



U.S. Department of Energy

Energy Efficiency and Renewable Energy

*Bringing you a prosperous future where energy is
clean, abundant, reliable, and affordable*



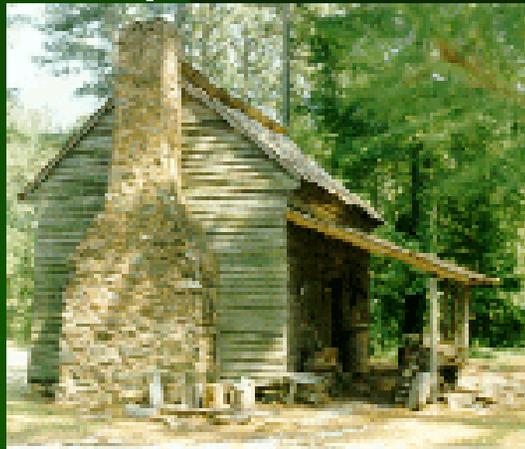
Log Homes In REScheck[®]

Acceptance of Traditional, but
“Alternative”, Materials and Methods
of Assembly



Log Home Heritage

- Ancient settlements date to 700 BC
- Use of indigenous materials
- Relatively simple, often one room



1785 hewn
log cabin

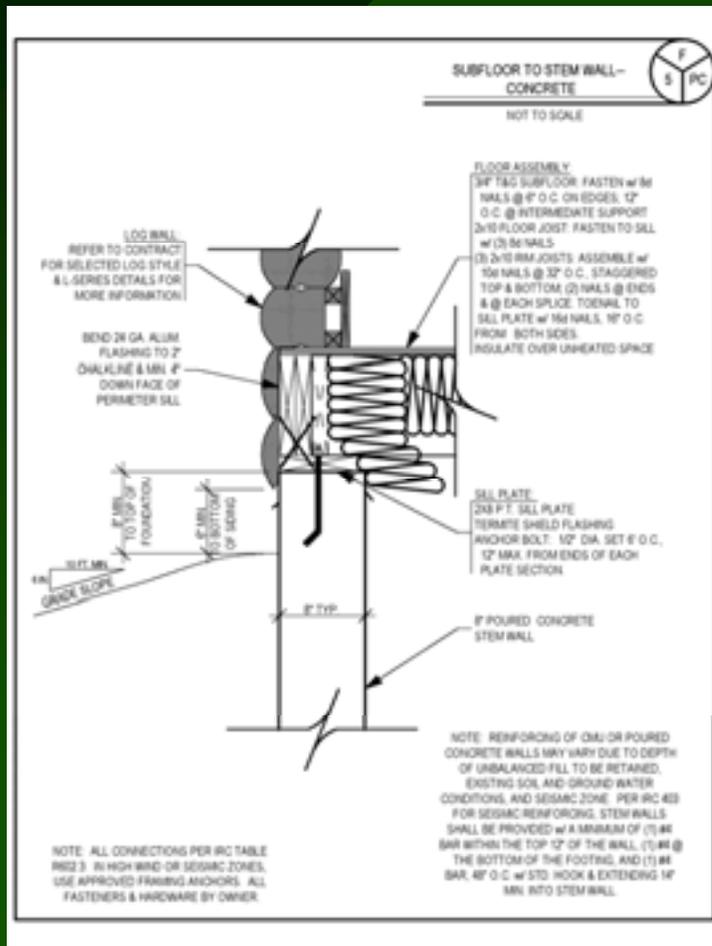


Evolution of Technology

- 1920 -- Pre-cut log home “kits”
- Handcrafted to precision milled
- Sophisticated design and engineering



Principles of Construction



Detail courtesy of Southland Log Homes Inc.

Same as conventional:

- Project planning & preparation
- Design loads and deflection criteria
- Plumb, square and level construction
- Receiving, handling, and protecting materials

1977: The LHC First Meets

22 Charter Members form the Log Homes Council to respond to code issues

Building Systems Magazine's 2001 Excellence in Model Home Design –

Appalachian Log Structures, Inc.



