Chapter 2
Problems and Solutions

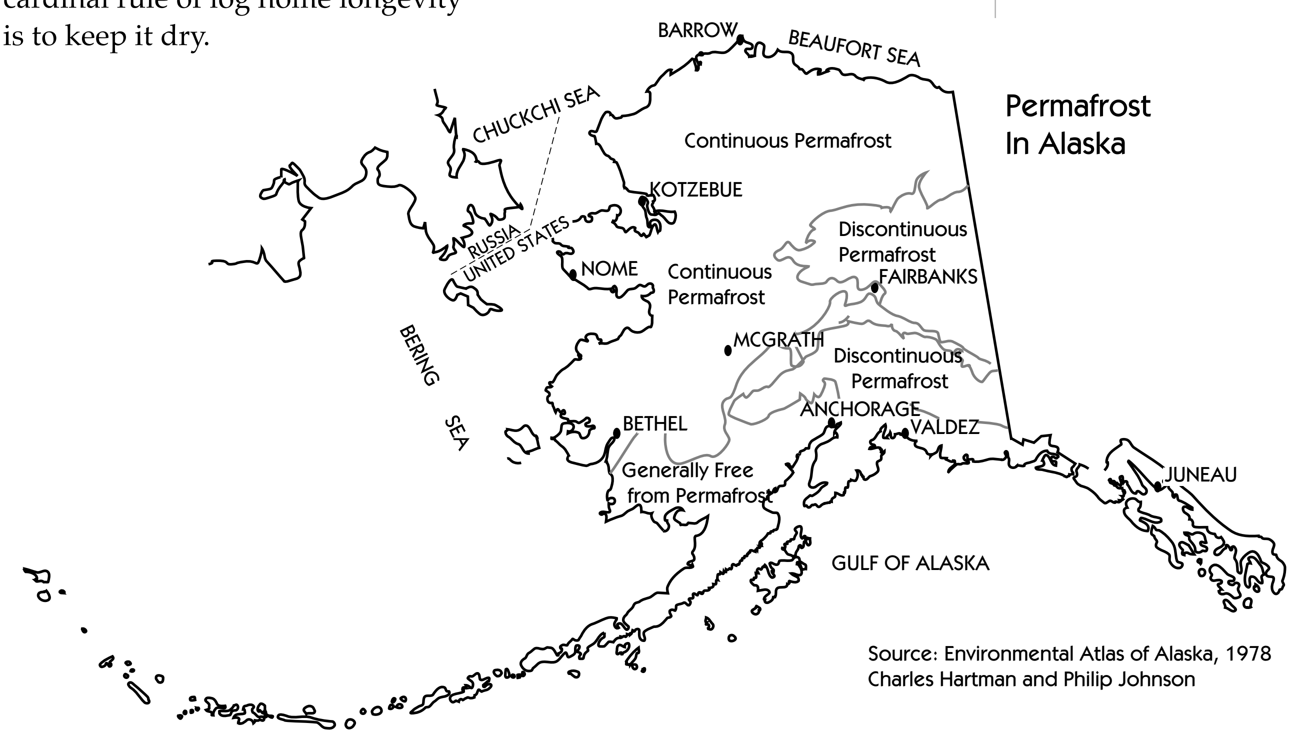
Problems

The first mistake that many log home builders make is building a "permanent" structure on a temporary foundation. When the foundation fails, the house will rapidly self-destruct. Differential settlement caused by melting permafrost, seasonal frost heaving, and flooding is the single most destructive problem in Alaska buildings.

A close second is poor moisture control, which may take only a little longer to destroy a log house through the natural decay process. Damp wood will be attacked by rapidly growing colonies of mold, mildew, and mushrooms, programmed to return the logs to compost on the forest floor. The cardinal rule of log home longevity is to keep it dry.

