Build cheap, temporary shelters for your homestead's temporary needs

By Don Fallick

At some time, every homestead will need expedient temporary shelter to protect livestock, tools, or other possessions from damage, theft, or the effects of weather.

Temporary shelter can last for a few days to several years. Cheap temporary shelter can cost $5 and up. I can't tell you what to build without knowing what you need to protect, but there are seven principles that can aid in deciding how to build anything from a storage shed to a temporary cabin.

Not all of these principles will apply to any given project. Some may seem contradictory. It depends on the purpose of each building, its intended length of service, the tools and materials at hand, the climate, and the lay of the land.

Many of these principles violate various local building codes. They are **not** intended for permanent buildings of any kind, especially for human habitation. Even people that I don't like deserve better than this. But if you need to get something or someone out of the weather in a hurry, in facilities a little better than camping out, using these seven principles will help to keep down costs.

I. Earth construction

Use earth for floors, walls, and insulation. Earth has a very low *R value* (insulation value), but is literally dirt cheap. Earthen floors, protected by sheet plastic and covered with old rugs or carpet, can be both warm and pleasant to walk on. One trick is to build up the floor so it's six to eight inches above the level of the surrounding ground. This keeps outside moisture from oozing under the walls and turning the floor to mud.

It also helps to dig a drainage ditch around the building, or even put in a "French drain"—a drain pipe buried below the frost level and bedded in gravel, leading ground water to an exit or sump away from the building. French drains are usually too expensive to use on temporary buildings, but can be useful if a permanent building is planned for the same site. But even a shallow ditch around the building will help a lot, especially if lined with plastic. Just make sure that the ditch slopes down to lead ground water away from the site.

Underground construction

The simplest way to use earth in walls is to dig out an open-roof "artificial cave," like a root cellar, in the side of a hill or bluff. This is OK for a well-drained cellar, but does not generally work well for other uses, because water running downhill is guided right in by the rear wall. French drains can help, but the cheapest solution is to place the entrance on the uphill side, and dig terraces or a patio uphill from that. (See Figure 1.)

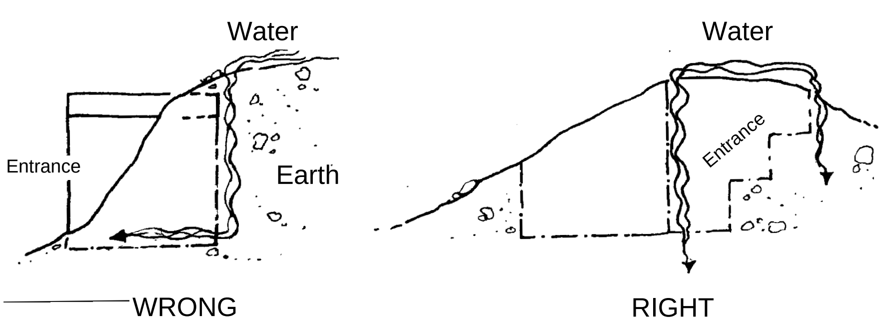


Figure 1. How to orient an underground house.

A better way to use earth as wall insulation is to build an earth-bermed structure. Be sure to use sheet plastic beneath the berm's surface to conduct ground water away from the walls. Make sure all earth-bermed walls are strong enough to bear the weight of the earth piled against them, and are cross-braced to opposing earth-bermed walls. The weight of the earth against an unbraced wall will make it collapse.

Sod roofs

Earthen roofs are subject to all of the same problems of weight and drainage as earthen floors and walls, and the solutions are similar: bracing and sheet plastic. Some builders of earthen roofs have tried to beat the cost of sheet plastic by using recycled roofing felt. This may work for a season, but for a year or more, sheet plastic is worth the expense. Two layers of plastic are much better than one.

