

You may add a small amount of Portland cement (for workability) to a lime, clay, and sand mix, but daubing mixes intended for most historic log buildings shouldn't have more than one part Portland cement to two parts lime. Portland cement tends to shrink and develop hairline cracks, retain moisture, and dry very hard, all of which can potentially damage the logs. If the daubing is white, use white Portland cement; if the daubing is grey, use grey Portland cement. Mix grey and white Portland cement together to produce a lighter grey (see figure 196).

Mix several small (about a cup) test batches of daubing to ensure that you have a formula that matches the original daubing. Formulate each test mix with slight variations in the amounts of sand, lime, and, if necessary, Portland cement (figure 197). When the batches dry, crack them open or crush them and compare the interior color, texture, and materials of the test batches to the original. If the insides of the old and new mortar match, the outside of the new mortar will weather to match the old mortar over time. Choose the best match and use that formula to mix a test batch of new daubing. Apply the test batch either on the building or in a mockup elsewhere to test whether the formula's color and texture match the original daubing.

Masonry daubing tools (figure 198) include:

- Pointing, tuck point, margin, and brick trowels
- Hawks
- Paintbrushes, mason's brushes, and wire brushes (wire brushes are used to clean up all the tools afterward)
- Buckets, mud pans, and grout bags
- Spray bottles

For more information about these tools, see [Appendix F—Acquiring Tools and Materials](#).

Mortar Mix Formulas

A. The most commonly used mix in the Northern Region—

- 8 parts sand
- 2 parts lime
- 1 part Portland cement

B. Very soft mix—

- 4 parts sand
- 1 part lime

C. Moderately soft mix—

- 8 parts sand
- 4 parts lime
- 1½ parts Portland cement

D. Moderately soft mix good for use with fiber reinforcing—

- 4 parts sand
- 1 part lime
- ¼ part Portland cement
- Optional fiber reinforcing

E. Moderately hard mix—

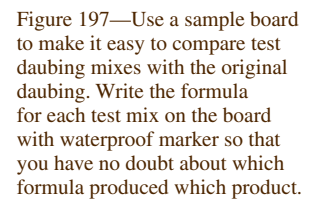
- 6 parts sand
- 2 parts lime
- 1 part Portland cement

F. Somewhat harder mix than the moderately hard mix—

- 6 parts sand
- 2 parts Portland cement
- 1 part lime

G. Similar to bagged masonry premix—

- 4 parts sand
- 1 part Portland cement
- ½ part lime



A collection of various tools and equipment, including a lantern, a bag of cement, brushes, and trowels, arranged on a white background. The items are laid out in a grid-like fashion, showcasing a variety of construction and maintenance tools. The tools include a black lantern with a glass lens, a bag of cement with a red logo, several brushes with wooden handles and different bristle types, and a row of trowels with wooden handles and metal heads. The background is plain white, and the entire set is enclosed in a thin black border.

Use hand trowels to clean out daubing that is loose or that hasn't adhered well to the logs. Leave original chinking, blocking, and fillers intact, but refit loose pieces. You may need to clean out the joint entirely to get a good bond between the daubing and the logs, but that usually is unnecessary. If there was no original chinking and the voids are too large to bridge with daubing, press soft filler, such as oakum (figure 199), firmly into voids with a stick or blunt tool.

The cabin builder originally may have used concealed reinforcement, such as protruding nails, wire mesh, or nailed-on tie wire, to keep the daubing in place. Sometimes builders only used nails on the upper side of the log, sometimes they only used nails on the lower side of the log, and sometimes they placed nails randomly. If you have to replace the reinforcement, use only galvanized nails or wire mesh and follow the original nailing pattern.

Because daubing is a masonry product, do not apply it in full sun, excessive heat, or when you expect freezing temperatures. Just before you mix the daubing, recheck to ensure that the chinking is tight and secure. Then, thoroughly mix all the dry daubing materials. Just before applying the daubing, add water to the dry materials and mix the daubing to a stiff, paste-like consistency. The mix dries quickly, so don't prepare more daubing than you can apply in about 30 minutes.

Spray the area with water just before you apply the daubing. The extra moisture prevents the dry filler from drawing off the moisture within the daubing too rapidly and helps prevent hairline cracking. Use a small trowel to press the daubing into the chinking space and to smooth the filled areas (figure 200). You may need to daub wide or deep chinking spaces or joints in layers to prevent the daubing from sagging and separating from the logs.

Figure 199—This preservation crewmember is stuffing oakum chinking into the gaps between the logs at the Gates Park Guard Station cabin (Lewis and Clark National Forest, Northern Region). After filling the gaps, he will apply the daubing.



Chinking and Daubing



Figure 200—This preservation crewmember is using a small trowel to apply daubing to a cabin, carefully matching the profile of the new daubing to that of the original daubing. His hawk is nearly empty of daubing material.

Chinking and Daubing

Ensure that the new daubing matches the tool marks and texture of the original daubing. For instance, if the original daubing had trowel marks, use your trowel to mimic those marks. If the daubing had a brushed surface, lightly brush the daubing with a paintbrush or mason's brush to produce the same texture after the daubing sets slightly.

After applying the daubing, respray the daubed area lightly with water to keep the surface from drying too fast. On sunny, hot days, misting with water won't be enough to prevent premature surface drying, so hang a wet sheet or tarp on the wall to shade and moisturize the daubing.

If the daubing cracks as it cures, remove it and start over.

This time, mix the daubing and allow it to rest for a few minutes until it sets slightly. The appropriate resting time varies from about 5 to 10 minutes, depending on the outside temperature and humidity. The initial hydration "kick" occurs during the resting time. When the initial set occurs, add a little more water, mix the daubing to the consistency you need, and then apply the daubing. This process is called tempering the mix, and should prevent cracking during the curing period.

Keeping the Rain Out

Every log cabin needs a good roof to keep moisture out of the structure. The foundation, walls, and roof all are important to the durability of a cabin, but if the roof doesn't perform properly, the cabin will soon disintegrate. Use the information in the following sections to help ensure that your roof works properly.

Roofing Safety

For tips on working safely on roofs, refer to the [Safety First](#) section of this guide. At a minimum, follow OSHA safety requirements. Do not hesitate to take extra precautions that make you more confident about your safety. Just because people were cavalier about roofing safety in the past or claim to be as sure-footed as a cat doesn't mean that you should take unnecessary risks.

Most roofs are a long way from the ground, and most historic roofs have steep pitches. To protect workers from falls, use scaffolding, temporary guard railings, or a fall-arrest system.

If you use scaffolding, set it plumb and level, ensure that the safety rails are in place, and attach it to the building. If you use a fall-arrest system consisting of a harness, lanyard, rope, and ties to the building, ensure that all the equipment has enough capacity to protect the user, that the equipment is in excellent condition, and that you inspect it daily. Also, follow other safety precautions, such as ensuring that all workers at the site are aware of work being performed on the roof above them, using a bucket on a rope to lift materials and tools onto the roof rather than having workers carry them up a ladder, ensuring that workers do not carry more than they are comfortable carrying, and ensuring that workers always reserve one hand for holding onto the ladder when going up and down. Forest Service employees must follow the precautions in the job hazard analysis.

Using Roofing Jacks and Roof Anchors

As roofers lay courses of roofing higher and higher on the roof, they will no longer be able to work from scaffolding set next to the building and will need to stand on the roof. Use roof jacks, also known as toe board holders or slide guards, to provide a secure surface for the roofers' feet. Roof jacks are brackets that support toe boards. You nail them to the roof through angled slots so you can remove them without damaging the shingles or shakes. Roof jacks are not fall protection. Use rope and harness, lanyard and harness, or properly guarded scaffolding in addition to roof jacks to prevent falls off the roof and serious injury. Follow OSHA requirements and the precautions listed in your job hazard analysis.

To set a row of roof jacks, position each roof jack so that the horizontal bar that holds the toe board is at least 2 inches below the lower edge of the shingle course that will lay above it (figure 201), with the top of the roof jack's nail slots positioned over the gap between adjacent shingles (if possible) and directly over a purlin or rafter. To prevent denting the roofing under the roof jack, place a piece of roofing felt folded double or a spare piece of asphalt roofing between the roof jack and the shake or shingle to provide some cushion.