From the Ground Up

The most important consideration for building a foundation for a log structure is the ground upon which it sits. A log home may be two to four times heavier than a comparable frame house. The heavier and more expensive a structure is, the more important it is to have good soil information upon which to base a foundation design. The best way to determine what kind of ground is under your proposed log home is to core drill test holes under the footprint of the foundation, to at least 40 feet deep if permafrost or mass ice is possible. At the very least, use whatever technology is at hand to dig a hole in the ground. Drive a steel rod or dig a hole with a shovel or a backhoe or a cat.



Permafrost In Alaska

Source: Environmental Atlas of Alaska, 1978
Charles Hartman and Philip Johnson

> The cardinal rule of log home longevity is to keep it dry.

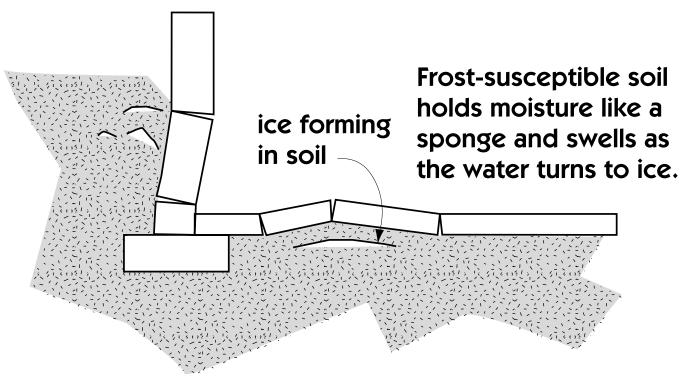

Damage from rot

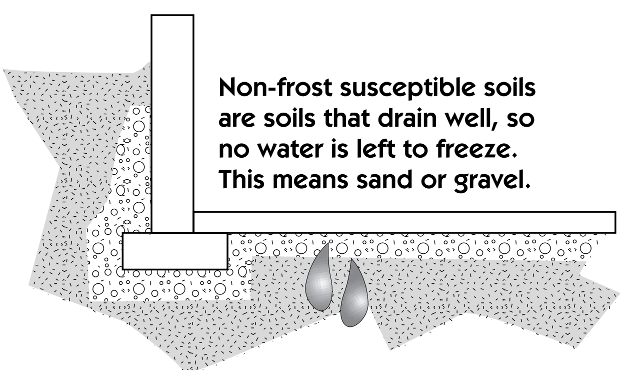
About half of Alaska is underlain with permafrost. Approximately one quarter of the state must contend with discontinuous permafrost, while the remaining quarter is generally free of permafrost (see map on previous page). The U.S. Natural Resources Conservation Service may be a good source of information on soils in your area.

Good Soils

Good building soils in Alaska are generally non-frost-susceptible (NFS). By this we mean solid rock or free-draining sand and gravels that will not hold water and will not cause frost heaving when the ground temperature is below freezing. If you are building on good soils, just about any structurally sound foundation that complies with local building codes and accepted engineering principles can be used to support a log home.

If you are building in an area where NFS material is not available, you must be especially careful to control the flow of water off the roof with ample roof overhangs and rain gutters or roof troughs. The ground should be sloped away from the foundation in all directions, and surface runoff should be diverted around the site with swales, berms, or ditches or a combination of all three.





Permafrost

If you are building in the half of Alaska with continuous permafrost, you must design a foundation that will maintain the below-freezing temperature of the soil beneath the house. If you are in the transition zone of discontinuous permafrost, you must design and build as if you are building on frozen ground, unless you know no ice is present because you did a core drilling or other research.

Design

Log house design should begin in the woods. You need to know what sort of trees are available. You should know the average mid-log diameters, how long, how straight, how dry, how old, what species.