- Develop and promulgate standards of quality and safety throughout the log home industry
- Disseminate information about developments in the log home industry to regulatory bodies, governmental agencies, the press, and the general public

Setting Log Standards

- Log grading & moisture content
 - 1980: ASTM D3957
 - 1982: LHC Grading Program
 - 1984: Log grading becomes mandatory for LHC members



Setting Log Standards

- Log grading & moisture content
- Fire-resistance Ratings
 - 1997: Urban-Wildland Interface Code
- Thermal envelope



1983: Thermal Testing

± 2 yrs in development, monitoring and evaluation

–National Bureau of Standards report demonstrates the thermal benefits of log and other heavy mass walls

Six 20'x20' test buildings w/90" walls:

- 2x4 insulated R-12
- 2x4 without insulation R-4
- masonry internally insulated R-14
- un-insulated masonry R-5
- 7" solid square log R-10
- masonry externally insulated R-12



1989: Thermal Mass

Section 502 of the Model Energy Code...

502.2.1.1.2 Mass walls. When the thermal mass of the building components is considered, the U_w for exterior walls in Section 502.2.1.1 and having a heat capacity greater than or equal to 6 Btu/ft² · °F [1.06 kJ/(m² · K)] of exterior wall area shall be less than or equal to the values in Table 502.2.1.1.2(1), 502.2.1.1.2(2) or 502.2.1.1.2(3) based on that U_w required for walls with a heat capacity less than 6 Btu/ft² · °F [1.06 kJ/(m² · K)] of exterior wall area as determined by Equation 5-1 in Section 502.2.1.1 and Figure 502.2(1).

Thermal mass credit when density ≥ 20 lb/ft²

Note: Masonry or concrete walls having a mass greater than or equal to 30 lb/ft² (146 kg/m²) of exterior wall area and solid wood walls having a mass greater than or equal to 20 lb/ft² (98 kg/m²) of exterior wall area have heat capacities equal to or exceeding 6 Btu/ft² · °F [1.06 kJ/(m² · K)] of exterior wall area.

The heat capacity of the wall shall be determined as follows:

$$HC = w \times c$$

where:

- HC = Heat capacity of the exterior wall, Btu/ft² · °F [kJ/(m² · K)] of exterior wall area.
- w = Mass of the exterior wall, lb/ft² (kg/m²) of exterior wall area is the density of the exterior wall material, lb/ft³ (kg/m³) multiplied by the thickness of the exterior wall, ft (m).
- c = Specific heat of the exterior wall material, Btu/lb · °F [kJ/(kg · K)] of exterior wall area as determined from Chapter 24 of the *ASHRAE Handbook of Fundamentals*.

Today: Settling Standards

- All logs may experience dimensional change
- Compression
- Slumping in scribe-fit log walls

