alaskaplans BUILDING DESIGN

Figure 1

Alternative Construction in Alaska:

A Guide for Choosing Which Method Works Best for You

Alternative Construction in Alaska:

A Guide for Choosing Which Method Works Best for You

Disclaimer

As with all construction projects, there are many various methods and materials available for constructing a new building. Alaska Plans, Inc. strongly recommends that you research all applicable codes, products, and the effects of their climate zone. This guide is intended to provide a quick glimpse into the complexities of the methods of construction covered and should not be used for construction. Consult with the appropriate professionals prior to construction.

Special thanks to our reviewers:

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Alternative Construction in Alaska, A Guide For Choosing Which Method Works Best for You was produced by Alaska Plans, Inc., April 2011.
Written by Jordan Rausa, Building Designer

How to use this guide…

This guide is intended to be used by homeowners, future homeowners, builders, students, and anyone who seeks to better understand the basics about the benefits and detriments of a few methods of construction used across Alaska. ***This guide is not intended to be used as a conclusive construction guide or handbook.*** *Each area of specific interest should be researched thoroughly, specific to your project and its location, to determine which methods and materials should be applied. We hope you find this helpful reference useful in determining how you will build your next home. ~ Alaska Plans Inc. ~*

COST RATING $ $ $

The green colored dollar signs are intended to represent a rough comparison from one method of construction to the next. This should not be used for estimating purposes, as no specific dollar amount is implied. In this guide, less dollar signs represent lower construction costs, while more dollar signs represent higher construction costs. The methods of construction in this guide are rated from 1 to 5.

EFFECTIVE R-VALUE R-21

The R-Value ratings applied in this guide are based on specific materials used within a wall system. Depending on what materials are used and how they are installed, the assigned R-Values can change dramatically. Because of this, the R-Values represented in this guide should be used as a comparison from one to another. Higher "R" numbers indicate more effective insulation.

ENERGY EFFICIENCY

The energy ratings implied in this guide should be used only as a comparison to one another. Two homes built with the same wall construction could produce different energy ratings, depending on the quality of workmanship. For this reason, each home should have an independent energy rating performed. The scale used in this guide is 1 to 5+ stars

VENTILATION

As everyone strives to create an air-tight building envelope for new home construction, indoor air quality has become a major concern. In this guide, we use a 1 to 3 rating. One symbol represents a low priority for a whole-house ventilation system, while three symbols represent a high priority for installing a whole-house ventilation system.

Wall Type 1:
2x6 wood studs @ 16” o.c. w/ batt insulation

COST RATING

$ $

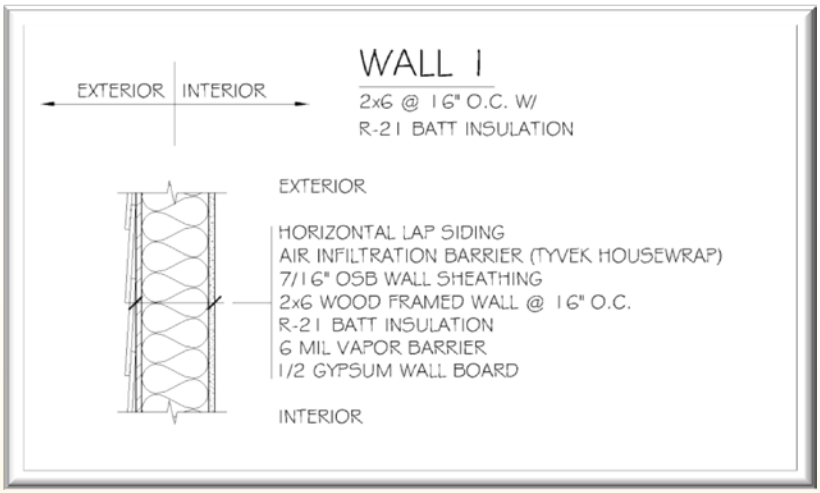
EFFECTIVE R-VALUE

R-21

ENERGY EFFICIENCY

VENTILATION

Figure 2



PROS

Most homes built in Alaska today are constructed using this wall type. Since the walls are assembled on site, there is much flexibility in the design and construction of these homes. The wall can be sheeted with either T1-11 or oriented strand board (OSB) wall sheathing with your choice of exterior siding. If built properly, using the right combination of an air-infiltration barrier, vapor barrier, and well-installed batt insulation, this wall system can be very cost-effective and provide years of comfort and energy efficiency. The R-Value of this wall type will not vary significantly between different types of batt insulation, so its efficiency is very predictable.