The best way to build a sod roof is to lay four-inch poles next to each other as a sub-roof, supported by a post every eight feet at most. Pad this sub-roof with roofing felt and/or corrugated cardboard, then a layer of 6 mil plastic. Cover with an inch or two of earth—no more! Then another layer of plastic and earth. Plant grass, and you'll have a weather-tight roof. The root cellar on my old homestead had such a roof. It cost relatively little, required no maintenance, and never leaked in 12 years. But nothing that labor-intensive to build really counts

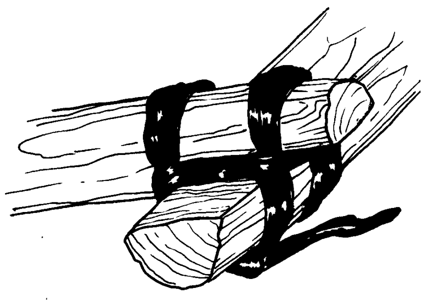


Figure 2. A notched and lashed joint.

as cheap, temporary shelter in my book.

II. Green pole framing

Green poles have two major disadvantages for framing: they're heavy and they twist as they dry out. Their advantages are more numerous: green wood is very easy to work, relatively easy to peel, and available free on your land with no waiting.

The extra weight of green wood makes very little difference in framing a temporary building, but its tendency to twist in curing will cause nailed joints to split and fail. The solution is to make joints without nailing them. This is not as difficult as you might imagine. Lash poles together with baling twine, or baling wire for a more permanent job. If you have access to a Boy Scout, get him to show you how to lash poles together. If not, see the accompanying instructions, "How to make Japanese lashings." Tied or lashed joints won't split out as the poles twist—they just revolve within the lashing. If anything, the joint may even tighten up a bit.

For a really tight joint, notch the poles together (see Figure 2), then tie with wire or lash with baling twine. The poles will twist as they cure, expanding the joint against the unyielding wire or twine, creating a super-tight joint which won't allow any movement. Really soft wire (or string) will break under the terrific strain. But green wood is soft, especially pine and fir, and will conform to a strong lashing. That's why I use only baling twine or wire.

For a really fast framing job, plant green wall posts, peeled or unpeeled, about two feet deep, every eight to twelve feet. Place tall posts in the centers of the end walls, to support a ridge pole. Horizontal stringers lashed at the top, bottom, and center of each wall serve as nailers for the wall sheathing. Green pole rafters with horizontal purlins serve the same purpose for the roof. Support the ridge pole in the center, too. (See Figure 3.)

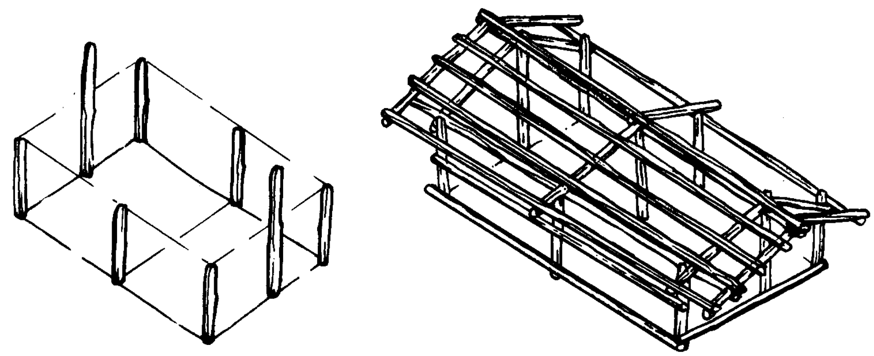


Figure 3. Post-and-purlin framing with green poles.

III. Improvised materials

There are three major types of improvised materials: standard building materials recycled from wrecked buildings, lumber "mined" from other sources such as crates or pallets, and non-building materials adapted to construction, such as chimney flues made from tin cans.

Demolition

Demolishing a building for the materials in it can be a wonderful deal or a lot of hard work for nothing, so it pays to check out the situation very carefully before choosing this option. Here are some ways to protect yourself:

1. Count *all* the costs of demolition. These include transportation, dump fees, licenses, tool rental, and a reasonable wage for yourself, unless you have nothing better to do than spend your time wrecking buildings. Demolition is hard, dirty, dangerous work, and the time you spend on it is time you won't be able to spend on other projects. You may well find that you're too tired to do other chores you need to do. Don't forget that you will spend much of your time recycling materials that you personally don't need. For example, if you're building a barn, you won't need the toilets in the house you're wrecking, but you'll have to remove them anyway. The time you spend is part of the true cost of the lumber you want.