Place the roof jacks no more than 6 feet apart; that's about as far as a 2x wood plank will span without cracking under the weight of a large person. Drive 16d (pronounced "16 penny") nails through the top of the nail slots, into the gaps between shingles, and through the sheathing into the roof rafters or purlins to secure the roof jacks to the roof. Drive the nails just shy of flush with the roof jacks so that you can remove the roof jacks when you finish using them. The main body of the jack will rest on a just-laid course of shingles, with additional support provided by the course below, the sheathing, and the framing.



Figure 201—This closeup photo shows how roofers set roof jacks on a shingle roof. The chalkline for the next shingle course is above the point where the triangular-plank support attaches to the slotted bar. Notice how the roofers nailed the slotted bars to the purlin through the spaces between adjacent shingles.

Keeping the Rain Out

Lay planks (2x6 to 2x12 lumber, depending on which width fits snugly into the roof jack) across the jacks and wire or nail the lumber to the roof jacks (figure 202). Install the next course of shingles or shakes, setting a wide shingle over the nail slots of each roof jack. Be careful not to drive any roofing nails within a couple of inches above and to the right of each roof jack or you won't be able to get the roof jack out without cutting the shingles (and then replacing them).

After finishing the roofing job and removing the toe boards, force each roof jack up and to the right so that the slots slide past the nails, freeing the roof jack. Then, slip the roof jack down and out from under the shingles or shakes. For asphalt shingles only, drive the nails flush by carefully hammering on a wood or rubber block positioned directly over the nails that held the roof jacks. This prevents lumps or raised shingles on the roof. Do not attempt to drive the roof jack nails flush on wood shingle or shake roofs. Doing so risks damaging the roofing, which you will then have to replace.

Roofing Anchors

Roofing anchors are secure tie-off points for ropes or straps that connect to body harnesses to form a system that provides fall protection. You can secure either permanent or removable roofing anchors to the roof structure. Anchors for shingle, shake, and rolled roofing typically consist of a D-ring attached to a long metal strap with nail holes. Lay the strap of the anchor with its long dimension perpendicular to the ridge of the roof, directly over a rafter, truss, or purlin, and nail or screw it in place.

If you plan to own the building long enough to be involved in future roofing repairs, consider installing permanent anchor points to make future work easier. In most cases, set permanent anchors close to the roof ridge. The roofing covers all but the D-ring (figure 203). This D-ring placement provides an unobtrusive anchor point. Always follow the manufacturer's instructions for attaching permanent or temporary roofing anchors.



Figure 202—These roofers placed planks on roof jacks, providing a secure surface for their feet during the reroofing of the Moose Creek garage (Helena National Forest, Northern Region).

Keeping the Rain Out

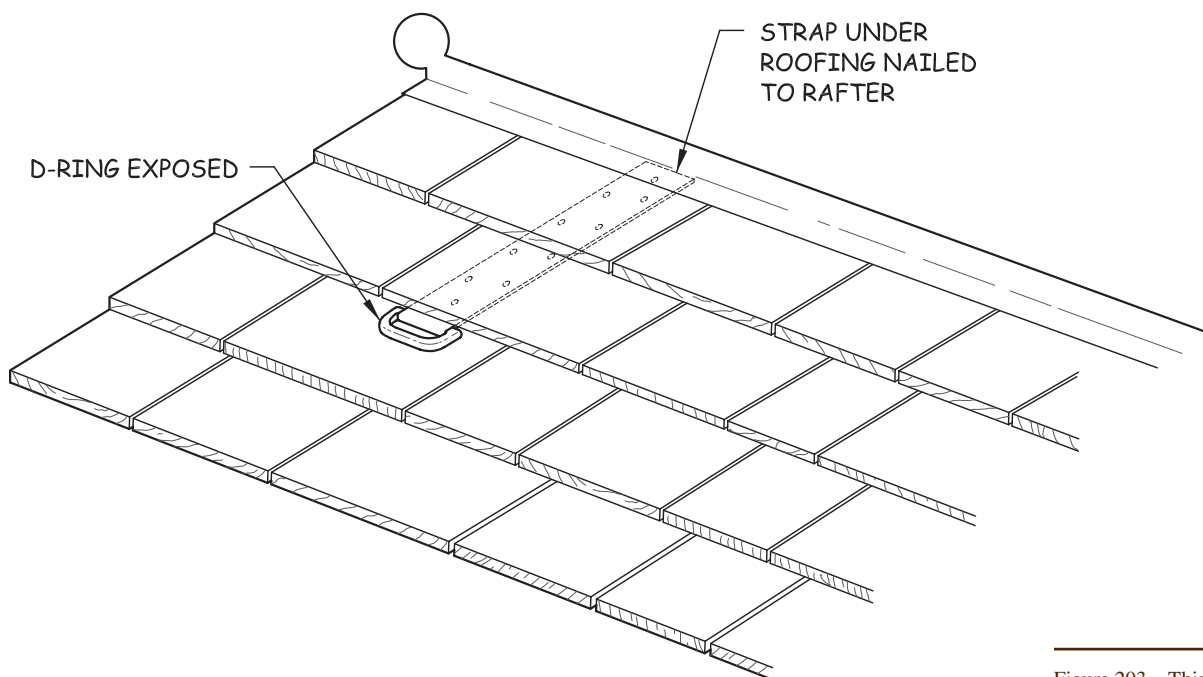


Figure 203—This drawing shows the proper placement of a permanent tie-off point for fall protection.

Rafters, Purlins, and Trusses

The framing that supports the sheathing and roofing on a log cabin may consist of trusses, purlins, rafters, or purlins with rafters. Trusses (figure 204) are complex, usually triangular

roof support units that may be constructed of dimensioned lumber, timbers, or round logs. Purlins (figure 205) are logs or timbers that run the length of the cabin and are supported by the end walls and sometimes a center wall of the cabin.

Keeping the Rain Out



Figure 204—A simple king post truss constructed of logs supports the porch of the cabin at the Stolle Meadow Guard Station (Boise National Forest, Intermountain Region). The cabin has a cedar shingle roof. This photo was taken in 1939, not long after the builders constructed the cabin. The cabin still is in use today.

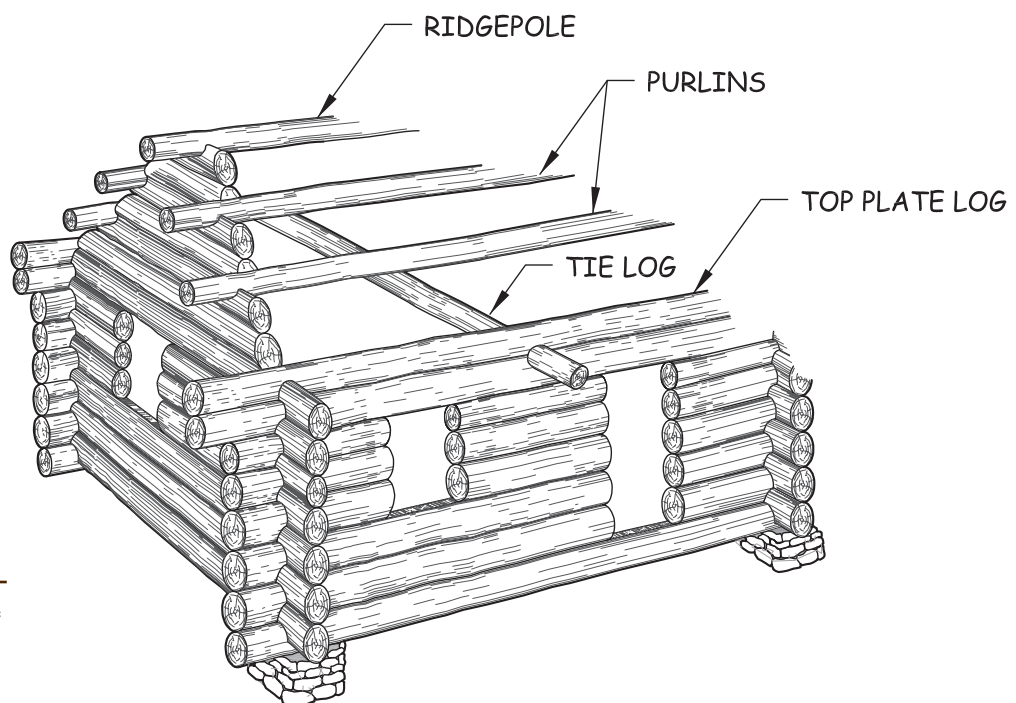


Figure 205—This drawing shows the structural framing of a purlin roof system.

