Prefabricated Straw Bale Walls: SFI SIPs

Affordable, Sustainable Construction
How Do Bale Walls Work?

- Bale walls operate as a stressed skin panel, with two skins of strong, brittle plaster bonded to the dense, insulative straw.
Q: Won’t the big bad wolf be able to blow this house down?

A: “Both walls tested withstood the maximum static air pressure that was applied, representing a significant wind of over 134 mph (60m/s).”*

*ASTM E72 80 transverse load testing of load-bearing straw bale walls, Building Research Centre of the University of New South Wales, Australia, 1998

Load bearing, two story home. Karen Soltan, Peterborough, On.
Q: Are these walls strong enough to hold up a roof? What about a second story?

A: “Two-string bale walls average an ultimate strength of 6156 pounds per lineal foot, exceeding ASTM E72 requirements.”*

*ASTM E72 compression test of plastered straw bale walls, University of Colorado at Boulder, 1999

Testing of an earth-plastered, load-bearing straw bale wall at Queen’s University, 2005
Q: Won’t these walls rack or twist?

A: “In both racking tests, the 10kN (2,248 lb/ft) horizontal load at the top corner of the wall produced small deflections of slightly more than 2mm. The material’s performance under racking load would be considered acceptable.”

*ASTM E72 racking test of plastered straw bale walls, Building Research Centre at the University of New South Wales
Q: Won’t these walls be easy to burn?

A: “Bale walls withstood temperatures up to 1,850°F for two hours.”*

“The bale panel was tested for over two hours and withstood temperatures that reached 1942°F. The temperature rise on the unheated side averaged less than 10°F.”**

*Fire safety tests, National Research Council of Canada
**ASTM E-119 Fire Test, SHB Agra, New Mexico, USA, 1993
Q: What is the insulation value of a straw bale wall?

A: “The R-value varied from 30 to 40. The R-value of the straw bale walls is in the range of super efficient homes.”

A: “A straw bale wall has R-enough.”

*Canadian Society of Agricultural Engineers, Nova Scotia, Canada
** Pete Fust, straw bale philosopher, Kingston, New Mexico
Q: Will a bale home be less expensive to heat?

A: “Straw bale construction, along with appropriate building conservation technologies and simple passive solar design, could provide up to a 60% reduction in building heating loads over current practice.”

*US Department of Energy (DOE) straw bale assessment program, 1995
Q: Won’t a bale home be likely to rot or mold?

A: “Straw bale walls do not exhibit any unique propensity for moisture retention. It is clear that straw bale walls can function, without incorporating an interior vapor barrier, in northern climates.”*

*Strawbale Moisture Monitoring Report, submitted to the Canada Mortgage and Housing Corporation (CMHC) by Rob Jolly, 2000
Q: Can straw bale techniques really make a difference to the environment?

A: “The embodied energy for the conventional frame house was 509,000 KBtus. The embodied energy for the low impact straw bale house is 41,000 KBtus, or about one twelfth that of the frame house.”

What Does This Mean?

• The construction of the average (2000 square foot) home uses the same amount of energy as it would take to drive around the world 20.5 times (16,950 gallons of gas) or to supply a home with electricity for 16 years (150,000kw/h)!

• The sustainable home uses the equivalent fuel to drive around the world 1.65 times (1,365 gallons of gas) or 1.3 years worth of electricity (12,000kw/h)!
With All These Positives, Why *Not* Straw Bale?

- Retraining of designers & builders
- Sourcing of materials
- Messy work on site (loose straw, plaster mixing)
- Skilled plasterers and commercial pumps expensive and rare
- Weather concerns (rain and freezing prevent construction)
- Site-built walls require skill to get straight, flat and square
Why Prefab Straw Bale?

• Significantly lower labour costs by eliminating skilled plastering… horizontal pour in one coat, not vertical troweling in three coats
• Eliminates weather concerns during construction… load-bearing walls with very low lumber use are not problematic
• Straight and square walls guaranteed
• Source of straw more predictable
• Controlled curing of plasters
• Builders and developers can buy walls, not retrain crews to build them
• Public domain process lends itself to small, micro-factories
How to MakePrefab Bale Walls

• Frame components are assembled, including sill plate, top plate, sides (may be temporary or permanent) and temporary backing.
• Frame created on shop floor
  – Permanent top and bottom plates
  – Sides may be temporary or permanent
  – Jigs optional
Plaster is poured into jig

[Images of people working with plaster in a construction setting]
Bales are “buttered” to ensure strong bond with plaster in form
Bales are placed into plaster
Plaster is poured on top
Plaster is screeded and finished
Panels cure for seven days
Cured panels loaded on boom truck
Delivered panels are installed on foundation
Window and door openings are framed on site
Roof is installed on bale walls

We build our roofs on the ground and crane them into place. Roofs could be conventionally framed on the prefab walls.
Finished walls can be finished in many ways

Paints, trims and wall treatments are up to the designer/client
Exterior walls can be finished in many ways
The Financial Picture

• Fleming projects have been completed at $10-12 per square foot of wall, assuming a $15/hr pay rate for those assembling the panels. This includes boom truck rental, travel/delivery (up to 250km) and on-site framing.

• This compares very well with conventional framing ($18-20/sf), and extremely well with closer competitors like ICF and conventional SIPs ($22-25/sf).
For more information:

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