Don't forget to include clean-up time among your "costs." Pulling nails is tedious, and may be unnecessary from your point of view, but in some states it's illegal to transport wood with nails in it. Even if it's legal, it's dumb to risk years of flat tires just because you're too hurried to remove all the loose nails.

2. Check prices of new and recycled building materials in your local area. If your primary need is for lumber, you may be able to get a really low price by purchasing directly from a local mill and curing the wood yourself. Counting all the true costs, and considering the price of "boughten" materials, you may find that "free," recycled lumber isn't such a great deal. In fact, recycled lumber may cost more than new.

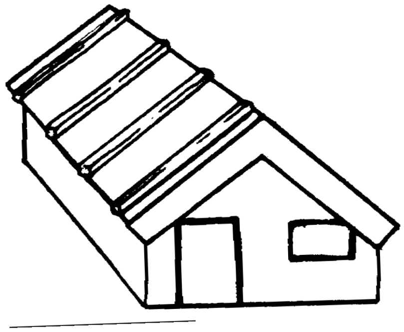


Figure 4. A cardboard-and-plastic rabbit barn with laths on the roof.

3. Get written permission from the owner before you start. Your "contract" should specify the building(s) to be torn down, the date of completion, who is responsible for which costs and fees, and how far the demolition is to proceed. I know a guy who thought he had a great deal until he discovered that the owner expected him to remove the foundation of the barn he had demolished. Put it in writing, so there won't be any arguments later.

"Mined" lumber

Most structures these days are built largely of wood, and wood can be found in many places besides the lumber yard. Shipping crates and pallets are a good source for short pieces of lumber. Crates are usually bolted together, but pallets are nailed with ring-shank nails and drive-screws that can be hard to remove.

To separate the decking from a pallet without splitting it, use a large pry bar between the rail and the decking boards to start the nails. If they won't budge at all, there are several strategies that may work.

Cheapest is to try pulling the nails out using a tool called a *cat's paw*. If the nail starts, or the head comes off, pry the board off with the pry bar. If the nail will neither budge nor break, cut it between the stringer and the decking with the metal-cutting blade of a Sawsall or other reciprocating saw.

If you don't care about the decking boards, but just want the stringers, cut through the decking with a chainsaw, reciprocating saw, or circular saw, halfway between the stringers. Then use a sledge hammer to twist the decking boards around in a circle. Either the nails will come out, or the boards will quickly splinter and come off. Nails left can either be pulled, hammered in, bent over, or broken off.

Adapted materials

I'm only going to mention a few adapted materials. Just about anything can be adapted to construction, with enough imagination and time.

If you have more time than money, you can use one-gallon "tin" cans to line the flue of a "stick-and-mud" chimney, by leaving one end attached and bending it back. This makes a handy bracket for embedding in the mud of the chimney. Or you can make fine metal shingles by removing both ends, cutting the can open, and pounding it flat. School and hospital kitchens are the best source for gallon cans.

In times past, it was almost traditional to use old aluminum printing plates for shingles or siding. They are mostly not available any more. Heavy metals in modern printer's inks are expensive enough, and toxic enough, to make it worthwhile for newspapers to recycle them.

Very large cardboard boxes, such as refrigerator cartons, can yield wall or roof sheathing that is nearly as good as plywood—maybe better for non-flat surfaces. The cartons themselves can make temporary tool sheds, or they can be stapled or nailed onto a green-pole frame to enclose several hundred square feet.

To keep high winds from tearing the cardboard off, use wooden laths. Make them about ¼" x 1½", though the exact size is not critical. Nail them to the framing over the cardboard, with a nail every foot or so. Acceptable lath materials can be found free in many places. Old pallet decking boards make wonderful laths.