Rafters (figure 206) can be made of logs, timbers, or dimensioned lumber running from the peak to the eave of the roof. The outside walls of the cabin support the rafters. The rafters either brace against each other at the peak of the roof or a ridge beam at the peak supports them. Many rafter roofs need a tie log or tie beams (figure 207) to prevent the weight of the roof from pushing the walls of the cabin outward where the rafters bear on the wall logs. Builders sometimes used rafters and purlins together (figure 208), especially in situations where they could procure only smaller logs or timbers or when they didn't have the resources to lift larger timbers into place on the roof.

Common structural roof problems include underbuilt or undersized lumber or logs, too few or too widely spaced rafters or trusses, connections that have broken or become loose, rotten wood, and inadequate ventilation. Defects in the roof-framing system may show up as humps or dips in the roof. Humps or dips in the roof aren't always because of defects in the roof framing. Foundation, floor, or wall problems that are telegraphed through the structure to the roof may have caused these deformations.

If the building condition and historic assessment identified structural roof problems, review your preservation strategy

and project plan to determine what you need to do to fix the problems. Complete any necessary structural design work and use that information to order materials for the repair work. If you didn't complete any of these steps, back off and complete them before you begin repair work. If you don't, you may have to redo your repairs later. Similarly, ensure that the entire building is plumb, level, and square before performing any structural roof repairs. The roof problem may or may not disappear once you realign the building, but at least you won't have to repair the roof structure twice, which may happen if you fix the roof first and address the foundation and other support problems later.

For information about repairing or replacing deteriorated purlin ends or rafter tails, see the [Log Purlin End and Rafter Tail Repairs](#) section of this guide. Most other structural roof repairs or structural member replacements are fairly straightforward carpentry work. Select and shape logs using the techniques explained in the [Round Logs](#) and [Hewn Logs](#) sections of this guide. As with other work on historic structures, select replacement materials that are the same as the materials you removed, or as close to the same as possible.

The SHPO probably needs to review or approve any changes to the roof structure, such as sistering new lumber to old,

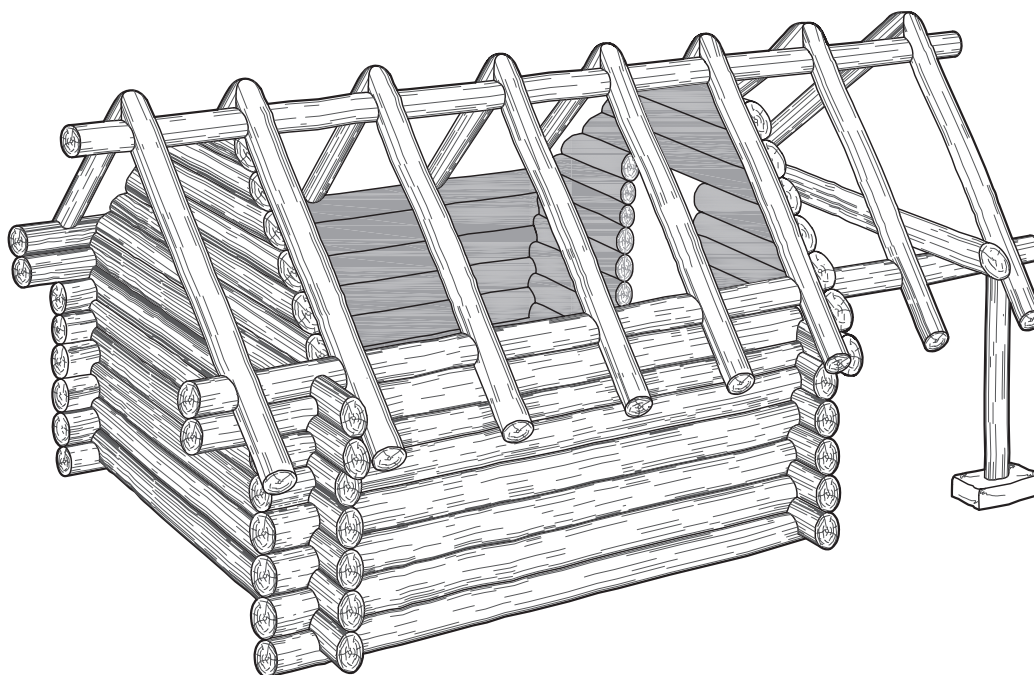


Figure 206—This drawing shows the structural framing of a rafter roof system. Rafter systems may include a ridge beam, shown in this drawing, or may use a simple ridge board that ties the rafters together at the peak of the roof.

adding a knee wall, adding roof vents on gable ends, or adding rafters, trusses, or rafter ties, if a Federal or State government agency owns the cabin, or if Federal or State sources provide some or all of the funding for the cabin preservation work. Check with your heritage resource specialist

or archaeologist for the requirements. The local building department also may need to approve structural changes and repairs. You normally can make such repairs as reattaching connections between structural members without getting approvals.

Keeping the Rain Out



Figure 207—The builders used tie beams (that also served as ceiling joists) on the two-story Steel Creek Barn (Beaverhead-Deerlodge National Forest, Northern Region) to ensure that the walls wouldn't spread apart over time because of pressure from the rafters.



Figure 208—The Liz Creek Cabin (Clearwater National Forest, Northern Region) has a rafter and purlin roof structure. Because of decay, preservation crewmembers removed one of the purlins and the roofing, revealing the framing. They replaced these components before installing the new roofing.

Insulation and Ventilation

Ventilation is very important to roofing durability. Most uninsulated historic cabins had more than adequate ventilation because air moved freely through the walls and roof. These days, people expect more comfortable temperatures, and insulation is part of the solution for temperature control.

If your cabin needs roof insulation, install it between the ceiling of the cabin and the floor of the attic (with an air barrier on the ceiling side) and vent the attic to the outside, unless you have to heat or cool your attic. This will provide plenty of air movement through the attic and no air movement from the occupied space, so there should be no condensation to cause moisture damage.

If you need to add insulation or modern construction materials such as plywood sheathing, air may not circulate as easily as it did with the original construction materials and the building may need additional venting. The general code requirement for venting attics is that the net free ventilating area must be at least $\frac{1}{150}^{\text{th}}$ of the floor area of the space to be ventilated. Some code reductions are allowed for installing forced ventilation or vapor retarders. Ask your facilities engineer to check the venting design for functionality and local code requirements. If a Federal or State government agency owns the cabin, or if Federal or State sources provide some or all of the funding for the cabin preservation work, check with your heritage resource specialist or archaeologist to determine whether you must consult with the SHPO to add ventilation that changes the appearance of the cabin.

If you need to heat or cool your attic, you'll need to insulate between the rafters or purlins. Avoid installing insulation tightly to the underside of the roof; it usually leads to condensation-related moisture damage within a few years. This damage is particularly common in air-conditioned structures. If you must install insulation between the rafters, always provide at least 2 inches of ventilation space between the insulation and roof, across the full width between rafters. If the roof has continuous sheathing, provide venting at the eaves and at the ridge line to minimize moisture formation on the underside of the roof.

Sheathing

Most roofs have a layer of sheathing, sometimes called sheeting, on top of the roof framing. One-inch-thick boards of various lengths and widths butted against each other, shiplap or tongue-and-groove boards, or spaced sheathing boards usually make up sheathing on historic cabin roofs. Spaced sheathing sometimes is called skip sheathing or shingle lath (figure 209). The builders may have laid sheathing horizontally on the roof framing (figure 210), vertically (figure 211), or diagonally (figure 212). Various people may have repaired sheathing many times over the years, using different materials.

If you need to replace some of the boards, look for sheathing materials that match the originals. You may need to custom order lumber to match the size and configuration of the original sheathing to provide an even surface for the new shingles.

Often, the sheathing connects the rafters, purlins, or trusses together and provides rigidity for the roof structure. If you must remove and replace large quantities of sheathing, do the work in sections to avoid possible shifting or collapse of the roof structure. Replacing sheathing boards is fairly straightforward. You can easily copy the original construction methods. Just be sure to take the safety precautions required by your job hazard analysis, which include setting up scaffolding, roping up, and tying off.