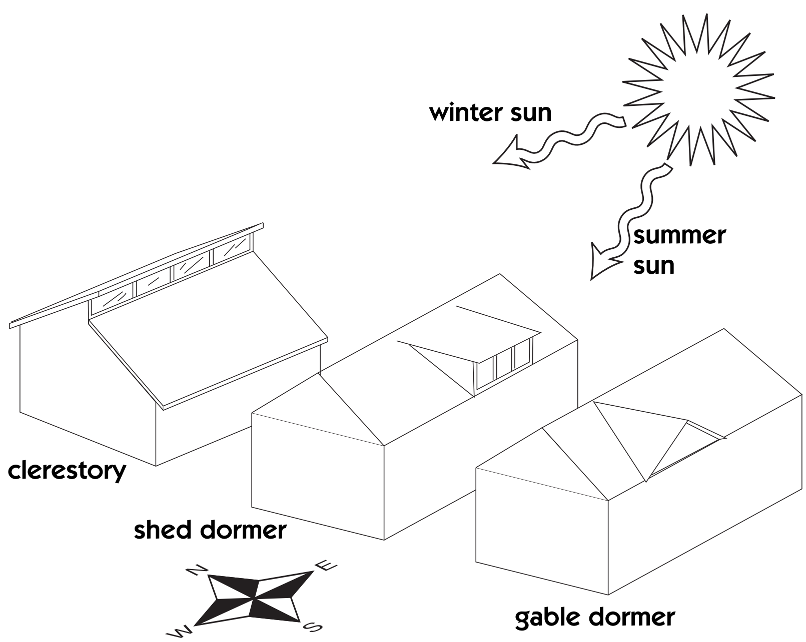
It is equally important to know the building site. When choosing the best location for the house on your property, make a drawing showing the location of the most beautiful natural features on the land. This may be an ancient grove of trees or an interesting rock formation or a meandering trout stream. Whatever it was that made you want to buy this land to build your home on should not be destroyed in the process of building that home. Move back from the stream, avoid getting close to the grove of trees, and don't bulldoze that fascinating rock outcropping.

The house must also work with the slope, solar aspect, vegetation, and other natural and man-made features of the landscape. Face the long side of the house directly at the midwinter sun for natural light and passive solar heat. Don't block the winter sun with evergreen trees. Birch or aspen will shade the house in summer and drop their leaves in the fall, allowing the sun to penetrate deep into the house in the winter.

South-facing clerestory or dormer windows are preferable to skylights because of potential glaciering and because a vertical window will catch the low winter sun more directly. Take care to avoid overheating with too much unshaded west-facing glass.

Design the home to fit your needs now and in the future. Think in terms of growing old along with your new log home. Your children may choose to live there with their children. Some log homes in Scandinavia have been lived in continuously by succeeding generations for over five hundred years. Design, construct, and maintain a log home so that it will last at least as long as it took to grow the trees that are used to build it.

> "Think in terms of growing old with your new log home."