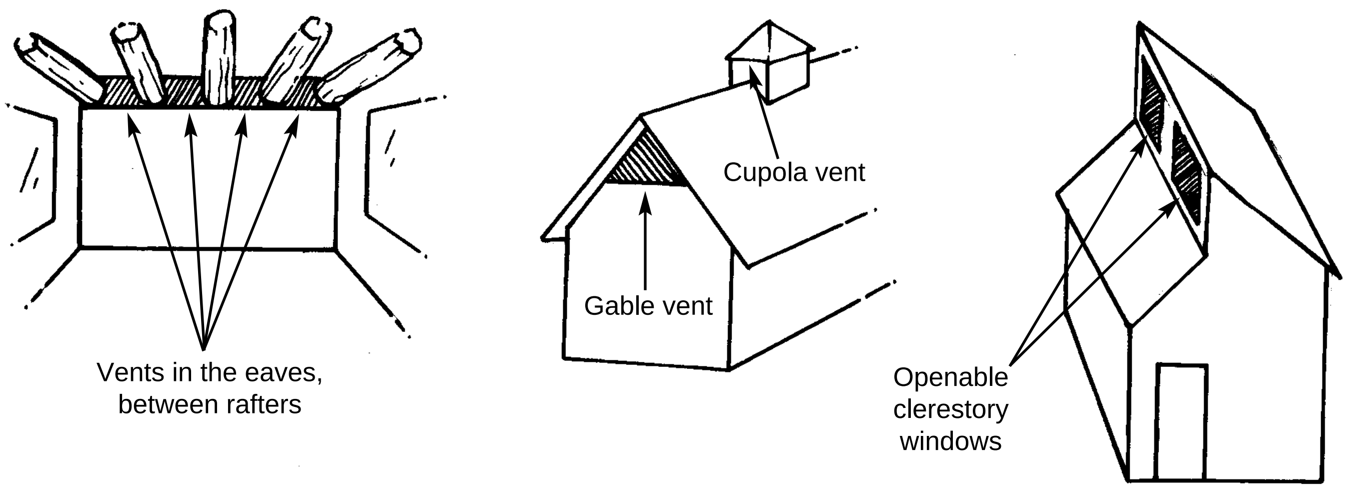


Figure 5. Types of vents: eaves, cupola, gable, clerestory.

So do mill ends from cabinet shops, etc. Perhaps the best laths are those sawn from a sheet of old plywood.

IV. Plastic sheeting

A single $10 roll of sheet plastic can turn a very temporary barn made of cardboard into an almost permanent, weatherproof structure. The plastic not only keeps the rain and snow from dissolving the cardboard, it also keeps out the wind and cold. Ordinary clear plastic can be used as a temporary storm window. You won't be able to see through it, but it'll let in nearly as much light as the perfectly clear (and expensive) stuff in store-bought window insulation kits. Sheet plastic comes in various thicknesses, from less than 1 mil to 8 mil or more. If you don't need much strength, 1 or 2 mil will do fine, and costs a lot less than 6 mil plastic. Use the heaviest stuff you can afford for roofs, 4 mil for walls, 2 mil for windows or storm windows.

Some farm supply stores can special order sheet plastic for you in virtually any size or weight. You may pay premium prices for such service, but it's still cheap compared to traditional construction.