CONS

This wall system has a high potential for failure if it is not installed properly. If the fiberglass insulation is compressed in the wall cavity, it loses its ability to insulate. Additionally, voids in the wall cavity are common, and cause cold spots. Hiring a high-quality fiberglass insulation installer is paramount to the integrity of this wall system. Another problem, one which cannot be avoided, is the thermal transfer which occurs at each framing member within the wall. This can be seen with the naked eye on a cold winter day. Each stud, rim joist, and header can be seen in frost lines on the exterior of a building constructed this way.

*see *Table 2: R-Value and Thickness from Special Considerations For Building In Alaska* (Seifert, 2000)

Wall Type 2:
2x6 wood studs @ 16” o.c. w/ polyurethane insulation

COST RATING

$ $ $

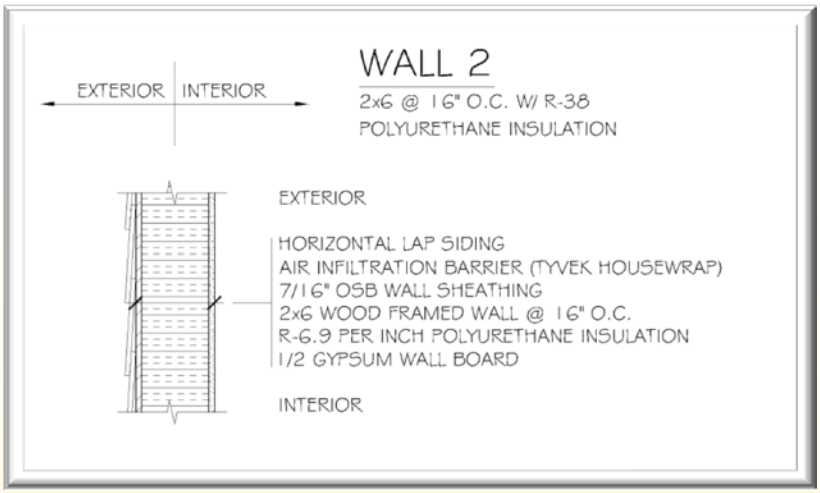
EFFECTIVE R-VALUE

R-38

ENERGY EFFICIENCY

VENTILATION

Figure 3



PROS

In addition to all of the benefits of Wall 1, this wall provides a much higher R-value and an air-tight vapor seal at the building perimeter. This wall accommodates design flexibility, allowing the wood frame to be assembled on-site before the foam is sprayed into the wall cavities. The foam is sprayed in “wet” and expands to fill the wall cavity. The finished product is a very dense, rigid wall that is ready for sheetrock.

CONS

The best thing about this wall type is its air-tightness and its ability to isolate moisture, but it can also be its worst features. As warm air from inside a home passes through your exterior wall, the air becomes cool. The transferring air will reach its dew point somewhere in the wall cavity and condensate, leaving moisture in the wall. There is normally enough air passage in a wall system to keep this dry, but since this wall in particularly impermeable to air passage, the air in your home can become moist and stale. This is why a whole-house ventilation system must be installed for the health of your home and its habitants. The added cost of insulation and ventilation also make this wall system expensive. Some products may also be combustible.

Different insulation materials provide different “R-Value per inch” values. Consult a professional insulator to determine which will work best for your home.