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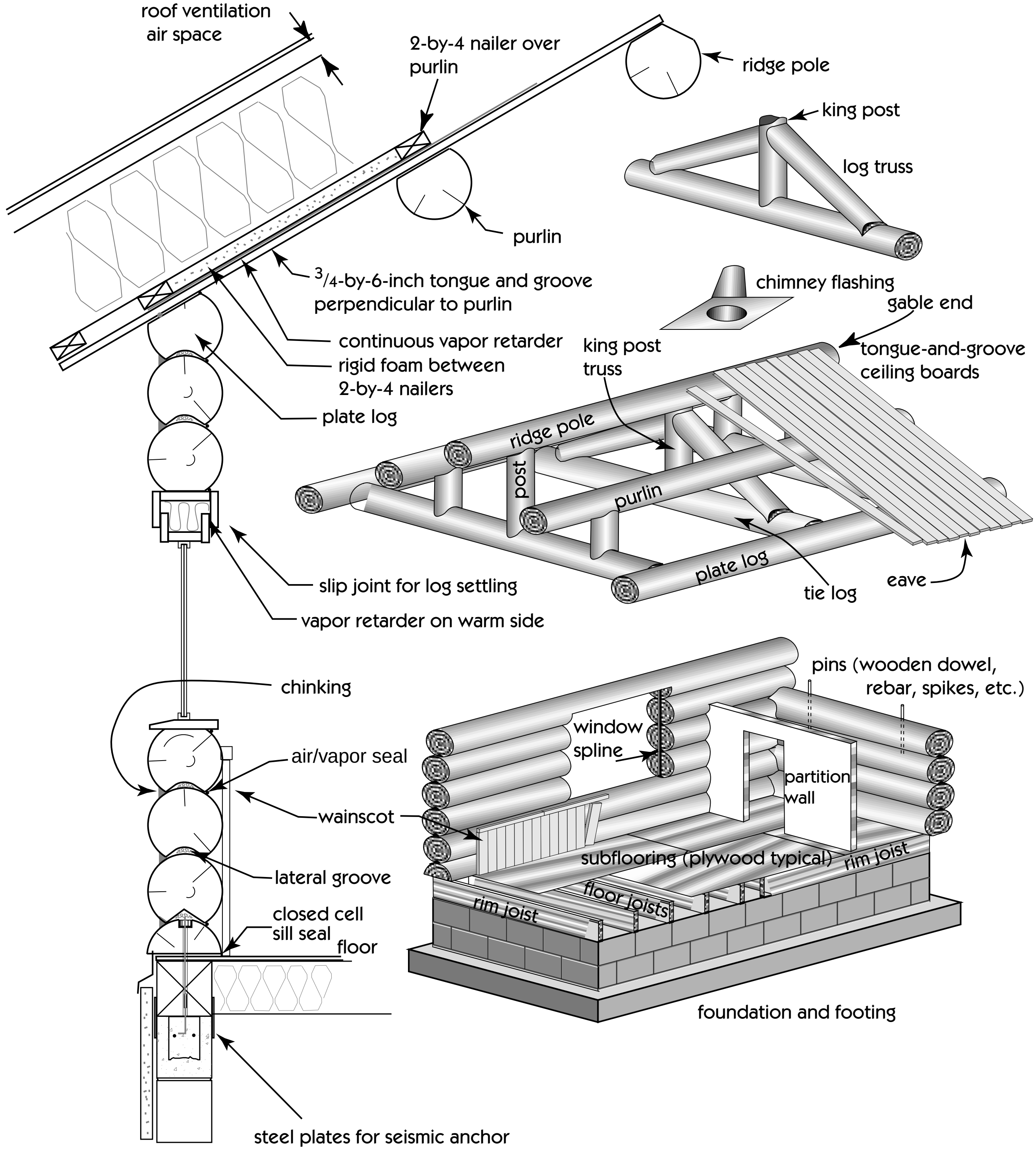