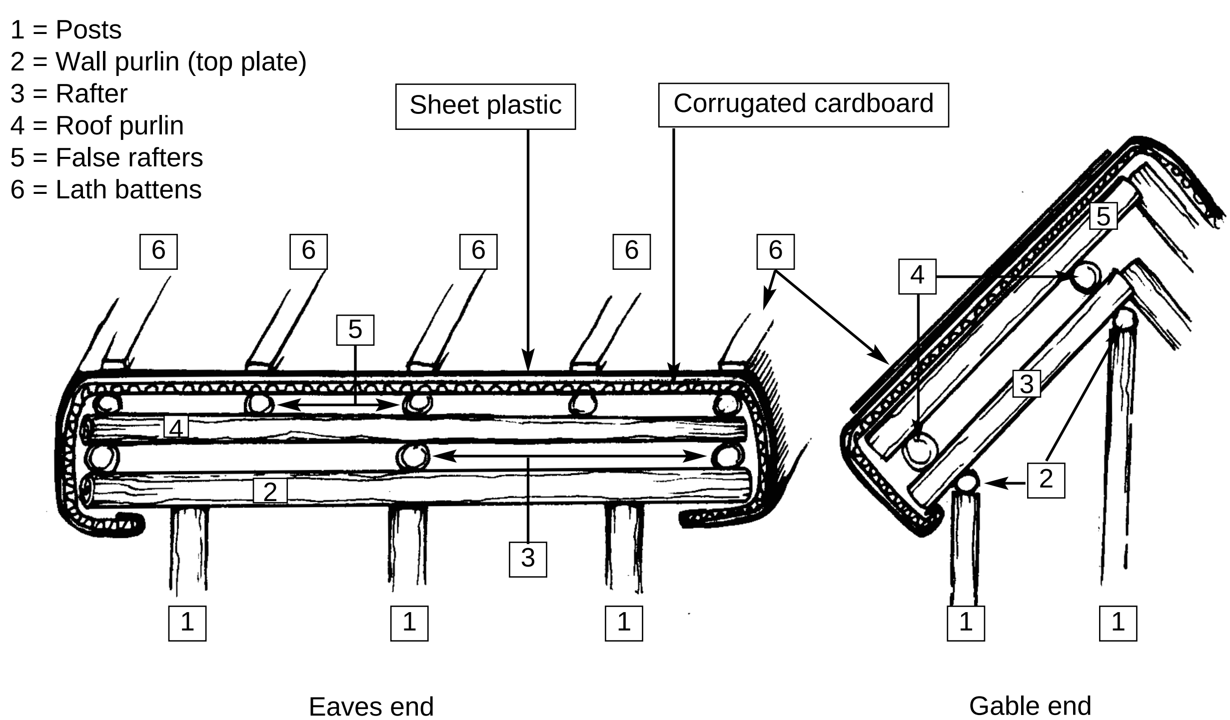
For example, I couldn't afford a concrete cistern, so I dug a bowl-shaped hole in the ground, 13' x 16' x 7' deep. I lined it with cardboard, then with a layer of 8-mil plastic. I had to special-order the plastic, and it cost nearly $50. But that was the total cost for a 5500 gallon cistern. Three years later, I replaced the plastic. At about $16/year, I could have kept replacing the plastic for 50 years before equalling the cost of a concrete tank of the same size, assuming such a tank would have lasted 50 years without needing repairs.

Another time, I built a rabbit barn of green poles, cardboard, and recycled plastic (with big holes in it!) that lasted 5 years before it needed a new roof. Doubling the plastic and rolling the edges kept out the rain. I rolled the edges around strips of cardboard, for laths, and stapled them down with a staple gun. I got the plastic free from a neighbor who was going to throw it away. Total cost for a temporary, 200-square foot barn: $2.75 worth of staples. This barn looked terrible, but it lasted through four Colorado winters. One reason: I folded plastic over all the exposed edges and surfaces of the cardboard, so no moisture could get to it. (See Figure 4.)

Because it is completely impervious, it is necessary to build in adequate ventilation when using sheet plastic. If you don't, moisture in the air will condense on the plastic and cause mold and mildew problems. Air vents located at the tops of gable ends or between rafters at the eaves will help a lot, as will cupola vents at the ridge, or openable clerestory windows. (See Figure 5.)

V. Cheap insulation

Very few building materials have much natural resistance to heat transfer (R-value). Nearly all commercial insulation materials use small pockets of still air to provide insulation. Air is a very poor *conductor* of heat, but pockets of air more than 3/8" thick can transfer heat by *convection* within



Cross-sections of a green-pole, cardboard, and plastic roof. (Not to scale.)

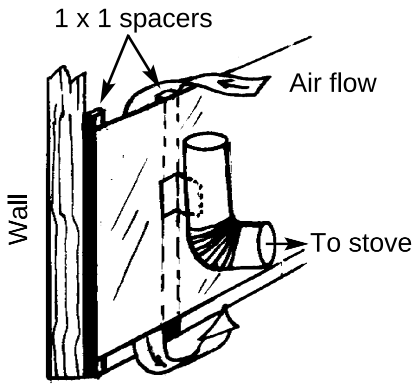


Figure 6.
Sheet metal heat shield for stove. Make six-inch stand-outs from flattened one-gallon cans and screw to each pipe section.

each pocket, so the pockets must be kept very small.