*see *Insulation Factsheet* (UAF Cooperative Extension Service, 2007)

Wall Type 3:
6-1/2” polyurethane structural insulated panel (SIP)

COST RATING

$ $

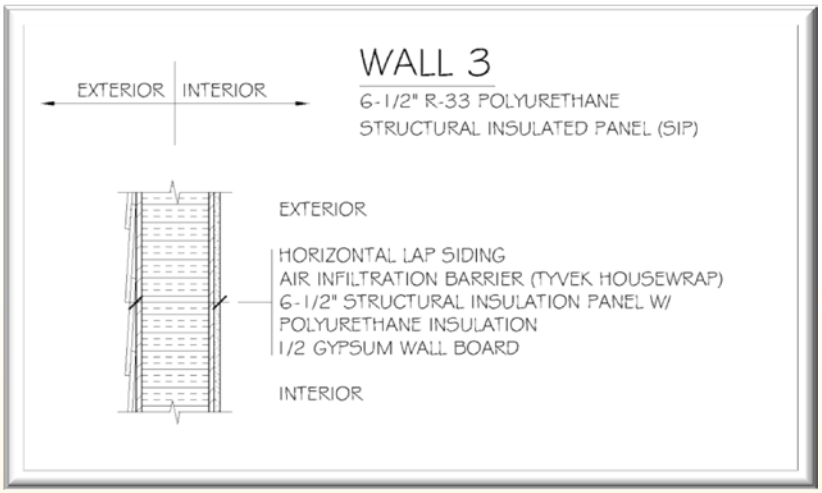
EFFECTIVE R-VALUE

R-33

ENERGY EFFICIENCY

VENTILATION

Figure 4



PROS

Rather than using dimensional lumber followed by insulation, the Structural Insulated Panel, or SIP, is the frame, the wall sheathing, and the insulation combined into one panel. They are most often ordered specific to each building design and can include electrical wiring as well as door and window openings; no vapor barrier is required. With newer SIP products, there are no continuous framing members from the interior surface to the exterior surface, virtually eliminating direct thermal transfer. SIP manufacturers and the Structural Insulation Panel Association argue that SIPs are more cost effective than conventional 2x6 walls with batt insulation, and they are definitely more energy efficient.

CONS

A home built with SIPs must be carefully planned out prior to construction. There is little room for changing a wall design or re-routing your home’s utilities during construction. Your building designer and the SIP supplier must work hand-in-hand to produce the design you want from the beginning. Some suppliers prefer to produce their own plans, which can be difficult for a homeowner in Alaska ordering SIPs from Canada or the Lower 48. It is also equally important for homes using SIPs to have a whole-house ventilation system.

*visit the *Structural Insulated Panel Association* at www.sips.org for more information. (SIPA, 2007)

Wall Type 4:
10-1/2” insulated concrete form (ICF)

COST RATING

$ $ $

EFFECTIVE R-VALUE

R-22

ENERGY EFFICIENCY

VENTILATION

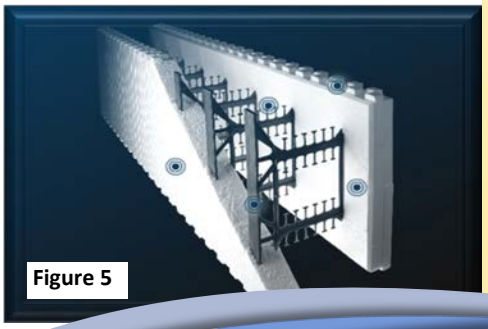
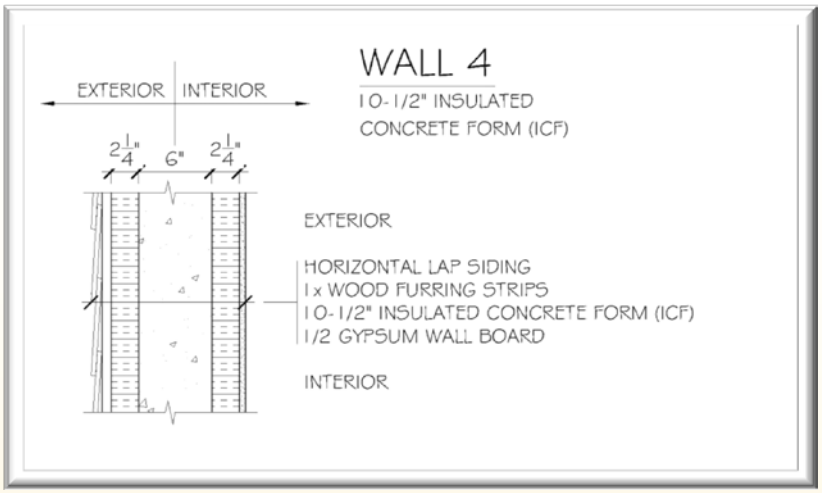