The parts of a log house

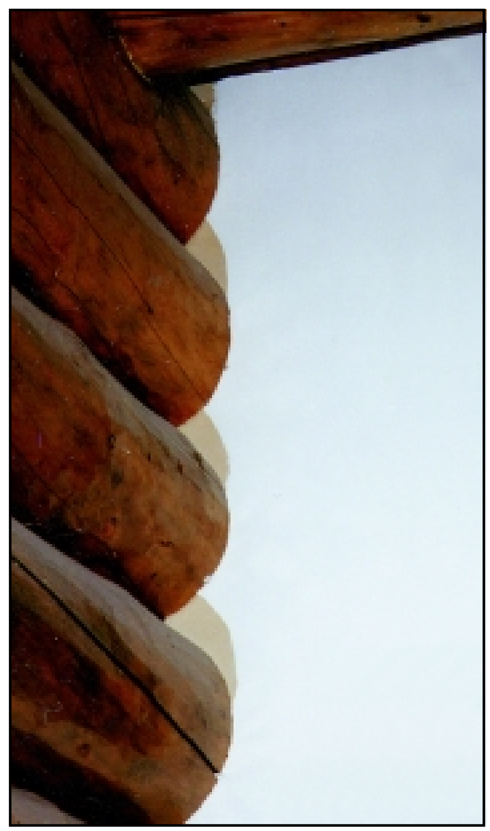
Shrinkage

Designing for log construction is not the same as designing for frame construction. You have to allow for settlement of the horizontal wall logs and gable logs of between $^1/_2$ and $^3/_4$ inch per round of logs, depending on species and water content. A green 8-foot-tall log wall may shrink about four to six inches in height, while a 12-foot-high log gable wall may shrink six to eight inches or more. All partitions and walls incorporating vertical posts and stairways must allow for settlement, and log floor systems must account for five or six inches of settlement.

All window and door framing and vertical support posts and interior frame walls must allow the logs to settle down without hanging up and causing gaps to occur between log courses. Air leakage through poorly fit logs is not only one of the greatest sources of heat loss, it is also the major moisture transport mechanism in a leaky house.

Moisture carried by air leaking through cracks between the logs or holes in the ceiling vapor retarder

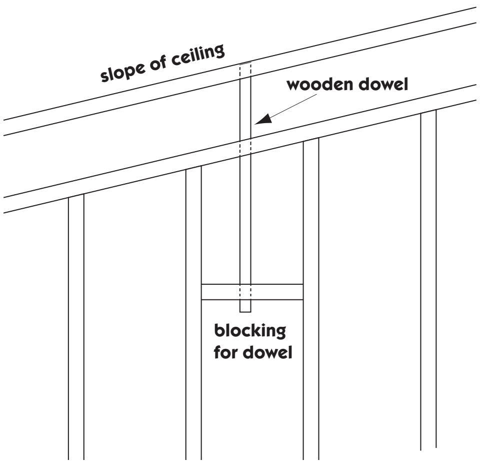
This ridge pole, which rests on a horizontal log gable, shrank and settled more than 6 inches and is now crushing the Sheetrock.



Unpainted Sheetrock exposed as logs settle. The space above the partition, which was more than 6 inches when built, is now 1.5 inches after 12 years of settling.

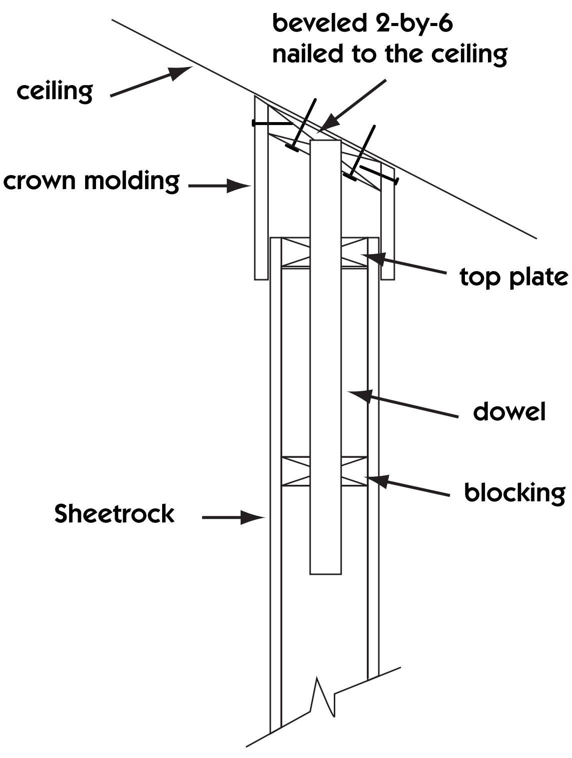
The gap left for settling here is covered with scribe-fit trim.