Table 3-5. Shrinkage values of domestic woods

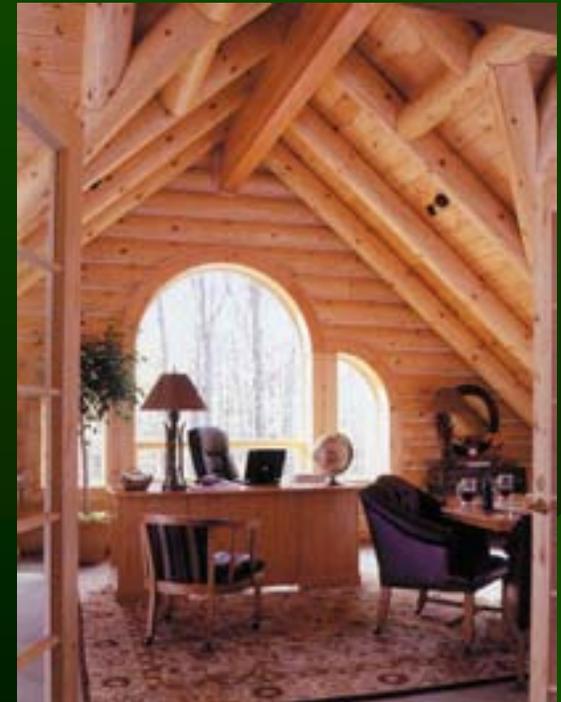
Species	Shrinkage* (%) from green to oven-dry moisture content			Species	Shrinkage* (%) from green to oven-dry moisture content		
	Radial	Tangential	Volumetric		Radial	Tangential	Volumetric
Hardwoods				Oak, white—con.			
Alder, red	4.4	7.3	12.6	Chestnut			
Ash				Live	6.6	9.5	14.7
Black	5.0	7.8	15.2	Overcup	5.3	12.7	16.0
Blue	3.9	6.5	11.7	Post	5.4	9.8	16.2
Green	4.6	7.1	12.5	Swamp, chestnut	5.2	10.8	16.4
Oregon	4.1	8.1	13.2	White	5.6	10.5	16.3
Pumpkin	3.7	6.3	12.0	Persimmon, common	7.9	11.2	19.1
White	4.9	7.8	13.3	Sassafras	4.0	6.2	10.3
Aspen				Sweetgum	5.3	10.2	15.8
Bigtooth	3.3	7.9	11.8	Sycamore, American	5.0	8.4	14.1
Quaking	3.5	6.7	11.5	Tanoak	4.9	11.7	17.3
Basswood, American	6.6	9.3	15.8	Tupelo			
Beech, American	5.5	11.9	17.2	Black	5.1	8.7	14.4
Birch				Water	4.2	7.6	12.5
Alaska paper	6.5	9.9	16.7	Walnut, black	5.5	7.8	12.8
Gray	5.2	—	14.7	Willow, black	3.3	8.7	13.9
Paper	6.3	8.6	16.2	Yellow-poplar	4.6	8.2	12.7
River	4.7	9.2	13.5	Softwoods			
Sweet	6.5	9.0	15.6	Cedar			
Yellow	7.3	9.5	16.8	Yellow	2.8	6.0	9.2
Buckeye, yellow	3.6	8.1	12.5	Atlantic white	2.9	5.4	8.6
Butternut	3.4	6.4	10.6	Eastern redcedar	3.1	4.7	7.6
Cherry, black	3.7	7.1	11.5	Inorse	3.3	5.2	7.7
Chestnut, American	3.4	6.7	11.6	Northern white	2.2	4.9	7.2
Cottonwood				Port-Orford	4.6	6.9	10.1
Balsam poplar	3.0	7.1	10.5	Western redcedar	2.4	5.0	6.8
Black	3.6	8.6	12.4	Douglas-fir,			



Settlement allowance over openings is a function of the building system.

2002-2006: ICC Log Standard

- Enforcement of grading requirement
- Uniformity in code analysis and enforcement
- Quick reference for technical data
- Broader acceptance with growth of ICC adoption at various levels of government
- Updated every code cycle
- Potential adoption beyond the U.S.



Building Systems Magazine's 2002
Excellence in Model Home Design –
Hiawatha Log Homes, Inc.

Log Walls in REScheck

Minimum requirements set by the ICC Log Standard

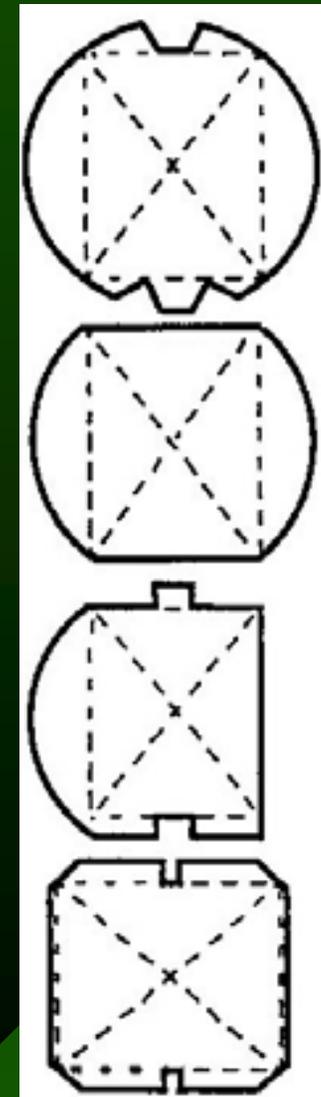
- Quality Assurance
- Differential movement and air infiltration
- R-value and density calculated at EMC
- Section Properties and Average Thickness