Figure 5



PROS

Insulated Concrete Forms, or ICFs, can be used both above and below ground, and there are systems available for assembling floor and roof diaphragms with the same methods. The finished product is an extremely solid, energy efficient home. Since there are no wood or paper products in the exterior walls, they will not promote rot, mold or mildew, leading to better indoor air quality. Standard sheetrock and siding can be applied to this wall via the plastic anchoring strips embedded in the foam. These walls are easy to assemble and will last for a long time. ICF manufacturers argue that the efficiency will pay for the added construction costs within a short time period. (Quad-Lock, 1997-2011)

CONS

Although there are many different ICF products available for design flexibility, this method of construction is still unconventional. Because of this, such features as bay windows, prow fronts, gambrel roofs, dormers, etc. will either be labor intensive or impossible to incorporate into a building design. This building system is also highly impermeable to air-transfer, which means a whole-house ventilation system will be required to regulate air pressure and humidity. Also, local building codes may only allow 2” of foam on the interior face of the wall system.

Different materials used to construct each manufacturer’s ICF wall system will produce different results. Consult each manufacturer to determine which will work best for your

Wall Type 5:
REMOTE wall system from the Cold Climate Housing Research Center

COST RATING

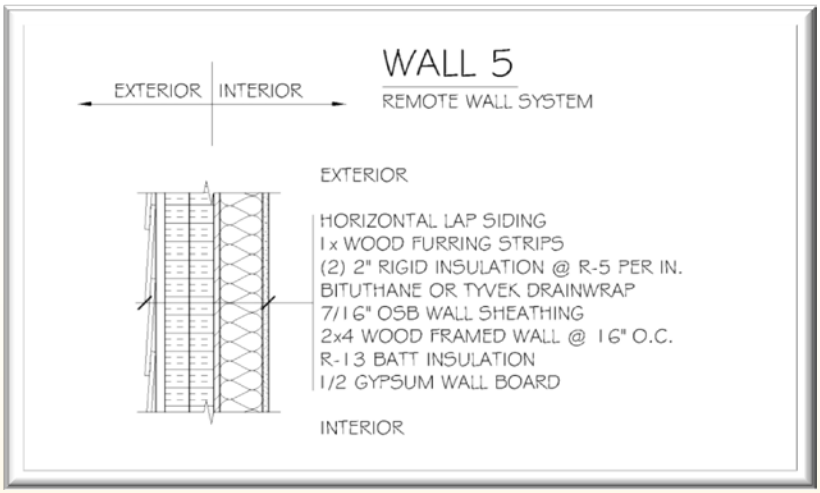
$ $ $ $ $

EFFECTIVE R-VALUE

R-31

ENERGY EFFICIENCY

VENTILATION



PROS

This wall system was developed by the Cold Climate Housing Research Center (CCHRC) in Fairbanks, Alaska, to endure the harsh, ever-changing weather conditions of interior Alaska. The primary benefit to this wall system is that the vapor barrier is on the exterior side of the wood frame, and 50% or more of the insulation is on the exterior side of the vapor barrier. This means that during cold winter months, the hot air will reach its dew point and condense on the outside of the vapor barrier, unable to adversely affect the wood frame. Depending on how many layers of rigid insulation are installed, this wall system can be highly efficient and very good for the health of your home.

CONS

The biggest detriment to this wall system is the cost. Consider the wall system as being a conventionally framed wall with an additional 4-6 inches of rigid insulation over it. Rigid insulation can be expensive, especially when it is used so extensively. Depending on which of Alaska's five climate zones you are building in, this wall system may vary slightly. For instance, you may need 6" of foam rather than 4", or you may need to use Tyvek Drainwrap instead of a Bituthane membrane. Each home constructed should be carefully researched and designed according to the specific climate the building will reside in. Failure to do so may produce undesirable results. This system will also require a whole-house ventilation system.