People may have replaced the original sheathing with plywood or oriented strand board (OSB) at some point. Plywood and OSB don't allow the roof to breathe as sheathing boards do. You should generally replace plywood or OSB with sheathing boards if you will install historic styles of wood shingles or shakes during preservation. In a few instances, plywood is justified, and the SHPO will most likely approve its use, even for structures eligible for or listed on the National Register of Historic Places. For example, if the roofing is sod and the framing and sheathing are rotten, you may need plywood as part of an engineered reconstruction of the roof. The SHPO probably will need to review or approve the project, and you will need a structural engineer and a green roofing expert, such as a landscape architect, to properly design the roof.

Some historic cabins didn't have any roof sheathing. Instead, the builders attached shakes or metal panels directly to the purlins. If you are restoring a cabin with no sheathing, you

most likely will need longer shakes than are commonly available these days. You can obtain extra-long shakes by special order.

Keeping the Rain Out



Figure 209—The spaces between the sheathing boards are clearly visible in this photo of the underside of a cabin roof. Roofers added new sheathing boards (lighter color) between the darker color original sheathing boards before putting new shingles on the roof. The shingles are visible in the gaps between sheathing boards. Spaced sheathing often is referred to as “skip sheathing” or “shingle lath.”



Figure 210—The roof sheathing on the Moose Creek Station garage (Helena National Forest, Northern Region), built in 1930, is 1-inch-thick boards applied horizontally over the rafters.

Figure 211—The roof sheathing on the Office/Cookhouse building at the Moose Creek Wilderness Station (Nez Perce National Forest, Northern Region), constructed in 1921, is 1-inch-thick by 12-inch-wide boards applied vertically over the purlins. This photo shows the south side of the building.



Keeping the Rain Out



Figure 212—The sheathing on the one-and-a-half-story Adams Camp Ranger's House, built in 1933, consists mainly of diagonal 1-inch-thick boards with vertical boards at the gable overhangs. The varying widths and colors of the sheathing boards provide evidence of various repairs made over the years. Adams Camp is located in the Salmon River Ranger District of the Nez Perce National Forest in the Northern Region.

Roofing

After you repair the roof framing and sheathing, it's time to repair or replace the surface that sheds the rain. Materials and methods used on historic log cabins varied, depending on

what was available locally and on the preferences and abilities of the builders. Common materials included wood shingles (see figure 204), wood shakes (figure 213), metal (figure 214), asphalt (figure 215), or sod (figure 216). People seldom

Keeping the Rain Out



Figure 213—Roofers used shakes that matched the original roofing to reroof the Office/Cookhouse building (Moose Creek Wilderness Station, Nez Perce National Forest, Northern Region). This photo shows the north side of the building.

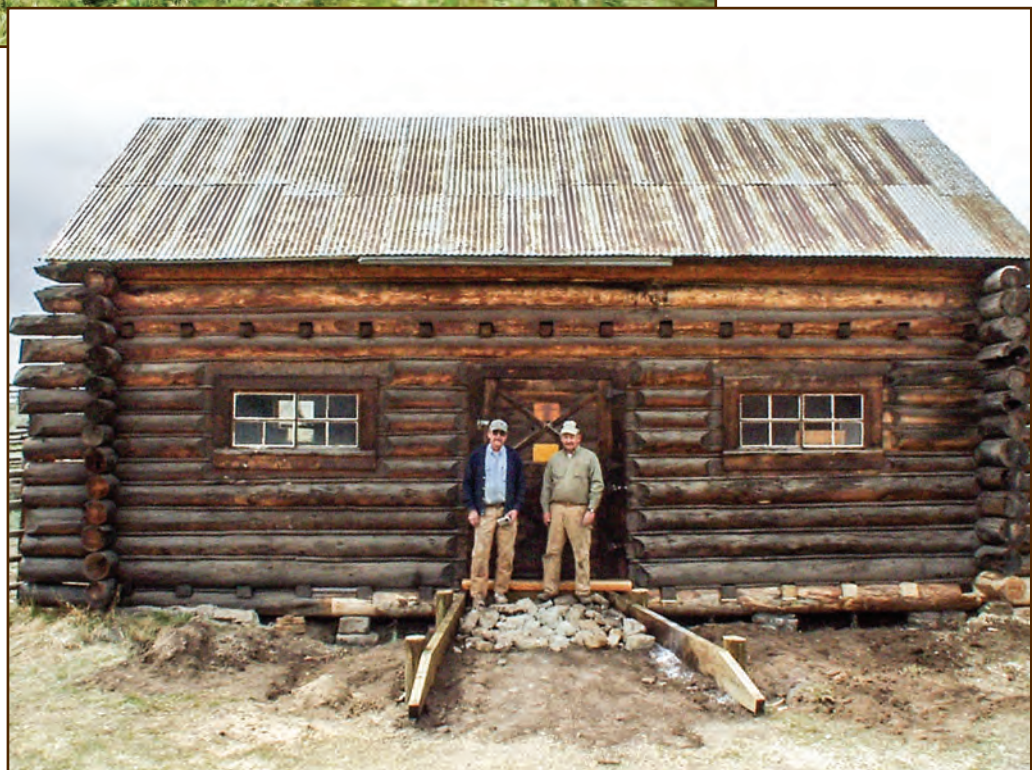


Figure 214—The corrugated metal roofing is original to the Steel Creek log barn (Beaverhead-Deerlodge National Forest, Northern Region), constructed in the early 1900s. Bill Harris and Dale Swee, the now-retired Forest Service Northern Region Historic Preservation Team employees who did the restoration work on the barn, stand in front of the barn door.



Figure 215—This early 20th-century log cabin in Grand Teton National Park has asphalt rolled roofing, just as it did originally. It now houses natural history exhibits.

Keeping the Rain Out



used other materials available in the last few hundred years, such as clay tiles and slate tiles, on log cabins. Tile and slate are very long-lasting but most log cabin builders couldn't afford them. People most commonly used cedar shingles, followed by cedar shakes, in a variety of sizes and shapes, as roofing on log cabins.

The roofing usually wears out long before the rest of a log cabin. Table 2 shows the expected service life for roof materials. Aside from the durability of materials, climate, sun exposure, regularity of cleaning and maintenance, adequacy of ventilation, and building use determine the lifespan of the roofing. No matter the roof material, follow the maintenance procedures identified in the [Roof Maintenance](#) section of this guide to extend the life of roofing.

Figure 216—Rangers H.C. Tuttle and N.E. Wilkerson stand in front of the Alta Ranger Station (Bitterroot National Forest, Northern Region), which they built with a sod roof in June, 1899. Figure 1 shows the station's modern appearance.

Table 2—Roof Material Expected Service Life.

Roof Material	Years of Normal Service																			
	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	
Sod/Vegetated	■	▲	▲	▲	▲	▲	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Rolled Asphalt	■	■	▲	▲	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Composition Shingles	■	■	■	▲	▲	▲	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Cedar	■	■	■	■	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	—	—	—	—
Metal	■	■	■	■	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	—	—	—
Tile	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	▲	▲	▲
Slate	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■

■ = Minimum service life
▲ = Likely service life
— = Not applicable

You eventually will need to repair or replace your cabin's roofing because all roofing eventually wears out or becomes damaged. Because roof replacement is a normal part of the life cycle of a structure, it isn't necessary to take extraordinary measures to preserve the original roof materials after they reach the end of their useful life. When repair or replacement becomes necessary, use the same kind of roofing originally used on the cabin. Don't "upgrade" to modern or more durable materials that would change the appearance of the cabin.

The inspectors should have included information about the roof material, configuration, detailing, and installation in the historic investigation report. Review the report but, as you begin work, be on the lookout for more evidence about the details of the original roof (figure 217). If you suddenly find evidence that conflicts with the report, stop work until you can determine which evidence is more compelling and more likely to accurately reflect the original construction. Then, use that evidence to match the original materials and workmanship.



Figure 217—This photo shows the remnants of an original shingle label that a crewmember found during restoration work on the Pintler Ranger District's Philipsburg Station (Beaverhead-Deerlodge National Forest, Northern Region).

A Few Words About Wood or Asphalt Roofs and Fire Danger

In areas where forest fires are prevalent, people often are concerned about the flammability of wood shingle or shake roofing and asphalt roofing. People tend to forget that logs also are wood, which means the entire exterior of a log cabin is flammable, not only the roof. Even when a cabin's roofing isn't flammable, sparks and cinders from wildland fires may still ignite the building, especially if the sparks are wind driven or if the cabin has a wood porch.

