NH Codes Now Recognize Log Building Standards

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New Hampshire now recognizes log building standards. Is this news? Not really, but while the energy code (IECC, International Energy Conservation Code) has gotten the most attention, the adoption of the other codes contain some important news. Since New Hampshire has adopted the 2009 I-Codes published by the ICC (International Codes Council), where engineered design is used with referenced standards, the design shall comply with the code. For the first time ever, building with logs is now covered by an ICC Standard that is referenced in the 2009 edition of the IRC (International Residential Code) and IBC (International Building Code). This standard is ICC400-2007 Standard on the Design & Construction of Log Structures, an ANSI-approved document, which means that it was developed following a public, consensus process. Per ICC policy, standards are reviewed every five years to provide an opportunity for update. As such, ICC400 is currently open for public comment (for more information, go to http://www.iccsafe.org/cs/IS-LOG/Pages/default.aspx).

The availability of this standard in New Hampshire will facilitate evaluation of new and existing log homes. This is very important, as log homes have been successfully performing in New Hampshire for decades. Log home industry surveys dating back to 1986 have shown New Hampshire in the top half of the states for log building, accounting for 7% or more of the single-family homes in the state (versus less than 2% for the nation as a whole).

Until recent economic trends took hold, New Hampshire experienced a steady growth of log home producers, builder/dealers, and homes, generating more than $100 million in business annually from 2001 to 2006. A log building materials package generally consists of log walls, roof and loft/second floor framing, and porch framing. Log walls require from 50 to several hundred logs, with an estimated average of about 200 logs per home. Accessories such as entrance doors, windows, log siding, chinking, sealants, paints and finishes, fasteners, and adhesives may also be available with the log package.

ICC400-2007 provides a guideline for evaluating log structures to ensure compliance with the IRC, IBC, and IECC. The log home industry had long been aware of the need to provide a standard for log construction and supported the development of ICC400 with the goal of raising the quality of log construction and providing unbiased information specific to log building. The document is an accumulation of the experience of milled and handcrafted log home producers, wood engineers, and interested building officials. The standard offers multiple options: prescriptive (minimum requirement without additional technical support), calculated (allows for cases that can perform better than prescriptive), and tested (where other analysis does not match known performance). ICC400 primarily relies on log grading to establish structural capacity, certified moisture content to control dimensional change, methods to account for the potential for settling, and methods for establishing fire resistance ratings and determining heat transmission. Structural considerations in the standard adapted conventions for light wood framing to industry-wide practices and capacities provided by the larger cross sections of logs.

LOG WALLS IN CLIMATE ZONE 6

Assuming the market for new custom homes will recover, the biggest threat to the construction of log homes today is the perception that log walls cannot comply with the new energy code. In the NH Energy Code (see http://www.puc.nh.gov/EnergyCodes/NH%20Code%20Certification%20IECC%202009%20Form%20EC-1%203-10.pdf), log walls must comply with ICC400 with an average minimum wall thickness of five inches or greater and must have overall glazing of U-.31 or lower and heating AFUE of 90% (gas) or 84% (oil). The minimum wall thickness is very important because of the need to protect the many jobs associated with companies that produce the smaller log size, and to protect the existing log home inventory from unnecessary modification of the log wall. A call for larger nominal log sizes to comply with new energy codes will

certainly strain the entire industry and the families associated with it, as there is a statistically significant loss of new home sales as prices rise. Many companies have noted that the increase from a nominal six-inch log wall to a nominal eight-inch log wall will be $5,000 or more for a typical home. While the industry is adjusting somewhat, the market is price-sensitive, and this cost increase limits the number of potential buyers. The inability to continue selling affordable log homes with current products will not only force log home companies to make hard decisions, but also the ramifications will be felt throughout the log supply network, with all ancillary products and services similarly affected.

Because New Hampshire will be reviewing the energy code again for 2012, more research is needed to substantiate the energy benefits of log wall construction. In response, the log home industry is in the process of generating and collecting data. The best option is to work with EPA's Energy Star program, which provides an established, recognized benchmark for energy performance.

Log home enthusiasts still face skepticism from proponents of high-R insulation systems. The fact that existing log home owners are warm and comfortable with low energy bills is not enough to win the battle when the prime focus is on "R-value." The focus on R-value alone is one of the most dangerous misrepresentations of energy conservation because the code only calls for the rated R-value of the insulation product itself. In other words, one could market his or her "R-20 wall" featuring insulation in a wood or steel framing cavity, but the effective overall wall value is actually about R-17. The claim that the whole wall is the same as the insulation value is misleading. It is only a reference, like the nominal size of lumber (e.g., a 2×4 is actually 1 ½ inches × 3 ½ inches).