*information gathered from *Remote, A Manual* (Cold Climate Housing Research Center, 2009)

Figure 6

Wall Type 6:

Double 2x4 wood studs @ 24” o.c. staggered w/ batt insulation

COST RATING

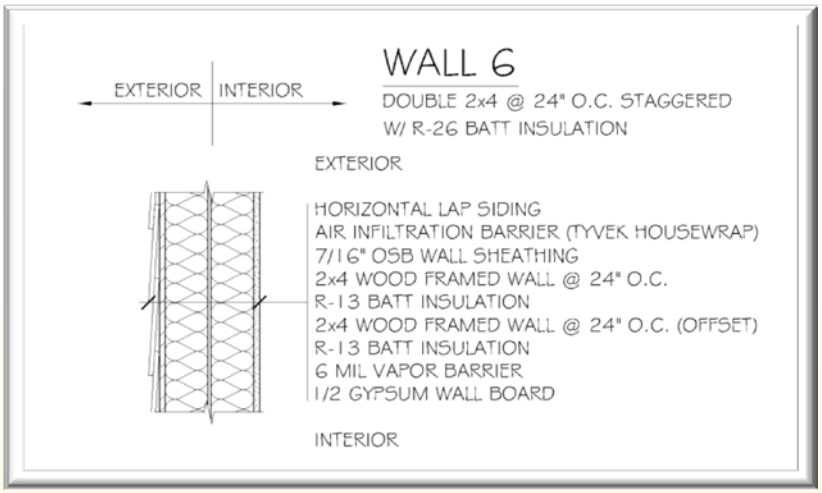
$ $ $ $

EFFECTIVE R-VALUE

R-26

ENERGY EFFICIENCY

VENTILATION



PROS

Although this wall system is highly uncommon and not widely used, there are many benefits that make it a good candidate for modern construction. The science is comparable to a standard 2x6 wall with batt insulation, but this wall eliminates almost all of the direct thermal transfer which occurs at framing members within the wall. In addition, the double 2x4 wall provides 7 inches of insulation in the wall cavity, as opposed to only 5.5 inches in a standard 2x6 framed wall. Since this is otherwise a conventional wall, it allows enough air transfer from outside into the wall cavity to not require a ventilation system, although it is still recommended. See (Leap Frog House, 2008)

CONS

The biggest problem with this wall system is the cost associated with “double framing” every exterior wall. Another consideration is that, in some areas, it can be difficult to find R-13 batt insulation 24” wide. This leaves two options:

> ***Option 1:*** *Frame both 2x4 walls @ 16” O.C., increasing the cost of the wall framing and reducing the insulation volume in your wall cavity, or*
>
> ***Option 2:*** *Use more readily available 24” R-11 batt insulation, sacrificing a total of R-4 in the wall system, leaving your wall with R-22 total insulation.*