The author does recognize the danger of fire, but doesn't recommend changing roof materials solely to avoid fire danger. Instead, use effective fire-resistant treatments for wood shingles and shakes that won't affect the visual integrity of the historic building. Although guidance varies from State to State, SHPOs in several States are unlikely to approve changes from the original roofing of historic buildings. Montana and Idaho SHPOs, for instance, prefer applying fire-resistant treatment and protecting structures rather than replacing roofing with different materials. The SHPOs in a few States may approve roof material changes that retain a similar appearance to the original.

Some local building codes may require use of fire-resistant replacement roofing. For example, some jurisdictions require the use of Class B or Class C fire-resistant roof assemblies. In most cases, you can meet these requirements simply by using wood shingles or shakes treated with chemicals or pressure-impregnated salts, or by changing composition roofing to more fire-resistant material that looks similar. You usually can meet the requirements without changing the type of roofing or affecting the visual integrity of the building. Using a fire-resistant treatment when flammability is a concern is always preferable to changing to different roofing.

Constructing a Class A fire-resistant wood shingle or shake roof without changing the appearance of the roof may be more difficult. Class A requires a solid underlayment, and people built many historic cabins with skip sheathing or no sheathing at all. If you require a Class A rating, work with an engineer experienced in designing roofs to ensure that the

solid sheathing won't create other problems for the cabin, such as preventing the attic from venting properly. Also, if a Federal or State government agency owns the cabin, or if Federal or State sources provide some or all of the funding for the cabin preservation work, check with your heritage resource specialist or archaeologist to determine if you need to consult with or seek approval from your SHPO.

Pressure treating manufactured wood shingles or shakes with fire-retarding polymers is the most effective and longest lasting fire-resistant treatment. If you must trim pretreated shingles or shakes at the site, check with the manufacturer to find out whether you need to treat the cut to maintain the fire-retardant qualities. While you are at it, be sure to investigate whether additional safety precautions, such as wearing a dust mask while cutting the material, are necessary. You can trim most pressure-treated shingles or shakes without losing the fire-retardant properties.

You can apply fire-retarding chemicals to the surface of the shingles or shakes after you purchase them or after you place them on the roof. To maintain the effectiveness of the retardant, you must reapply surface treatments at regular intervals.

In addition to providing information about fire-resistant treatments, the [International Wildland-Urban Interface Code](http://publicecodes.cyberregs.com/icod/iwuic/2012/index.htm) <<http://publicecodes.cyberregs.com/icod/iwuic/2012/index.htm>> provides guidance for improving the defensible space around a log cabin in case of a fire. Sprinkler systems that operate using water supply lines, cisterns, or a pump in a stream offer another option for roof protection. The sprinkler systems are mostly hidden in the roof framing, with only the sprinkler heads visible. Although the visible sprinkler heads do impact the building's historic integrity, they create a much smaller effect than changing the roof material. Should a fire directly threaten a cabin, you can "wrap" the entire building in foil fabric to protect it (figure 218). The Northern Region has successfully saved structures from wildland fire using these protective measures. In some cases, the trees right next to the cabin burned, but the cabin and the roof did not. Fire can be scary, but isn't necessarily a reason to alter the historic character of a log cabin.



Figure 218—Preservation crewmembers completely wrapped the Kenck Cabin (Lewis and Clark National Forest, Northern Region) with fire resistant material as the 2007 Ahorn forest fire approached. The poles attached to the flues support sprinklers, and the white “ribbons” trailing from the top of the poles are fire hose. The cabin survived unscathed.

Keeping the Rain Out

Choosing and Obtaining Roof Materials

Locating appropriate replacement roofing can be more challenging than obtaining other materials necessary to restore a log cabin. Changes in manufacturing, consumer preferences, and standard construction practices have combined to change the range of commercially available roof products. The following information explains current, commercially available materials and how to choose those that are appropriate for historic log cabins.

Wood Shingles and Shakes

Wood shake or shingle roofing (figure 219) is a visually important element of many historic log buildings. The variation in shapes and application of this versatile material is amazing and sometimes challenging to duplicate during repairs or replacement. Excellent, detailed information about the historic significance, fabrication, detailing, materials, finishes, repair, and maintenance of historic shingle roofing is available in the National Park Service’s Preservation Brief 19,

“The Repair and Replacement of Historic Wooden Shingle Roofs,” <<http://www.nps.gov/tps/how-to-preserve/briefs/19-wooden-shingle-roofs.htm>> and isn’t duplicated here. The essential thing to remember is that you must find replacement shingles or shakes that match the originals or the roof probably will perform poorly and the roof’s appearance certainly will be inappropriate.

People originally referred to any roofing made of overlapping elements as shingles. They usually hand split wood shingles and “dressed” or smoothed them on both faces. Today, people generally regard shingles as a smooth or grooved face, thin butt, sawn product. People generally regard shakes as a thicker butt, hand- or machine-split product with at least one face having a rough, corrugated surface (“undressed”). Some thick-butt, tapered shakes are sawn on both sides. Always match the original materials as closely as possible in size, species, shape, exposure length, attachment pattern and method, and so on.



Figure 219—This log church is still in use and has a recently replaced shingle roof.

Manufactured shingles and shakes made from western red cedar and eastern white cedar are available commercially. You may be able to custom order cypress, red oak, white oak, or other historically used woods. The Cedar Shake and Shingle Bureau (CSSB, figure 220) and the Canadian Standards

Association (CSA) set standards for grading and labeling shingles and shakes. Both of these organizations are independent, third-party inspection agencies that provide good sources of information on products, application standards, and specifications. Before purchasing or ordering shingles or shakes, examine samples of the products you are considering (preferably an entire bundle) to ensure that they will work for your particular roof.

When ordering cedar shingles, be sure to specify Number One Blue Label shingles (figure 221) certified by the CSSB or CSSIA (Cedar Shake and Shingle Inspection Agency, a division of CSSB) or Extra Grade A Blue Label shingles certified by the CSA. The manufacturers make these shingles out of clear heartwood with very few defects and 100-percent edge grain. Not only are these shingles more durable, they also more closely resemble historic shingles split from clear, old growth timber. Blue Label America Certified shingles aren't the same and their quality isn't as high.



Figure 220—This label assures the purchaser that the shingles were graded and labeled in accordance with the standards set by the Cedar Shake and Shingle Bureau.

Wood Shingle Length

Commercially manufactured shingles that are sawn on both sides are available in these lengths and designations:

- **16 inches**—Referred to as “Five X,” these shingles are 0.40 inches thick at the butt end. This thickness sometimes is referred to as “5/2,” meaning that five butts stacked on top of each other measure 2 inches thick. They are the most common size in the Western United States and usually are laid with a 5-inch exposure.
- **18 inches**—Referred to as “Perfections,” these shingles are 0.45 inches thick at the butt end. They are the most common size in the Northeastern United States and usually are laid with a 5½-inch exposure.
- **24 inches**—Referred to as “Royals,” these shingles are ½ inch thick at the butt end and sometimes are referred to as “4/2.” They are more commonly used in the Northeastern United States than in other parts of the country and usually are laid with a 7½-inch exposure.



Figure 221—This label is an example of the sort of label that the manufacturer attaches to shingles that meet the Cedar Shake and Shingle Bureau’s Number 1 Grade Blue Label shingles requirements.

When ordering cedar shakes, be sure to specify CSSB- or CSSIA-certified, premium grade because they are clear wood, 100-percent edge grain, with very few defects. They not only are more durable, they also more closely resemble historic shakes split from clear, old growth timber.

If you can’t find shingles or shakes commercially that match the size, species, and shape of the original ones on the cabin, you may be able to special order them. Although special orders tend to be expensive, they may be cheaper than the labor it would take to hand-split matching shingles or shakes.

Few people are still skilled at splitting flat or tapered shingles or shakes from a bolt (log section) with a mallet and froe (or axe). The splitting process can be relatively quick, but dressing or planing the shingles on a shaving horse with a drawknife or drawshave is more time intensive. An article on the Mother Earth News website, “[The Froe and You: How to Make Hand-Split Shakes](http://www.motherearthnews.com/Do-It-Yourself/1973-11-01/How-To-Hand-Split-Shakes.aspx)” <<http://www.motherearthnews.com/Do-It-Yourself/1973-11-01/How-To-Hand-Split-Shakes.aspx>> explains the basic method for splitting shakes, if you want to try it yourself.

