the underlying slates as possible, and the nail holes should be positioned close to the outer edges of the slates.
If you must punch a new nail hole in an existing slate, punch it above the existing nail hole, not closer to the center.
ROOF CANNIBALIZATION

When matching replacement slates cannot be obtained, identify a section of the existing roof that is least visible from the ground.

Remove the slates from the identified area and use them for restoring the remaining roof.

The “cannibalized” roof section can then be slated with either new or salvaged slates that match the original roof as closely as possible.
This PA Cathedral Gray roof was nearly ruined by roofers who installed asphalt shingles along the eaves.
The asphalt was removed and replaced with standing seam copper. Matching slates were not available.
FLASHING REPAIR
For flashing guidelines, refer to:


The Copper Development Association’s (CDA) “Design Handbook.”

The Revere’s “Copper and Common Sense” publication.
Useful References:

ARCHITECTURAL SHEET METAL MANUAL

Copper and Common Sense

Revere Copper Products, Inc.
The world's copper leader for over two hundred years.
FLASHING INSPECTION

All flashings are to be inspected for cracks, holes, splits, deterioration, exposed nail heads, and looseness.

Flashing metal that is perforated and leaking must be removed and replaced.

Valley and gutter flashings are more likely to be eroded over time than other flashings.
SOLDER JOINTS

Solder joints should be inspected and resoldered or repaired as needed, when possible.

If solder joint failure is evident, the entire assembly should be examined for thermal expansion and contraction design issues.

Refer to SMACNA, CDA, and Revere publications for sheet metal expansion and contraction design recommendations.
This solder joint could possibly be repaired by grinding it clean, riveting it, fluxing it, and either resoldering it or soldering a copper strip over it.
MORTAR JOINTS

Mortar joints that have been cut out to allow for the insertion of new flashing may be sealed using a high-grade caulk/sealant.

Fully cut out mortar joints may be repointed with mortar.

Refer to National Parks Service (NPS) Preservation Brief “Repointing Mortar Joints in Historic Masonry Buildings.”
An example of mortar joints that have been cut out, flashed, then caulked.
CHIMNEY FLASHING

Defective chimney flashings should be replaced in their entirety.

Flashing material shall be minimum 16-ounce copper or 4-pound sheet lead.

All corner flashings shall be installed to be watertight without sealant.
Chimney corners will leak if not soldered, seamed, or folded correctly.
This chimney had to have a cricket, or saddle, installed behind it to stop it from leaking. Chimneys wider than about 30 inches need to have such a diverter behind them.
Chimneys that are no longer in use can be removed to below the roofline.

Ensure that they are not in use for any reason.

The property owner must provide written authorization and a release from liability.

The resulting hole in the roof must be closed with matching roof sheathing and then slated to match the existing roof.
Examples of chimney top removal, before and after.
POSITIVE FLASHING OVERLAP

All flashings are to be installed to have “positive overlap,” such that higher flashings overlap on top of lower flashings, not underneath them.

Refer to SMACNA, CDA and Revere publications for flashing overlap recommendations.
An example of incorrect “negative overlap.” The side flashing should be underneath the back flashing, not on top of it.
APRON FLASHINGS

Lower, exposed edges of apron flashings are to be fastened to the roof with cleats or clips when fastening is required.

No exposed fasteners are to be used.
An example of a chimney with a cleated apron flashing and sweep-seam corners.
REUSE OF EXISTING SLATES

Slates overlying flashings should be carefully removed and reused whenever possible.
The original Buckingham slates could easily have been reused on this building when flashings were replaced. Instead, the appearance of the roof was ruined.
Open Valleys

Defective valley metal must be entirely replaced.

Slates overlying valley flashings must be carefully removed and reused whenever possible.

Number the valley slate courses before removal.

Sweep the roof deck and check for nail heads or other obstacles after valley removal.

Re-nail the roof deck as needed.

Install minimum 30 lb. felt over the roof deck when required.
Although this typical tarred valley, looks hopeless...
You can rip everything out and install new valley metal.
Then reslate with matching slates.
A hopeless-looking 34-foot valley can be replaced in a day by two experienced slaters.
OPEN VALLEYS

Do not make valley sections longer than ten feet.

Overlap valley sections 6 inches in most cases.

As much as 12 inches may be needed on lower slopes.

Valley sections may instead be soldered, using cleats to attach them to the roof deck.

