



# Space saver straw bale walls

*a.k.a. skinny straw walls*

BY IAIN REDFERN

*In this short article, I will describe the background and construction of thin section plaster on straw filled stud framed walls. The construction methods have been refined following discussions with and observations of owner builders who have used this technique.*

We specialise in non-loadbearing straw structures finished with lime plaster. By completing the roof before baling of the walls, work may continue regardless of our unpredictable climate. This provides a dry place to store and work with the straw, a more comfortable working environment for the owner builders, and a perimeter from which to secure the wind screens when lime plastering. Infill straw bale walls (both full bale width and skinny walls) do not rely on the straw itself to contribute to the structural integrity of the building for structural engineering purposes.

Unfortunately, straw bales are still perceived to be far less durable than timber. By using them in a non-loadbearing situation, as units of panels that can be fairly easily replaced without the need to dismantle the structure, this enables a lesser durability requirement to be applied. In turn, this reduces the requirement for components to perform without decay or loss of strength from a 'not less than fifty years' rating to a 'not less than five years' one, making it far easier to obtain building authority (shire) consents. *Ed note: this statement relates to the New Zealand building requirements.*

## Background

The idea behind the concept of skinny straw walls arose out of concern for the loss of usable space in straw bale homes where full width bale walls are used for internal walls. They have also been successfully used on the outside walls of garage and other non-habitable spaces where high levels of insulation are not as critical. Thin plastered straw walls enable a continuity of surface finish through the whole of the building i.e. the plaster system need not be interrupted by other materials.

## Design

The walls are specifically designed to use somewhat larger than usual timber (or steel) sizes at greater spacings – this allow us to show off some of the timber as architectural features, as well as saving on material usage. For skinny straw walls, which are often up to four metres high, we most commonly use 150x50mm studs at up

to 900mm centres (a structural engineer must confirm this is suitable for your building). The plaster is applied on netting that is fixed over the straw, giving a strong stable wall that muffles noise between bedrooms.

Typically doors and windows are taller than in most conventional homes (up to 2200mm high) to be in keeping with the more generously proportioned room sizes.

## Construction

Let us consider a typical skinny straw wall on a concrete slab, or set on a strip footing for the later installation of a suspended timber or poured earth floor on completion of the walls. Most of the accompanying photographs (overleaf) illustrate the technique as performed outdoors for a hands-on demonstration, and therefore do not follow through on some of the necessary steps.

Give it a try – you will be pleasantly surprised with the result!



## 'The Natural Plaster Book'

by

*Cedar Rose Quelberth & Dan Chiras*

This book provides much needed detailed information. It is highly recommended reading.

The book is available from the TOB Bookshop (see pg 64).

It was reviewed in TOB 144 (December 07/ January 08).

The review is also available on the TOB website.

**1** Studs (say 150x50mm @ 900mm centres) are fixed between top and bottom plates.

**2** If this is to be a bracing wall, to resist horizontal wind and earthquake forces, a pair of crossed metal strap braces are fixed from corner to corner (as close to forty five degrees as is practicable) on one side of the framing. Stuffing is much easier when the bracing is fixed on the less accessible side.

**3** Netting (galvanised netting 25mm hexagon x 1 mm wire diameter, or plastic fencing netting) is stapled off securely to the timber framing, the whole way up on the bracing or less accessible side. It must be stretched tight to give a keen surface for the plastering.

**4** On the working side, the first layer (900mm wide galvanised netting) is then stapled off keeping the netting tight. If using wider plastic netting, roll out the netting along the wall and fix off the first 8-900mm high, rolling the excess onto the floor; this should be fixed as taut as possible along the wall with final tightening done when stapling off along the top plate.



**5** Loose straw is then tightly stuffed into the gap between the two layers, until the netting begins to bulge (up to 50mm is okay). We have discovered that the softer straws, e.g. barley and oats, make for a much denser stuffing than wheat or rice straw. The harder straws may work better when crushed (trampled on) though we have no experience with this softening technique.



**6** Staple on the second layer of wire netting and tie the edges of both layers together, or roll up another 8-900 mm of the plastic netting and staple it off.



**7** Stuff this layer and repeat the process until you reach the top of the wall.

**8** Complete the netting by drawing it tight and stapling off onto the top plate. This works well, even for raked ceilings.