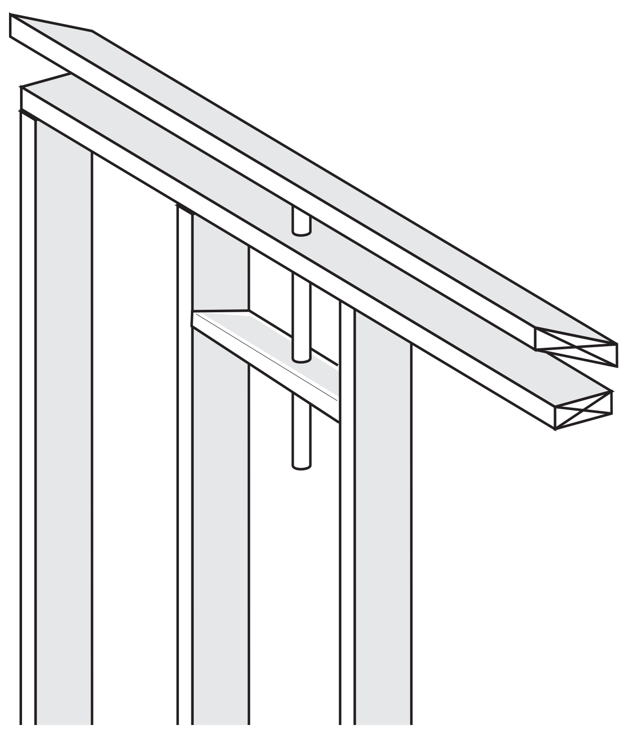
A slip joint for a partition wall that is perpendicular to the ridgepole



A 2-by-4 stud wall partition slip-joint to keep walls straight and allow the ceiling to settle. A wooden dowel is used to align the partition wall with the top plate, which is attached only at the top. The dowel is run down through snug-fitting holes and braced with additional blocking.

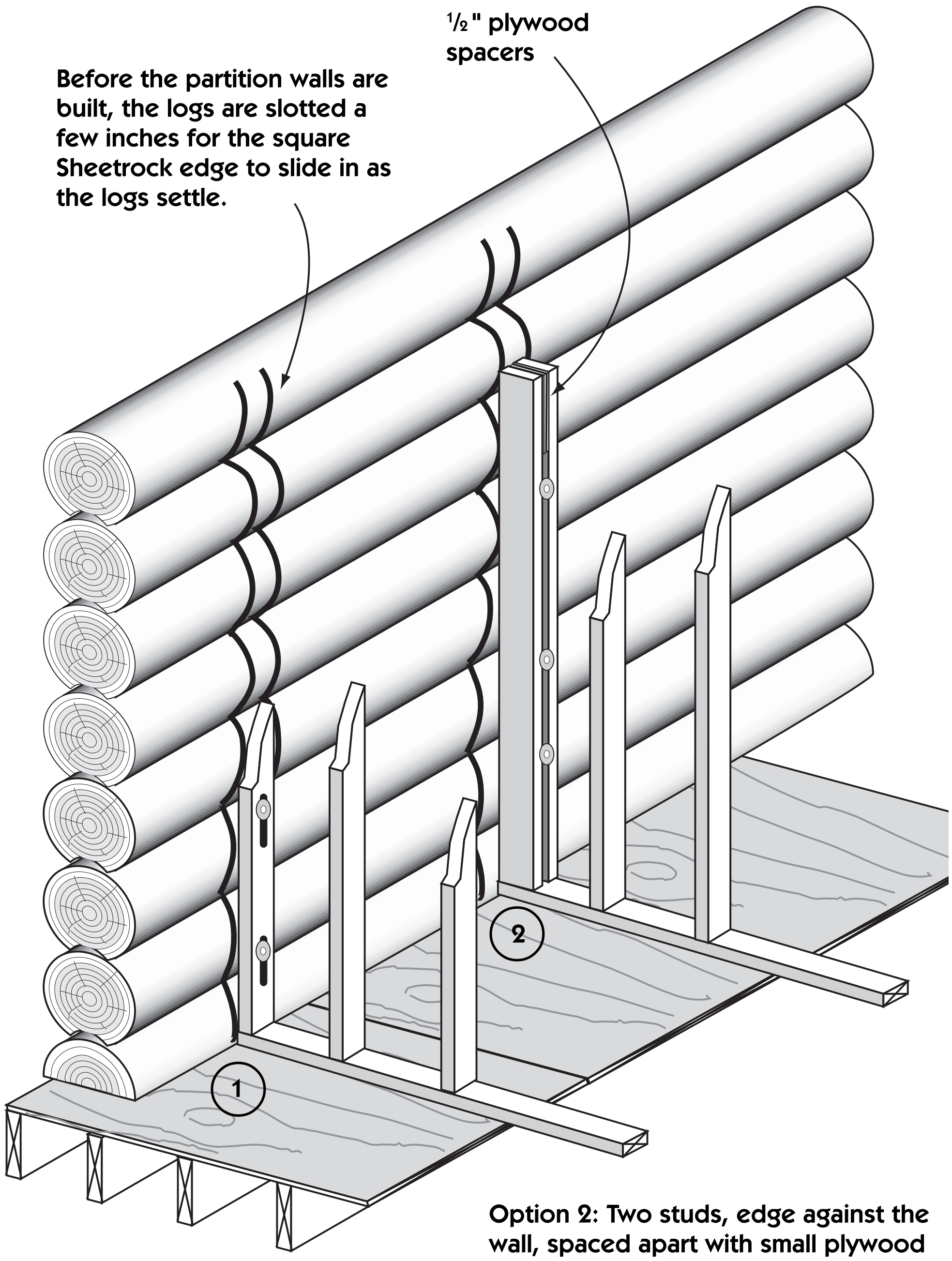
A slip joint for a partition wall that is parallel to the ridgepole