Where two valleys meet at a top juncture, they can be folded, soldered, or double locked.
An example of a double-locked sweep seam valley juncture prior to the installation of the ridge.
On asymmetrical roof slopes, form the valley with an inverted “V” groove down the center.

Between two steep symmetrical slopes, a straight-line bend down the center is often required.

Valley metal may be simply forced into the valley using a knee, creating a traditional rounded metal valley configuration.
When reslating the valley, the numbered slates will be nailed back into the same place where they were removed.

Chalk lines out from the center of the valley and align the slates with the lines.

Valleys can be parallel or tapered so they’re wider at the bottom.

Defective slates should be replaced with sound, matching slates.
Before Removing Slates When Replacing a Valley

Always number them first by scratching with a nail as indicated below. The roof will go back together much more quickly.

Note: On random-width slate roofs, number the rows 1A, 1B, 1C etc, 2A, 2B, 2C, etc.

Numbers will not be visible from the ground once the slates are replaced.
Open tapered W-valley.
Replace closed valley flashings when any of the existing valley metal becomes pitted and leaking.

Slates should be carefully removed and reused whenever possible.

The valley slates are numbered before removal.

Closed valleys are flashed with step flashing.
Typical Closed Valley
Closed valleys are typically step-flashed. Square pieces of flashing 16 inches on a side, can be used in many situations.
Defective pipe flashings should be completely replaced.

Slates surrounding the flashing must be carefully removed and reused, when possible.

The flashing baseplate must maintain a minimum 3-inch headlap with underlying and overlying slates, as well as min. 3-inch sidelap with adjacent slates.

Removed defective slates must be replaced with sound, matching slates.
Rubber sleeves can last about 15 years.
Copper and lead pipe flashings are relatively permanent.
These old pipe flashings have been replaced with 20-ounce shop-fabricated soldered copper.
**STEP AND COUNTER FLASHINGS**

Step flashings in acceptable condition may remain original when other roof flashings are replaced.

Step flashings lower on a roof will wear out sooner than the upper ones and it may be necessary to only replace the lower flashings.

Slates overlying step flashings shall be carefully removed and reused whenever possible.

Defective flashings are removed in their entirety and replaced with minimum 16-ounce copper.
Step Flashings are relatively protected and tend to last longer than more exposed flashings.
Wedging flashing using lead wool.
Slate ridges and hips are repaired by removing and replacing the defective slates.

Saddle slate ridges may need to be disassembled and reassembled to avoid face-nailing.

Worn metal ridges and hips are to be completely removed and replaced in their entirety.

When replacing metal ridges and hips, repair any defective slates underneath them.
Saddle ridges without flashing can open and leak over time.
Step flashing installed in a saddle ridge or hip makes for a tighter roof.
If necessary, use wider ridge replacement metal to cover the old nail holes.

It is recommended that new metal be installed with concealed, not exposed, fasteners.

If ridge/hip metal is nailed or screwed, the nail or screw heads should be gasketed.

New ridge/hip metal must be sized to maintain correct headlap with the underlying slate.
Oversized ridge is being installed to cover the existing ridge due to a lack of headlap.
BUILT-IN GUTTERS

Built-in gutters are built into and below the roof plane, or on the plane of the roof, usually at or near the eaves.

When they wear out, the metal linings must be removed and replaced in their entirety.

Built-in gutter liner replacement can be delayed with temporary or emergency patching.
Old built-in gutter replaced with new 20-ounce copper.
The old metal is completely removed before the new metal lining is installed.
HANGING GUTTERS

Hanging gutters are installed on the exterior of the structure at the eaves.

When they wear out and leak, are damaged, or installed incorrectly, they may need to be removed and replaced in their entirety.

Gutter hangers must not be attached through the slate but should be installed directly onto the roof deck underneath the slates, or to the fascia.
When replacing exterior gutters, remember that the outside edge of the gutter must be below the roof plane.

Source: Berger Building Products, Inc.
Exposed gutter hangers face-nailed through slates must be removed, correct hangers properly installed underneath the slates, and any damaged slates repaired.

It is recommended that the metal type of hanging gutters be galvanically compatible with roof valleys and other roof flashings.
Gutter hangers on top of slates ruin the roof. The hangers must be removed and re-installed underneath the slates and the damaged slates must be repaired and replaced.
Questions?

THE PRESENTATION IS FINISHED!
THANK YOU FOR ATTENDING!