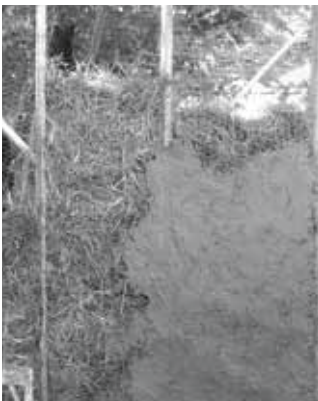
**9** Any slackness in the galvanised netting can be twitched tight, and bulges compressed by 'quilting' both layers of netting together using baling twine. A pair of baling needles is pushed through the straw wall about 75mm apart and the twine is threaded into the needles. The needles are withdrawn bringing the twine to the working side and are tied off. We use the parcel slipknot to be able to compress the wall the desired amount, before locking it off with a half hitch. For plastic netting, initial tensioning is achieved by tying several squares together with baling twine, then the quilting will also true up these walls.



**10** On one side, lightly mist the straw with a fine spray of water to wet the surface straw, but not soak through the full thickness of straw. This stops the straw from drawing the moisture out of the plaster, causing premature drying and loss of curing by preventing the proper carbonation of the lime plaster and resulting in a brittle scratch (or discovery) coat of low quality. An over spray of lime water (that free water found on the top of the lime putty barrel) just before plastering also helps slow down this unwanted drying.



**11** Prevent the newly plastered surface from drying out while it cures, which may take up to seven or ten days depending on local conditions, by frequently misting the surface with a fine spray of water. This misting must not form riverlets down the walls, which scour the lime out from the sands. Never use plastic to cover the walls, although dampened hessian cloth draped near the surface will reduce evaporation. As the scratch coat toughens up (gets firm) gently create a bonding pattern on the surface in a classic diagonal diamond pattern with a toothed wall rake.



**12** The 'other side' of the wall can be scratch plastered once the first coat on 'this side' has cured to an even white finish. You should be aiming to get an even 10–15mm coverage on the wall with this first coat.

**13** Trim off the excess stalks with an electric powered weed trimmer once the plaster has fully cured, rub a brick or concrete biscuit over the surface to remove dags of plaster, then brush or spray wash the wall down.

**14** Thoroughly dampen the surface with several passes of a fine misting spray, and start the brown (or middle) coat once the free water has soaked in i.e. the wall has lost its glisten. We prefer to lay the plaster on with a gloved hand using an upward sweep, thoroughly massaging this coat into the preceding one. The brown coat should be about 5–10mm thick. Any depressions should be filled with several thin layers of 'wadding' (straw-rich cob mix), which is better than one thicker layer. If several layers are required, apply a few layers each day until the surface is true. This layer must also be kept damp as it cures, in the same way the scratch coat is.

**15** The top (colour coat) layer is also laid up on a thoroughly dampened substrate, with a gloved hand, and may be finished off in any number of ways. When at the green (semi hard) stage, a very effective waterfall finish can be achieved with a soft kitchen broom being drawn down the wall. Although this initially appears to be quite rugged, it will be softened by the many coats (at least five) of whitewash added later.

**16** Apply whitewash on consecutive days (at the earliest). It will quickly harden to a non-dusting and wear-resisting surface. This hardening continues over years. ■

*Adobe South is a boutique architectural design studio devoted to designing sustainable, eco-healthy homes, especially in earthen and straw bale techniques, for more than a decade. Their homes are amongst the earliest straw bale homes in northern New Zealand and the author has presented at many workshops including the International Straw Bale Building Conference at Wagga Wagga, Australia; and Camp Kawartha, Ontario, Canada. 09 430 2020, [www.adobesouth.co.nz](http://www.adobesouth.co.nz)*



Useful TOB back issues relating to this article are: TOB 97 & 98 – Lime and it's uses in building; TOB 118 – Earthen plasters; TOB 138 – Light straw clay.

### Note

- Straw can withstand several wettings as long as it thoroughly dries out in a reasonable time (days not weeks)
- Lime based plaster (or gritty earthen plaster) is made up with a generous portion of fibre
- The addition of chaff (very short straw) will help control the amount of plaster that oozes through the netting, providing enough friction to lock onto the netting without filling the straw stuffing. Other fibres may be used e.g. modern short polyester used in concrete work, horse hair (most other animal hairs are too smooth and are not as durable)
- Loose stalks will stick through this layer giving a very whiskered and rough look – do not worry, the excess can be trimmed off with a weed trimmer once the plaster has cured
- A wall rake may be made by driving panel pins through the flat of an old paint brush head to give tynes about 12 mm long at about 25 mm centres
- **Coats and their names:** first coat – base coat, scratch coat, or discovery coat; second coat – brown coat or infill coat; third coat – finish coat, final coat, or colour coat