Finding or making shingles or shakes that are the right length is important for all roofs, but is particularly important for roofs where the shingles or shakes attach directly to the purlins. Purlins usually have wide spacing, so you need extra-long shingles or shakes (figure 222) to get the double lap that ensures a leak-free roof.

Types and Lengths of Shakes

Commercially manufactured shakes are available with split faces, sawn faces, or with one split face and one sawn face. Shakes are produced in two thicknesses: medium and heavy. Medium shakes measure $\frac{1}{2}$ inch at the butt; heavy shakes measure $\frac{3}{4}$ inch at the butt. You also can special order “jumbo” shakes that are 1-inch thick or more at the butt.

- **Tapersawn shakes** are sawn on both sides and come in 18- and 24-inch lengths and in medium and heavy thicknesses.
- **Resawn shakes (sometimes called “Split and Resawn”)** are sawn on the reverse side, but the face is split with the natural grain of the wood, providing a highly textured surface. These shakes come in 18- and 24-inch lengths and in medium and heavy thicknesses.
- **Tapersplit shakes** are hand-split shakes made by reversing the bolt, end for end, with each split, so that one end of the shake is thinner than the other. Tapersplits usually are 24-inches long with $\frac{1}{2}$ -inch butts.
- **Straight split shakes** are hand- or machine-split shakes split from the same end of the bolt without reversing. They are a uniform thickness the full length of the shake. They come in 18-, 24-, and 36-inch lengths and in medium and heavy thicknesses.



Figure 222—This 1920 storage building at the Greenwood station in the Lolo National Forest of the Northern Region needs extraordinarily long shakes to span the spacing between purlins.

Some cedar roofs have stained shingles or shakes. Dark green is a common color in the Forest Service (figure 223). See the [Using Paint, Stain, and Oil](#) section of this guide for more information on staining shingles.

Often, the most distinctive element on a shingle or shake roof is the ridge cap. If the cabin has a metal ridge or hip cap in good condition, remove it carefully so you can reuse it. If it's deteriorated, you probably can find another one that matches the style, or you can have one custom made. If the ridge cap is made of wood boards, shingles, or shakes, copy the existing pattern.

If you're not sure whether the existing ridge cap matches the original, investigate to determine the original ridge cap type, exactly as you would for any other part of the cabin. If the condition and historic assessment doesn't identify the original type of ridge cap, have your heritage specialist or archaeologist help you determine what is appropriate.

Common Ridge or Hip Cap Styles

- **Cock's Comb**—Leave wood shingles or shakes high on one side of the ridge (figure 224).
- **Board**—Lay two overlapping boards along the ridge (figure 225).
- **Metal**—Use a premanufactured piece; often has a ball or other finial on each end (figure 226).
- **Shingle or Shake**—Lay the overlapping shingles or shakes sideways at the ridge or hip of the roof (figure 227).



Figure 223—The 1941 Big Creek Ranger Station (Payette National Forest, Intermountain Region) has green-stained shingles. The color is original to the building. This building is on the National Register of Historic Places.

Figure 224—The cock's comb ridge cap is clearly visible on the skyline of the newly reroofed Office/Cookhouse building at the Moose Creek Wilderness Station (Nez Perce National Forest, Northern Region).



Keeping the Rain Out



Figure 225—Roofers used boards to construct the ridge cap on this log cabin with a shingle roof north of Lander, WY. Photo © Andrew Gulliford; used with permission.



Figure 226—Builders commonly used metal ridge cap on early 20th-century buildings, including log cabins. This photo shows the original metal ridge cap, which preservation crewmembers carefully removed and reinstalled after they replaced shingles on this building at the Ninemile Ranger Station (Lolo National Forest, Northern Region). Most of these premanufactured metal ridge caps had ball-shaped trim on each gable end, as shown here.



Figure 227—The shingle hip cap shown in this photo is a common style used on square, shingle-roofed lookouts in the Northern Region.

Asphalt Roofing

If a historic cabin originally had an asphalt roof, it probably was rolled asphalt roofing (figure 228). Some log cabins built in the 20th century had Dutch lap, interlocking (figure 229), or straight-laid individual shingles, or even three-tab or hexagonal strip shingles. You can find more information about identifying, caring for, and replacing 20th-century asphalt roofing in the publication “Early 20th-Century Building Materials: Siding and Roofing” <http://www.fs.fed.us/eng/php/library_card.php?p_num=0873_2308P>.

Asphalt rolled roofing and asphalt shingles currently are available with an organic base or a fiberglass base. Organic base products have been around since the late 1800s, and builders still prefer them in some parts of the country because they are more flexible and easier to install in cold weather.



Figure 228—Builders constructed Hogback Cabin (Lolo National Forest, Northern Region) between 1913 and 1915 using rolled asphalt roofing. They used metal flashing all around the dormer and at the transition between the main roof and front porch roof.



Figure 229—This cabin has an interlocking asphalt shingle roof. Builders have used this interlocking pattern since the late 1920s and still commonly install it on new buildings, particularly in high wind rural areas, because of its wind resistance. An interesting detail on this roof is the bent-over shingles at the roof eaves that function as a sort of inexpensive, integral drip edge.

Fiberglass base products have only been available since the 1960s. Builders prefer them in some parts of the country because they are available with a Class A fire-resistant rating. Most manufacturers make shingles that meet ASTM D3462; a tear-resistance test. Avoid the cheap shingles that don't meet the ASTM standard.

Because shingles with organic bases and fiberglass bases look nearly identical, choose shingles with a fiberglass or organic base, depending on your desired performance characteristics. Manufacturers coat both types of shingles with tiny stones, flyash, or ceramic-coated granules, which give the roofing its color. Match as closely as possible the color and pattern of the replacement asphalt roofing with the historic roofing.

Metal Roofing

Historic metal roofing may have been made of tin- or terne-plated iron, aluminum, galvanized steel, or copper. Some early miners even roofed cabins with flattened tin cans. Miners used tin and steel more often than other metals because these materials were cheaper and more readily available.

Metal roofing has long been available in a variety of styles, including standing seam, corrugated (figure 230), ribbed panels in a variety of patterns, and shingles that resemble wood shakes, slate, or ceramic tiles or that have decorative patterns. Ensure that replacement or repair materials match the appearance of the original metal roof, even in small details, because pitched roofs are easy to see. For instance, the spacing of the roof seams on a standing seam metal roof is a big factor in maintaining the appearance and historic integrity of the building.

Some currently available metal roof products are the same as or very similar to products that builders have used for more than 100 years. You can special order other historic patterns. Unfortunately, some older metal roofing shapes and patterns

no longer are available. Patterned shingles are the hardest historic metal roofing to match. Roofing with the same patterns is unlikely to be available today. Unless you can salvage identically patterned shingles from another building, you will need to have replacement roofing specially manufactured. Fortunately, builders seldom roofed log cabins with fancy patterned shingles.

If you can't find the exact material of the historic roof, you may find a similar pattern with a similar appearance in a different material. You probably can use lead-coated copper, terne-coated steel, or zinc-coated steel with a matching profile to replace tin, terne plate, zinc, or lead. Remember that you can absorb lead through your skin and it can cause serious health problems. Information about working safely with lead is available in the Forest Service Facilities Toolbox section on [lead roofing and flashing](http://www.fs.fed.us/eng/toolbox/haz/haz22.htm) <<http://www.fs.fed.us/eng/toolbox/haz/haz22.htm>>.

If you can no longer obtain the historical metal roof shape, material, or pattern, you may need to consult with the SHPO to determine an appropriate substitute roof material. Check



Figure 230—This fancy log house has corrugated galvanized steel panel roofing. Roofers used matching galvanized steel ridge covers on the pyramidal second floor roof.

with your heritage resource specialist or archaeologist about consultation or approval requirements if a Federal or State government agency owns the cabin or if Federal or State sources provide some or all of the funding for the cabin preservation work.

Although table 2 shows a wider range, you can expect most metal roofing available today to last 40 to 60 years if you install and maintain it properly. Painted finishes on metal roofing, unless they are very high quality, may not last anywhere near that long. If the metal roof requires a colored coating and you want it to be durable and color stable, specify powder-coated paint with polyvinylidene fluoride (PVDF).