Double- or triple-glazed windows work on this principle. So do foam, fiberglass, and other commercial insulation materials. You can mimic the properties of these materials at a fraction of the cost, if you are willing to accept the disadvantages of other materials.

Sawdust

One of the most common forms of insulation in pioneer times was sawdust, used to insulate ice in ice houses. It insulates very well, but has the disadvantage of being extremely flammable. This is not a problem in an ice house, but could be very dangerous anywhere else. Modern cellulose insulation is very much like sawdust, with fire-retardant chemicals added.

There is nothing magic about sawdust. Virtually any dry plant product chopped up into small enough pieces will work as well—and be just as flammable. Chaff and straw work well. So does crumpled-up newspaper. The important thing is fire protection. There are many fire-retardant chemicals on the market that can be used to "fireproof" sheets of newspaper, which can then be crumpled for insulation. In every case I have heard about, such insulation cost more than commercial cellulose insulation, even without including the time and effort involved.

Straw bales

Paper, straw, or sawdust insulation is only safe to use where there is ***no chance*** of fire, but there it works very well. Bales of straw piled around foundations or exterior walls of barns in the winter time can greatly increase their R-value, while snow on the ground (and on the straw bales) increases their resistance to fire. Hay works just as well, especially if you keep it dry with a tarp or other cover. I once built a goat barn with a flat roof into the side of a hill, below my driveway. The roof was strong enough to support several tons of hay, which was easy to feed to the goats and provided insulation during the coldest part of the winter. The building wasn't temporary, but the insulation was.

One variation on crumpled-paper insulation is to use rags. Rags don't burn nearly as readily as paper, and they insulate nearly as well. Over the course of years, such insulation will compact until only the bottom half of the wall is insulated, but this should not be a problem in a temporary shelter.

VI. Safety

The two great dangers in temporary shelter are collapse and fire. Recycled materials may not have the strength of new. Inspect all recycled wood for insect damage and dry rot before trusting it to support any weight greater than you can catch. You can't always see dry rot, but it's readily apparent if you stab the wood with an ice pick, or hammer a large nail into it. If the pick penetrates easily, the wood will not be safe.

Wood that contains a small amount of dry rot may still support weight temporarily. The danger is that you may use such wood for an integral part of a temporary structure, which may last for years and turn into a semi-permanent one. As the dry rot progresses, the building can become unsafe. Whenever using any materials with known defects that require checking, it pays to mark them and inspect regularly. I once used a root cellar that leaned about 15° out of

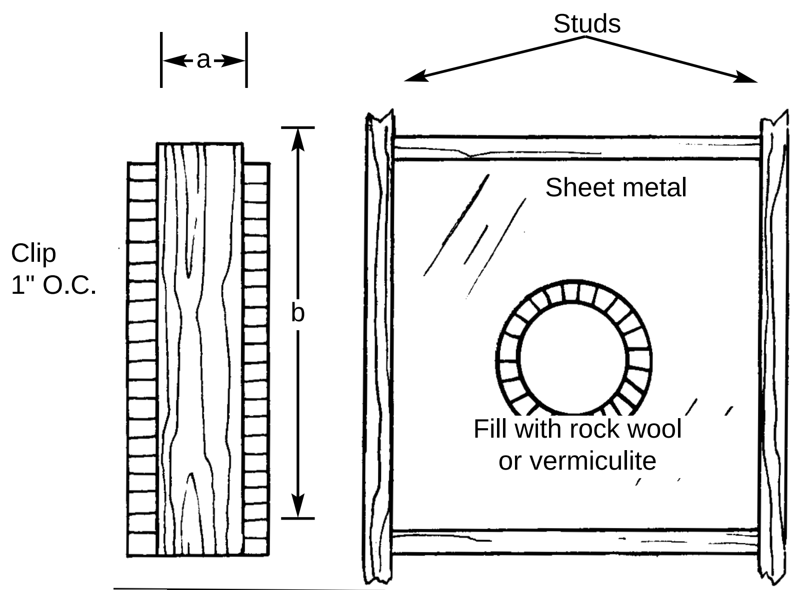


Figure 7. A fire-stop box.
a = *thickness of wall.* b = *Pi (3.14) x diameter of pipe*

plumb. I checked it every Saturday, and determined to vacate if it ever got to 20°. It never did.