Avg. Width = A / Stack height

Section Properties of Sawn Round Timber Beams & Wall-Logs

	Area (A)	Section (S)	Moment (I)	Area (A)	Section (S)	Moment (I)
Rectangles	bh	$bh^2/6$	$bh^3/12$	SRTB* (Sawn Round Timber Beams)		
Full Round	$\pi D^2/4$	$\pi D^3/32$	$\pi D^4/64$			
	3.1416 r ²	0.7854 r ³	0.7854 r ⁴			
for diameters				for diameters		
						$\bar{y}_{bar}=0.915r$
5	19.63	12.27	30.68	5	17.79	21.92
5.5	23.76	16.33	44.92	5.5	21.52	32.09
6	28.27	21.21	63.62	6	25.61	45.45
6.5	33.18	26.96	87.62	6.5	30.06	62.61
7	38.48	33.67	117.86	7	34.86	84.21
7.5	44.18	41.42	155.32	7.5	40.02	110.97
8	50.27	50.27	201.06	8	45.54	143.66
8.5	56.75	60.29	256.24	8.5	51.41	183.08
9	63.62	71.57	322.06	9	57.63	230.11
9.5	70.88	84.17	399.82	9.5	64.21	285.67
10	78.54	98.17	490.87	10	71.15	350.72
10.5	86.59	113.65	596.66	10.5	78.45	426.31
11	95.03	130.67	718.69	11	86.09	513.49
11.5	103.87	149.31	858.54	11.5	94.1	613.42
12	113.1	169.65	1017.88	12	102.46	727.26
14	153.94	269.39	1885.74	14	139.46	1347.34
15	176.71	331.34	2485.05	15	160.09	1775.54
16	201.06	402.12	3216.99	16	182.15	2298.5
18	254.47	572.56	5153	18	230.53	3681.75
20	314.16	785.4	7853.98	20	284.61	5611.57
24	452.39	1357.17	16286.02	24	409.84	11636.16

*SRTB has 0.3radius removed.



Design/Construction Criteria

- Wall-Logs: Species, size, shape, treatments, moisture content
- Extent of processing: Lineal length, pre-cut, handcrafted
- Joinery: Corners, butt joints, openings, sealants
- Connections and fastening patterns
- Accommodating movement

There's only one right way to build a log home...

Per the blueprints, details, and instructions (construction manual) provided with the log package.

The Log Homes Council

60 Member companies
subscribe to the LHC Code of
Ethics and today's Log
Standards

The LHC represents about
20% of all North American log
home producers

BUT

Produce about 50% or more
of new log home construction

The screenshot shows the website for the Log Homes Council, titled "The Log Home: An American Dream". The page features a navigation menu with links to Home, Featured Home, Photo Gallery, Publications, Member Directory, Products & Services, Events Calendar, and Guest Registry. The main content area is titled "LHC Tech Notes" and includes sections for "Controlling Carpenter Bees" and "Termite Prevention & Control". The "Controlling Carpenter Bees" section describes the damage they cause and provides a link to a PDF document. The "Termite Prevention & Control" section provides a summary of how to prevent log home termite damage and also includes a link to a PDF document. The footer of the website lists member companies: Kuhns Bros. Log Homes, Inc., Appalachian Log Structures, and Sun Valley Log Homes, Inc., along with their contact information. Copyright information for the Log Homes Council is also present.

Questions?

For more information:

Log Homes Council
1-800-368-5242 x8577

www.loghomes.org