Most manufacturers design fasteners, clips, corner pieces, and other components of metal roofing to integrate only with a single, specific roof product or with products produced by a specific manufacturer. Always use the manufacturer's recommended fasteners and methods of fastening. Not using the recommended components and methods may invalidate the roofing warranty. Unless the roofing manufacturer recommends otherwise, always use self-tapping, metal-to-wood roofing screws with gasketed flanges if the

fasteners remain exposed to the weather. Gasketed fasteners remain leak tight even when the fastener holes enlarge over time because of normal wear from thermal expansion and contraction.

If sustainability is important to your preservation project, consider specifying nanotechnology solar reflective coatings for a “cool” roof. These coatings generally cost only a little extra and provide longer lasting thermal protection than other types of thermally protective roof coatings.

Sod and Vegetated Roofs

Sod roofs are exactly that—a layer of soil supporting grass growing on the roof. People have used sod roofing in one form or another for thousands of years (figure 231). Even primitive sod roofs had surprisingly few leaks, because they tended to be quite thick and because the old-timers knew it was critical to install a drainage layer of some sort under the soil. Drainage layers usually consisted of organic material, such as birch bark or heavily oiled or waxed sturdy fabric. These layers eventually rotted, so they had to replace the entire roof on a regular basis.

Keeping the Rain Out



Figure 231—The little log assay office at Virginia City, MT, has what the builder probably intended to be a sod roof. It appears that someone tried to replace the roof and wasn't entirely successful; rather than grass, the thin soil on the roof mostly supports weeds. This roof needs some work, including replacing the soil with higher quality soil or growth media and some good native grass seed. Asphalt building paper that someone applied as a drainage layer is visible on the gable end of the cabin. The round poles surrounding the roof hold the soil in place.

The ongoing expense of replacing historically accurate sod roofing means it probably isn't reasonable for you to replace sod roofing exactly as originally constructed for most buildings. You may be able to provide nearly the same appearance using a modern, long-lasting sod or other vegetated roof system. The two key components are drainage and waterproofing.

You can construct a vegetated roof that will last a long time and not leak if the roof is well designed and you execute the details properly. A proper design by a structural engineer and a green roofing expert, such as a landscape architect, is essential. You may need the SHPO to provide prior input or approval of the design if a Federal or State government agency owns the cabin, or if Federal or State sources provide some or all of the funding for the cabin preservation work. Check with your heritage resource specialist or archaeologist for the requirements.

Roofing Repairs

If sudden, dramatic damage occurs to an otherwise sound roof, such as a large branch being driven through the roof during a storm, repairing just that area may keep the roof functional for another 10 years or more. Most roof repairs tend to be a stopgap measure performed on deteriorating roofing that postpones roof replacement only for a little while. For instance, plastic roofing cement or asphalt roofing tar can temporarily repair isolated small holes or cracks. However, those holes or cracks usually indicate that the roofing is beginning to wear out and that it's time to replace it. Following are a few repairs that may stop the leak and allow you to postpone roofing replacement until a more convenient time.

In instances where a few shingles or shakes are cracked or the vertical joints of overlapping shingles or shakes are aligned and water is leaking into the building, slip a piece of metal flashing beneath the shingle to stop the leak temporarily. You can temporarily stop leaks and prevent damage to the cabin using patches of roofing tar or rubber roofing membrane sealed with roofing tar. These patches won't last more than a few months in severe climates or a year in mild climates. Permanently repair the leak or replace the roofing as soon as possible.

You can replace individual cedar shingles on roofs and walls. First, remove the broken shingles. Try to gently pull out the broken shingle without disturbing the adjacent shingles. If pulling doesn't work, use a utility knife, chisel, or roofing hammer to split the damaged shingle and pull the split pieces out with pliers. If the shingle still won't come out, reach up under the broken shingle with a roofer's saw or a shingle ripper (figure 232) to sever the nails holding the shingle in place.



Figure 232—You can slip a shingle ripper (left) up under a shingle and around a nail, then hammer down sharply to cut the nail. You also can slip a roofer's saw (right two) under a shingle and use the tiny teeth to saw the nails. Either tool will sever roofing nails so that you can remove individual shingles without damaging the surrounding shingles.

People sometimes call a shingle ripper a shingle-ripping bar, slater's ripper, shingle nail cutter, or nail puller. To use it, slide the head of the nail cutter gently up under the shingle using a little leverage to raise the shingle slightly. Then, move the head of the cutter around to catch the nail in the cutting fork. Cut the nail using a hammer or mallet to give the bent handle end of the cutter a sharp blow in the direction of the downward roof slope. A shingler's saw accomplishes the same thing and requires less skill, but it will take longer to saw through the nail. With practice, you can cut the nails and remove the shingles without damaging adjacent shingles.

When you've removed all the shingle pieces, find a matching replacement shingle. Tap the shingle most of the way into place, stopping when the butt is about $\frac{3}{4}$ inch shy of flush with the adjacent shingles. Hammer two nails $\frac{1}{2}$ inch in from the opposing edges of the shingle and as close to the butt of the shingle above as you can without damaging the shingle above (figure 233). Protect the butt of the new shingle with a wood block and tap the block to drive the shingle the rest of the way into place, flush with the adjacent shingles.

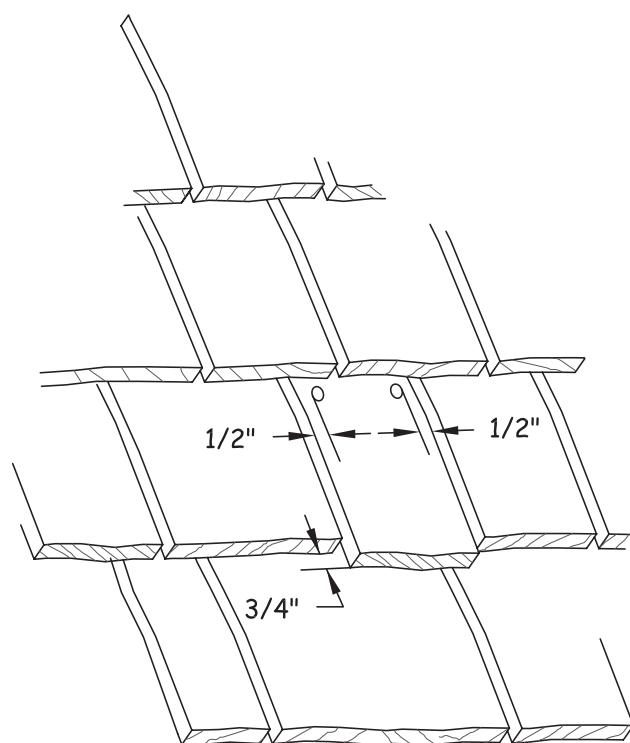


Figure 233—This drawing shows how to space the nails when you install a replacement wood shingle.

You can replace damaged individual asphalt shingles and often can cement curled asphalt shingles back in place. Because asphalt shingles crack easily in cold weather and are easily disfigured and scuffed in hot weather, only install asphalt shingles when the temperature is between 40 and 85 °F.

To replace an individual shingle, first slip a pry bar or stiff putty knife between the damaged shingle and the shingles above and below it to break the tar seals that hold them together. Very carefully lift the shingle above the damaged one to expose the nails or staples holding the damaged shingle in place, remove the fasteners and then remove the shingle. Do not attempt this method in cold weather and be careful not to bend the shingle too far or it will break. Remove the plastic guard from the tar seals of the replacement shingle and slip it into place, then nail or staple it. Apply a dab of roofing cement across the top of each new nail head or staple. The tar seals on the new shingle will adhere to either the shingle above or below it, depending on how it was manufactured. Apply a few dabs of roofing cement between the new shingle and whichever adjacent shingle won't adhere with the tar seals. Press the shingles carefully and firmly together to create a good seal.

You can replace metal roof panels and rolled asphalt roofing in kind. If the rest of the roof is sound, replacing a damaged section of roofing can be a fairly straightforward repair. Replicate historic fastening and material patterns to maintain the visual integrity of the building. Do not use modern or "standard" methods or patterns—stick with what already is in place.

When repairing a roof, do not allow sustained contact between materials that are physically or chemically incompatible with each other. The materials will react and cause accelerated deterioration or corrosion. For example, do not use steel screws to fasten aluminum roofing because steel and aluminum are incompatible materials.

