RESEARCH HIGHLIGHTS

Revised October 2002

Technical Series 02-116

WOOD USAGE IN STRAW BALE HOUSE CONSTRUCTION

Introduction

Straw bale houses are an increasingly popular form of construction. There are three major types of straw bale houses:

1. Post and beam: where the bales have no structural value but are used for insulation and wall surfaces
2. Modified post and beam: where the framing for windows and doors also supports the roof structure
3. Load-bearing (or Nebraska style): where the stuccoed bale walls support the roof, without additional framing.

There have been many claims made that the use of straw bales for house construction will result in less wood usage, and consequent environmental advantages. CMHC commissioned this small research project to see whether these claims could be substantiated. The house tested had load-bearing straw bale walls. This type of straw bale house offers potentially the greatest savings in wood usage when compared to stick-built housing.

Research Program

The builder of a straw bale structure kept track of all the wood used in the construction of his house, omitting the concrete forms (as they were reused by the forming contractor) and finishing material (as it would be comparable to that of conventional housing). The house was constructed in southern Ontario. The builder then simulated a conventional house of similar interior dimensions and then totaled all the wood usage on that structure. The conventional house had walls of 2"x 6" construction, with oriented strand board (OSB) on the outside and drywall on the inside. The straw bale walls were stuccoed on both sides. The straw bale house had a larger roof area, partly as the straw bale walls were significantly thicker than conventional walls, and partly because straw bale house design specifies significant roof overhangs to protect the exterior walls from rain. Roof systems were similar for both houses, with metal roofing on strapping over trusses.

Note that the house as constructed had no interior partitions. Houses with many separate rooms would use a considerable amount of additional wood for interior framing, in both the straw bale house and simulated conventional house.

Findings

The research showed that the equivalent stick-built house used about 50 per cent more wood than this load-bearing straw bale house. See the table below. Dimensional lumber refers to framing members such as 2"x 4" and 2"x 6". Engineered lumber includes the OSB panels and the engineered joists.

	Total lumber used (m^3)	Lumber used in roof system (m^3)	Lumber used in wall system (m^3)	Dimensional lumber use (m^3)	Engineered lumber use (m^3)
Straw bale	3.65	2.16	1.49	3.08	0.58
Stick frame	5.39	1.94	3.45	3.93	1.46
Increase in wood use (stick compared to straw)	1.74	-0.22	1.96	0.85	0.88
Per cent increase	47.5%	-10.2%	131%	27.6%	154%

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Implications for Builders or Home Owners

This study supports the claim that straw bale structures can save lumber over conventional stick frame buildings. A stick frame building of equivalent interior size and style would have required 47.5 per cent more lumber than the bale building constructed.

This study compared lumber use for only one style of straw bale building—the one likely using the least amount of lumber. A timber frame or modified post-and-beam straw bale building will certainly require more lumber than the load bearing straw bale structure that was built. Most houses will be divided into many interior rooms, with a consequent increase in the amount of wood used. If we were to compare wood use for houses with many interior rooms, the decrease in straw bale house wood use would probably be more in the range of 20-40 per cent.

For the straw bale building, 60 per cent of the lumber used was in the roof system. In comparison, the roof system in the stick frame simulation accounted for 36 per cent of lumber use. This suggests that further benefits could be realized by building up, rather than out.

Modern designs ensure that the roof plate distributes the roof load to the foundation vertically through the plaster, not the bales. Once the roof plate is compressed, and plaster is installed, any further roof load will be transferred to the foundation via the stucco skins. As such, there may be some efficiencies possible for roof plate construction.

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Housing Research at CMHC

Under Part IX of the *National Housing Act*, the Government of Canada provides funds to CMHC to conduct research into the social, economic and technical aspects of housing and related fields, and to undertake the publishing and distribution of the results of this research.

This fact sheet is one of a series intended to inform you of the nature and scope of CMHC's research.

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