Admittedly, solid wood does not test well to generate a rated R-value (about R-0.8 to 1.4 per inch of thickness), but solid wood walls do have sufficient mass to retain heat, control moisture, and prohibit airflow. When looking at alternative wall systems such as a log wall, you should instead look at the U-Factor tables in the code in comparison to cavity wall construction. This is where mass wall benefits are illustrated best and actually demonstrate a proper comparison of performance of the overall wall assembly.

Log walls are more analogous to continuous insulation, in that the thermal properties are consistent across the entire wall. They provide additional benefits over insulated cavity wall construction as they do not degrade from sagging or compressed insulation, damaged vapor barriers, or failure of external water screens. Without a wall cavity to collect/generate debris, allergens, or mold, log walls are truly "what you see is what you get." And last, there is no question of how well the "insulation" is installed, because you are looking at it!

A significant aspect of the energy conservation code is to limit air infiltration, or the entry of unconditioned outside air into the interior conditioned space. When designed and built in accordance with ICC400, log wall systems have demonstrated that they perform to the intent of the energy conservation codes and standards. ICC400 does not specify a preferred method, but it does require that wall joinery maintain an air and water seal over the life of the building. This is significant, as the industry works against those log homes that were poorly built and/or maintained without concern for tight construction. Compliant construction is evidenced by homes with air leakage measurements ranging from 0.33 to 0.66 air changes per hour (ACH). According to research studies in both Canada and the U.S., the heat loss experienced in log homes is not through the wall but is typically attributed the connection of the log wall to the roof (e.g., where the ceiling board extends across the log wall). Common areas of air infiltration are not log home specific, coming from elements common to all dwelling construction.

ENERGY UPGRADES FOR EXISTING LOG HOMES

As noted above, New Hampshire has a rich heritage of log construction. Therefore, it is important to consider the existing housing stock as well as new construction when you are discussing log homes and energy performance. The key factors to examine are the same for any existing home: orientation, efficiency of the mechanical systems, the design and condition of distribution systems, etc. There is a high percentage of log homes in New Hampshire that are built with logs milled from six-inch timbers (or cants), which also defines their nominal width although the actual average width is something less. When evaluating these buildings, you should have a full energy audit performed before taking any remedial action to update the log wall to the current energy code R-values. Inspect and improve all joints in the log wall, at the connection to the floor and roof, and around wall openings. Then look at the effectiveness of fireplaces and wood stoves, heating systems, and fenestration.

The easy fix is to insulate to the interior because it is accessible; however, that eliminates the mass wall benefits and conceals the interior wall surface—this is the surface that is most visible. Visual inspection of the wall surface is an essential element for the long-term maintenance of the wall unless the wall is not exposed to weathering elements. Insulating the exterior of a log wall is also an option, but it is difficult. Care must be taken to ensure against any moisture collecting on the log wall, as that will not be visible or treatable in the future. Many historical log homes across the country are being discovered when new owners look to renovate a home to find the solid wood walls under various siding applications, so it is known to be done.

How 'Green' Is Log construction?

- Log walls reduce the use of synthetic materials by relying on renewable resources (timber). Raw logs are often a result of reclamation efforts where the wood supply is not economically desirable for other products, such as smaller diameter trees or those killed by insect-attack, fire, or wind. Often milled from locally harvested (indigenous) wood, log components consume less energy and labor from raw material to finish installation than other building materials. Although log homes are shipped globally, many log homes in NH are shipped within smaller distances of harvest locations, resulting in lower transportation energy-use.

- Looking at the wall as a system, log walls provide "surface as finish," meaning that material and labor costs are reduced because a single trained crew effectively builds the structure, thermal envelope, and wall finish at the same time. Fewer (albeit proportionally stronger) fasteners are needed to erect a log-walled building, resulting in lower quantities of metals employed to complete the job (manufactured metals have high embodied energy).

- Due to the difficulty of working within the solid wood wall, builders typically keep wiring, plumbing, and other such systems to the interior of the log shell. This concept of keeping systems inside the thermal envelope is encouraged in all energy-efficient and green guidelines. With an insulated foundation wall and a vaulted ceiling common to many log homes, the design minimizes potential for energy consumption due to distribution loss in heating systems.

- Pre-cut and handcrafted log wall building systems provide an additional benefit that labor and waste are controlled by the producers who have outlets for the by-products of their work. The trail from forest to building site involves well-established practices to maximize material use and minimize waste.

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