If 20 percent or more of your cabin's roofing is damaged or worn out (figure 234), don't try to repair it. Replace it. Obvious signs of deterioration include cupped, curled, or broken shingles or shakes, missing portions of roofing, loose or missing fasteners in metal roofing panels, exposed sheathing, and leaks.



Figure 234—More than 20 percent of the shingles on this roof are worn out or damaged, so you should replace the roofing.

Planning and Preparing for Roofing Replacement

Before buying the materials necessary to replace the roofing, you need to do a lot of measuring and a little math. If you're not good at doing math in your head, a calculator is useful. Write down the numbers you come up with so you can use them later. You easily can determine how many square feet of roofing you need by measuring the length and width of the roof along the slope, then multiplying the length by the width. Do not forget to add in the roofing for small sections, including any ells, dormers, cupolas, etc.

You also need to determine the pitch (steepness) of the roof because some roof materials aren't suitable for flat or very steep roofs, and because the fastening requirements for some roofing differ depending on pitch. The pitch is a ratio of the rise to the run (figure 235) and is always expressed as the inches of rise in 12 inches of run.

You easily can determine the pitch if you have a pitch finder or framing square. Using the pitch finder is simply a matter of aligning it with the roof pitch and reading the dial.

To use a framing square to determine pitch, level the long arm and hold it against the gable end of the roof so that it crosses the roofing at "12" on the scale. To determine the amount of rise, read the scale on the short arm where it crosses the roofing.

You also can use a speed square and a bullet level if the cabin has gable end fascia or dimensioned lumber rafters more than 8 inches deep. To use a speed square to determine pitch, first mark a plumb line on the rafter or fascia. Place the right angle corner of the square at the point where the bottom of the rafter or fascia and the plumb line intersect. Align the leg marked in inches with the plumb line. Make sure the other leg points toward the center of your end of the cabin. The pointing end will be below the edge of the fascia or rafter. If it's not, flip the square over. Read the rafter scale ("COMMON") where it intersects the bottom of the rafter or fascia.

If you don't have any of these handy tools, dig out your tape measure and some scratch paper. Measure and record the rise (the vertical measurement) and the run (the

horizontal measurement) of the roof (see figure 235). To determine the amount of rise in 12 inches, multiply the rise by 12 and divide by the run. Be sure to measure the rise and run in the same units; inches, feet, or even metric will work.

To understand why this works, remember the basics of high-school algebra to solve the equation:

$$\text{rise} \div \text{run} = X \div 12, \text{ where } X \text{ is the pitch}$$

Before solving the equation, convert it to:

$$X = (\text{rise} \times 12) \div \text{run}$$

For instance, consider a cabin where the pitch of the roof rises vertically 3 feet 4 inches (3.33 feet, or 40 inches) over a distance of 10 horizontal feet (120 inches) from the eave to the peak. To solve the equation in inches, use:

$$40 \times 12 = 480, \text{ and } 480 \div 120 = 4$$

If you solve the equation in feet, it comes out the same:

$$3.33 \times 12 = 39.96 \text{ (round to 40), and } 40 \div 10 = 4$$

Thus, the pitch of the cabin roof is 4/12 (spoken as “4 in 12”).

Discuss the size and pitch of the roof with the roofing supplier. The supplier can give you information to help you determine how much roofing you need, which type of fasteners to use and how many, which underlayment product the manufacturer recommends, etc.

Do not forget to purchase enough of the correct fastener.

Cedar shingles and shakes require corrosion-resistant roofing nails (stainless steel type 304 or 316, hot-dipped zinc coated, or aluminum) that are long enough to extend through all layers of shingle and three-fourths of the way into the sheathing. Fasten pressure-treated wood shingles or shakes with stainless steel shingle nails. Stainless steel nails resist corrosion from the pressure-treatment chemicals. For metal roofs, follow the manufacturer’s recommendations. If the manufacturer has no recommendations, use self-tapping metal-to-wood roofing screws with gasketed flanges. See the [Roofing Fasteners and Tools](#) section of this guide for more information.

Manufacturers pack shingles and shakes in bundles and market them by the square. A square covers about 100 square feet of roof. When you estimate how many bundles or squares to order, add 1 extra square for every 100 linear feet of valley. Then, add 20 percent to the total for the ridge cap, the triple starter course, wasted shingles or shakes, etc. A square of wood shingles or shakes contains four or five bundles and a square of composition shingles contains three or four bundles.

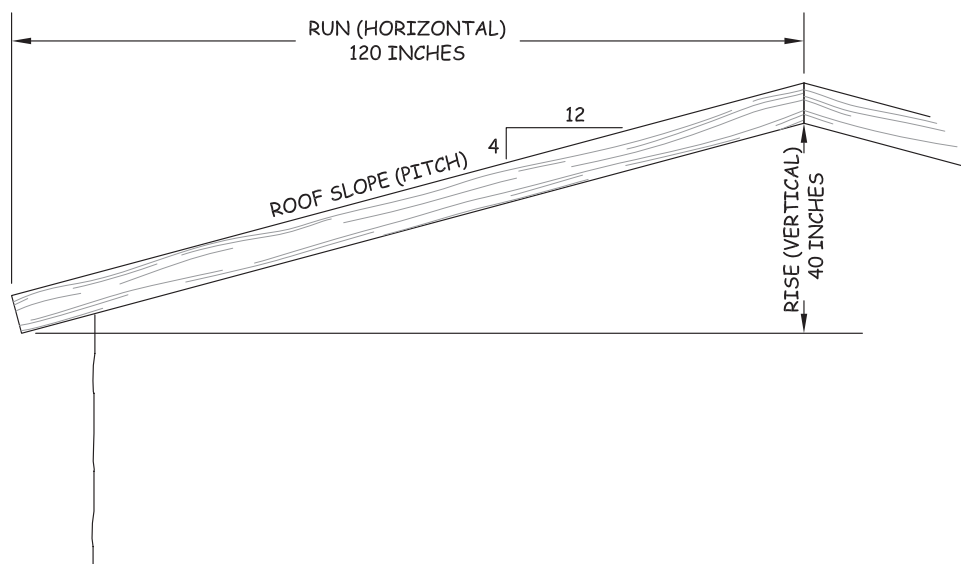


Figure 235—This drawing shows the relationship between the horizontal and vertical measurements of a roof and the pitch of the roof.

After assembling the new roof materials and ensuring that the safety system is in place, remove the existing roof down to bare sheathing (see figures 210, 211, and 212). Shingle rippers, pry bars, flat-bladed shovels, roofing spuds, roofing shovels, and hammers are useful for removing shingles and shakes (see figures 57, 59, and 232). If the cabin doesn't have sheathing, remove everything down to the purlins. Remove all the nails and other fasteners. By the time you need to replace roofing, the flashing usually is pretty beat up, too, so remove that as well. See the [Flashing](#) section of this guide for more information.

The builders may have used lead as flashing around chimneys or vents in the roof. Lead is an excellent flashing material that builders still use today, but you can absorb it through your skin and it can cause serious health problems. Information about how to work safely with lead is available on the Internet in the Forest Service Facilities Toolbox section on [lead roofing and flashing](http://www.fs.fed.us/eng/toolbox/haz/haz22.htm) <<http://www.fs.fed.us/eng/toolbox/haz/haz22.htm>>. You can reuse lead vent and chimney flashing if it is in good shape.

Once you expose the sheathing or purlins, examine the roof structure and repair or replace any rotted sheathing boards (figure 236), fascia, purlin ends, rafter tails, and holes. See the [Sheathing](#) section of this guide for more information about how to repair sheathing. See the [Log Purlin End and Rafter Tail Repairs](#), [Epoxies](#), [Crown End Repairs](#), [Selecting and Preparing Logs](#), [Round Logs](#), [Hewn and Sawn Logs](#), and [Shaping a Log](#) sections of this guide for more information about repairing or replacing log structural members.

If the roof has sheathing, use a broom or leaf blower to clean it. Make sure that you remove any raised or loose nails.

Standing and working on clean sheathing is safer and easier.

In addition, lumps between the sheathing and roofing cause most roofing to perform poorly, and loose or protruding items are likely to puncture the roofing and cause leaks.



Figure 236—This old photo shows a preservation crewmember planing a replacement sheathing board so that he can fit it properly on the log Ranger Cabin at Big Prairie Work Center (Flathead National Forest, Northern Region). All the rafter tails and the sheathing attached to the tails on this side of the cabin, built in 1933, were rotten; the preservation crew had to replace them.