The dowel is only nailed or glued at the top, and slides down through snug- fitting holes in the plate and blocking as the building settles. A 2-by-6 with both sides beveled at ceiling slope and 1 1/2 inches wider than wall frame is nailed or bolted to the ceiling to attach wide crown molding.The crown molding is only nailed at the top and slides down over the Sheetrock.

Two ways to attach frame partitions to log walls and still allow for the settling of the logs

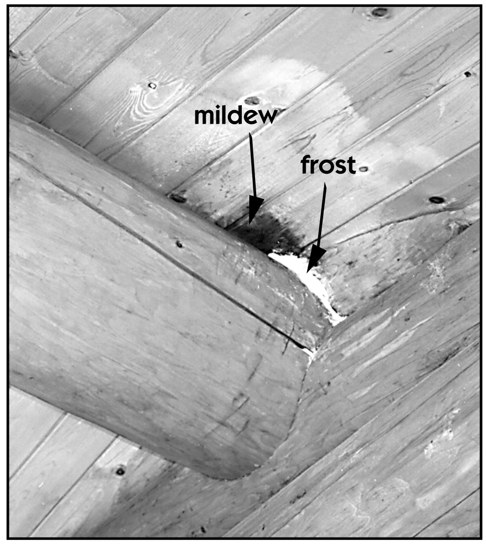


Option 1: A stud laid flat against the wall with bolt run through slots long enough to allow for settling. This method uses less wood.