If you live in snow country, remember that the weight of snow accumulation can add a great deal to the load on a temporary roof structure. If your roof isn't approximately as massive as a standard "stick-built" roof, it probably won't hold the weight. The solution is to use a rake, hoe, or other tool to scoop snow off the roof.

This can be hard to do with laths crossing the roof. Horizontal laths laid along the purlins also tend to collect ice build-up, which is even heavier. It may be harder to build, but a roof with laths along the rafters will be much easier to keep clear. In fact, sheet plastic is so slippery, such roofs clear themselves of all but the stickiest snow.

Fire!

Earthen floors will go a long way toward preventing fire in a temporary building intended to be heated by a stove. Or make a hearth from *dry-pack*—a mixture of earth and cement, mixed dry and tamped into a hard floor without water. If you must heat a temporary building, keep all parts of the heating system, including the stove pipe, at least three feet away from any unprotected, flammable materials. Or protect the flammable structure with taped and plastered sheetrock—at least two layers of ½" sheetrock, 18" from any hot metal. Better yet, mount sheet metal 1" from the sheetrock, with openings at the top and bottom to allow air to circulate behind the metal. (See Figure 6.)

Where the stovepipe passes through the wall, make a firestop box of sheet metal, to fit between two studs at least 32" on center. Fill the box with rock wool insulation, or with vermiculite. Other kinds of insulation will melt, burn, or give off poison gases when hot. Then use triple wall pipe to penetrate the box. (See Figure 7.) Or buy a commercial wall thimble. Expensive? Yes, but *lots* cheaper than a fire. Best is not to use wood heat around flammable materials.

VII. Thermal efficiency

Those who heat their homes with public utilities may think it strange to worry about the thermal efficiency of a temporary shop, barn, or dwelling. But those who have to chop the wood to heat such a structure—or grow the extra feed needed by livestock in cold weather—quickly learn to appreciate anything that will lessen their burden.

Standard tricks like south-facing windows, insulation, sealing cracks, and minimizing north-facing windows work as well for temporary buildings as for permanent ones. Some things are more important for temporaries, though. To be efficient in cold weather, it's vital to minimize the size and number of windows and doors. Homemade windows and temporary doors are virtually impossible to seal, without spending lots of time and money. They also have a much lower R-value.

It's best to permit no openings at all in the wall facing the prevailing wind and in the north wall. If you must have north windows or doors, line them with curtains made from old blankets. A cardboard "sweep" at the bottom of a temporary door will go far toward eliminating under-door infiltration of cold air. Make it replaceable. Water from rain, snow, or mud will dissolve it in a week or two.

Temporary shelters insulated with sheet plastic can get extremely hot in summer, and likely will not be wired for electricity, so will need passive cooling in hot weather. Existing deciduous trees make excellent sun shades in summer and don't trap snow in winter. Siting buildings to take advantage of such trees makes good sense, but will probably not be enough.

Oversize or extra vents of any kind will help, but cupolas or clerestories work the best. However, no amount of passive circulation will entirely make up for hot ambient air temperatures. One thing that will help is to make use of thermal conduction.

About five feet below grade level, the temperature of the earth is nearly constant year 'round. The exact temperature and depth vary from region to region, but temperatures are generally in the area of 50° F. If you can dig down to this level and fill the hole up with a foundation material that conducts heat well, you can "pipe in" cool temperatures in the summer and relatively warm temperatures in the winter. The *U value* of a material measures its thermal conductance. Rock and concrete have high U values. If you have access to digging equipment and rock, it may be easy for you to make a temporary foundation of rocks down to the constant temperature level. Your local U.S. Soil Conservation Service engineer can advise you on the details of temperature levels in your area. Look in the phone book under U.S. Department of Agriculture—Soil Conservation Service. It may seem all wrong to deliberately use "low-R" materials, but I have done this with great success, as has anyone who has ever built a root cellar.