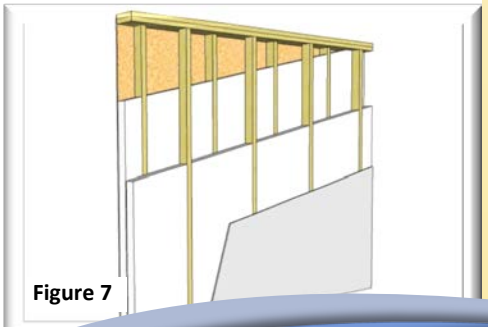


Figure 7

Wall Type 7:
8” Log Wall

COST RATING

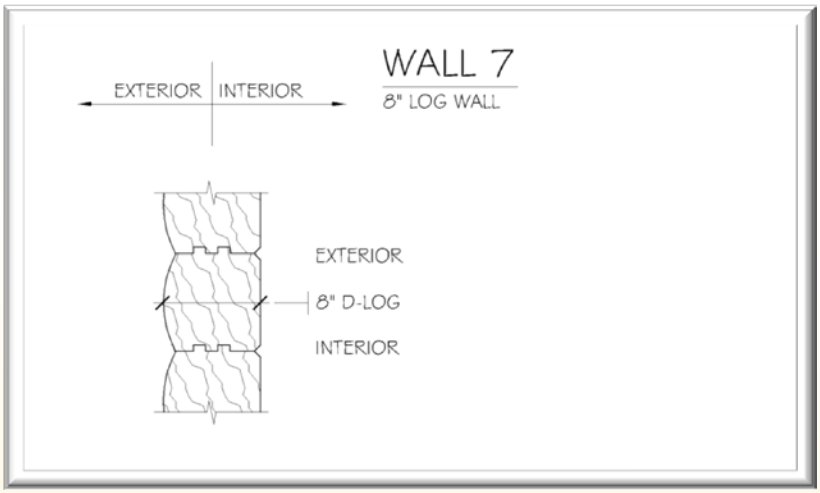
$ $ $

EFFECTIVE R-VALUE

R-11 *SEE NOTE ABOUT THERMAL MASS BENEFITS

ENERGY EFFICIENCY

VENTILATION



PROS

Owning a log home is a common dream of Alaskans. A conventional log home, as described in the diagram above, is somewhat primitive, but offers unsurpassed beauty, which manufacturers of modern products struggle to simulate. Although hand-built, full scribed log homes cannot be replicated using modern products, there are many energy efficient, dimensional, or “milled look”, log products on the market today. These include simulated log siding, logs with a foam layer in the middle, and many other modern log solutions. A “true” log home should never struggle with air quality, as there are often many leaks and cracks.

A 1980’s test performed by the National Bureau of Standards confirmed that the “thermal mass” of log walls is an energy-conserving feature, meaning that an R-11 log wall is actually much more efficient than “R-11” implies. Read the full report (Log Homes Council of the National Association of Home Builders, 1999) http://northernloghome.com/rvalue.htm

CONS

Fine log home construction is very costly, while log home kits are available at very reasonable prices. Because of this, it is very difficult to estimate the cost of log home construction until all of the materials are selected. Another downside to traditional log home construction is that they are drafty and can be limited on efficiency.

Figure 8

Additional Resources…

The following resources are excellent sources of technical data that will help you further investigate the techniques briefly described in this guide. We hope you find these bodies of knowledge useful as you seek to better understand the complexities of each method of construction.

ON THE WEB:

Quad Lock ICF Products http://www.quadlock.com/

Structural Insulated Panel Association (SIPA) http://www.sips.org/

Insulpan SIP Products http://www.insulspan.com/

Cold Climate Housing Research Center http://www.cchrc.org/

Sundberg Quality Homes http://www.sundbergqualityhomes.com/

Drobenko Investments http://iloverealestate.org/custom2.shtml

Alaska Building Science Network http://www.absn.com/index.cfm

Custom/Northern Log Homes http://northernloghome.com/

Cooperative Extension Service UAF http://www.uaf.edu/ces/faculty/seifert

Alaska Housing Finance Corporation http://www.ahfc.state.ak.us/home/index.cfm

Alaska Plans, Inc. - Building Design http://www.alaskaplans.com/home.html

Our References:

Cold Climate Housing Research Center. (2009). *Remote, A Manual.* Fairbanks: CCHRC.

Leap Frog House. (2008). *learn more.* Retrieved March 13, 2011, from The Leap Frog House: http://www.theleapfroghouse.com/index.cfm?fuseaction=cDisplay.learnmore

Log Homes Council of the National Association of Home Builders. (1999). *R-Value with Logs.* Retrieved March 2, 2011, from Northern Log Homes: http://www.northernloghomes.com/rvalue.htm

Quad-Lock. (1997-2011). *Bulletins.* Retrieved March 4, 2011, from Quad-Lock: http://www.quadlock.com/technical_library/index.htm#Bulletins

Seifert, R. (2000). *Special Considerations For Building In Alaska.* Fairbanks: UAF Cooperative Extension Service.

SIPA. (2007). *Home.* Retrieved February 27, 2011, from Structural Insulated Panel Association: http://www.sips.org/

UAF Cooperative Extension Service. (2007). *Insulation Factsheel.* Fairbanks: UAF Cooperative Extension Service.

Photo Credits

Figure 1: Gage Residence built by Drobenko Investments, designed by Alaska Plans, Inc.
Figure 2: “The Hawaii” built by Sundberg Quality Homes, designed by Alaska Plans, Inc.
Figure 3: foam installation image from http://www.foamanchorage.com/photo/photo.shtml
Figure 4: structural insulated panel image from http://www.insulspan.com/
Figure 5: insulated concrete form image from http://www.quadlock.com/
Figure 6: image from cover of *Remote, A Manual* from CCHRC
Figure 7: original image created for this document by Alaska Plans, Inc.
Figure 8: Glines residence addition/remodel, designed by Alaska Plans, Inc.