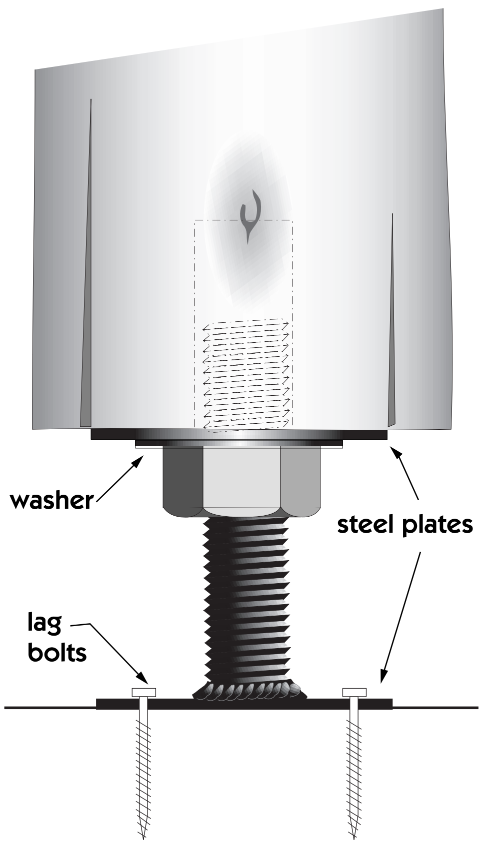
Option 2: Two studs, edge against the wall, spaced apart with small plywood scraps and bolts through the slot to the logs. This method can be faster to build.

will condense into liquid water when it reaches a cool surface. This could lead to rotting logs and glaciers forming on the roof.

In order for a log structure to meet the airtightness requirements of the energy standard, it should be built to the highest possible standards of craftsmanship as outlined in the Log Building Standards of the Canadian and American Log Builders Association (Appendix B).



Frost buildup and mildew at a leak around the ridgepole.

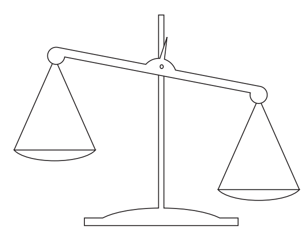


An adjustable vertical support post.

The Building as a System

Log buildings must be designed to work as a system and must control the flow of heat, air, and moisture in and out of the structure. The building system includes the foundation, floor, log walls, windows, doors, ceiling, heating appliance, ventilation system, energy-efficient lighting, the occupants, and the outside environment. A change in any part of the system will affect the performance of the rest of the system.

For example: you build a well-crafted home that is so air tight that the air inside becomes stale and unheathy, and the wood stove won’t draw very well. You must ventilate the house, so you put in a powerful exhaust fan. Then the wood stove belches smoke back into the house. Finally, you cut an opening in the wall to provide air for the wood stove. So now you have a system and you are in control of the fresh air in your house.



“A change in any part of the system will affect the performance of the rest of the system.”

> Building your house with an eye toward complying with the Americans with Disabilities Act makes the house easier for you and your visitors to live in, as well as making it easier to eventually sell.

If You Want to Borrow Money

All construction should comply with local building codes and the Uniform Building Code, the Uniform Mechanical Code, the Uniform Plumbing Code, the National Electrical Code, and the State of Alaska Building Energy Efficiency Standards. If you wish to borrow money from the Alaska Housing Finance Corporation and take advantage of their many interest rate reduction programs, or if you want to refinance or sell your home, most loan programs require you to design and build to meet these codes and standards.

Building your house with an eye toward complying with the Americans with Disabilities Act makes the house easier for you and your visitors to live in as well as making it easier to eventually sell. You never know when you might become permanently or temporarily disabled, and it's a lot cheaper to incorporate handicap-accessible features now, when you're building, than to retrofit later. Features like lever handles on doors and faucets make life easier even if you're not disabled.

Top Ten Building Science Rules

1. Heat flows from hot to cold.
2. Heat does not rise—warm air rises.
3. Heat is transfered by conduction, convection, and radiation.
4. Heat flow through insulation is slowed by air or other gases.
5. Airtightness prevents major loss of heat.
6. Air flows from higher pressure to lower pressure.
7. Air leakage is the primary moisture transport mechanism.
8. Diffusion is a secondary moisture transport mechanism.
9. Dew point is the temperature at which airborne water vapor condenses into liquid water. Water vapor is not a problem—liquid water is.
10. The vapor retarder should be placed on the warm side of the thermal envelope.