How to make Japanese lashings

A lashing is a way of fastening two or more poles (or pieces of lumber) with rope or twine, instead of nails. The basic principle of lashing is to wrap several turns of rope around the poles, then tighten the joint by *frapping*—taking several tight turns of rope around the previous wrappings, between the poles. The thickness of the frappings forces the poles apart, wedging the poles tightly against the wrappings.

There are many kinds of lashings, each used for a specific purpose. But the fastest and easiest general purpose lashing is the Japanese lashing. It can be made either as a square lashing (poles at right angles to each other) or a shear lashing (poles parallel). Here's how to make it:

1. Begin with a six-foot length of baling twine—about the length that comes off the bale.

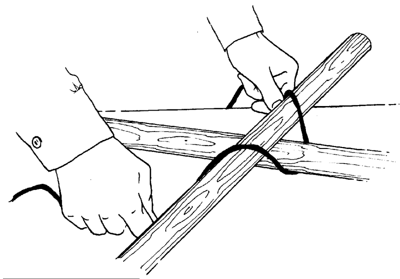


Figure A

2. Pass the twine behind the poles. Hold one end of the twine in each hand. (Figure A)

3. Wrap each end of the twine around the poles in opposite directions simultaneously, passing the ends from hand to hand. (Figure B) Make three wrappings. (Figure C)

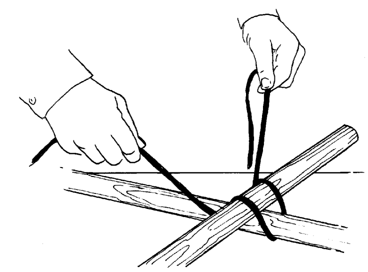


Figure B

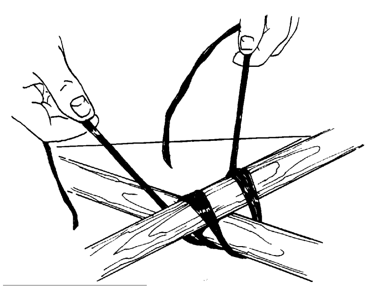


Figure C

4. Frap the lashing with both ends simultaneously in a similar manner. Make three frappings. (Figure D)

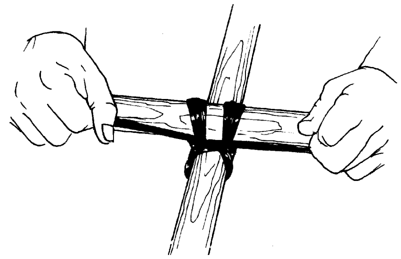


Figure D

5. Finish with a square knot. (Figure E)

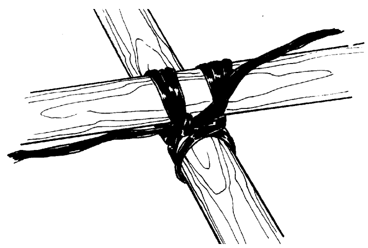


Figure E

6. You can use the same techniques for making shear lashings (Figure F) or tripod lashings (Figure G).

The Japanese lashing has many advantages: it's fast; it uses free materials; it's very easy to make; it's not bulky; and it needs no fancy beginning or ending knots. Δ

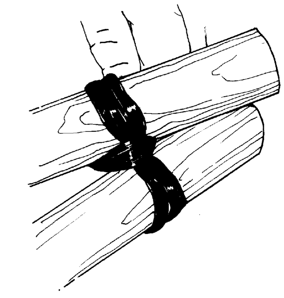


Figure F

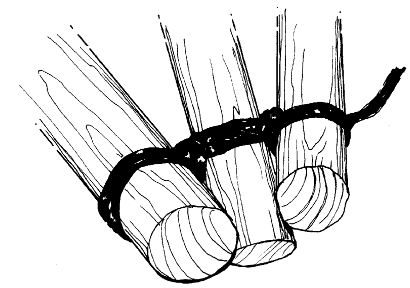


Figure G