Low-Cost Construction Techniques For Earth Keepers

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Introduction

Straw has been used as a building material by many cultures for many centuries. In the Old Testament we read about the Israelites using straw and mud to construct monuments for the Egyptian rulers. Use of mud and straw mixtures to build walls is still prevalent in Africa, Middle East, Asia, and China. Straw has been a standard material used for roofs by many cultures and even today in Ireland and Scandinavian countries one can see thatched roofs in rural areas.

The Construction Techniques described in this manual use straw as filler in wall sections. It further describes how one need not have to bale the straw to use it for wall construction. Straw-bale construction started at the turn of the century when John Deer invented a straw baling machine and the pioneers in the Northwestern part of Nebraska started to use straw bales as construction materials. Even today one can find houses built with straw bale and plastered with cement standing in Nebraska.

The author used the techniques described in this manual to build plasteredd straw structures in Indea and Pennsylvania. The pictures in the following pages should provide sutfficient information for anyone to construct a low-cost, earth-friendly building using straw as building material for the walls.

One can find a number of web sites on te Internet that profvide valuable information on owner built and conventionally built straw bale houses. These houses are found to be comfortable as they damp out noises and have a high R-Values that far exceeds the code requirements. They are also safe as far as fire is concerned. Tests conducted by Underwriters Laboratory and other National Laboratories found the fire ratings of the plastered straw bale walls to be well above the requirements. There have been no reporting of termite infestation or other insect damages to the plastered straw bale walls.

The author estimates that a plastered straw house in Indea costs one-fourth of a brick and mortar house and keeps the inside temperature 10 to 15 deg. F below the summer outside temperature. It was also noticed that these houses could be built with very little skill by the owners themselves and therefore, results in considerable savings to the owner builder.

Post and Beam Straw Construction Technique (Technique 1)

(Non-Load Bearing Straw Walls)

Step 1. Lay the foundation for this building using standard methods. As the walls are not load bearing, a concrete foundation of 6 inches depth is sufficient. Dig at least 24 inches holes to set the treated poles and pour concrete for strength and stability.

Step 2. Build the frame work as shown in the photograph below. Fasten rigid fence material (not chicken wire) to the posts and create a 9 inches to 12 inches cavities.

Step 3. Fill the cavities with straw or other waste materials like carpet padding, shredded paper, and styrofoam packaging materials.

Step 4. Plaster the inside and outside of the walls with mud dug from the foundation and let it dry for a couple of days.

Step 5. Plaster the walls with cement and sand mixture (1 part of cement to 5 parts of sand). Paint the walls with desired color paint.

Pre-fabricated Wall Panels
(Technique 2)

Step 1. Make a 3'x5' (the wonder boards come in 3'x5' size) frame using 2"x6" lumber.

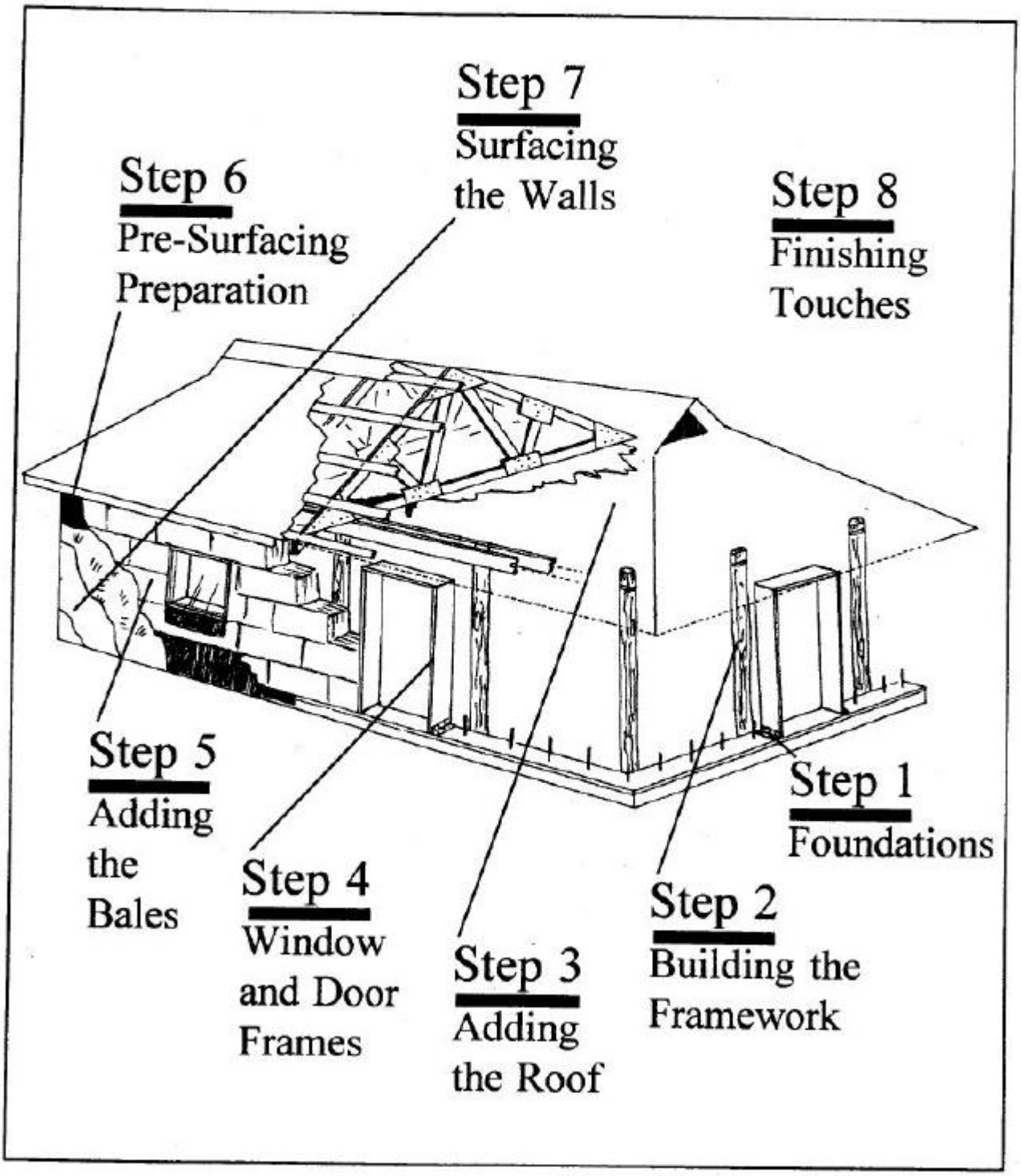
Step 2. Fasten the wonder board to one side of the 3'x5' wooden frame.

Step 3. Fill the cavity with loose straw, carpet padding, shredded paper, or styrofoam package materials.

Step 4. Cover the exposed side with another 3'x5' wonder board using appropriate screws.

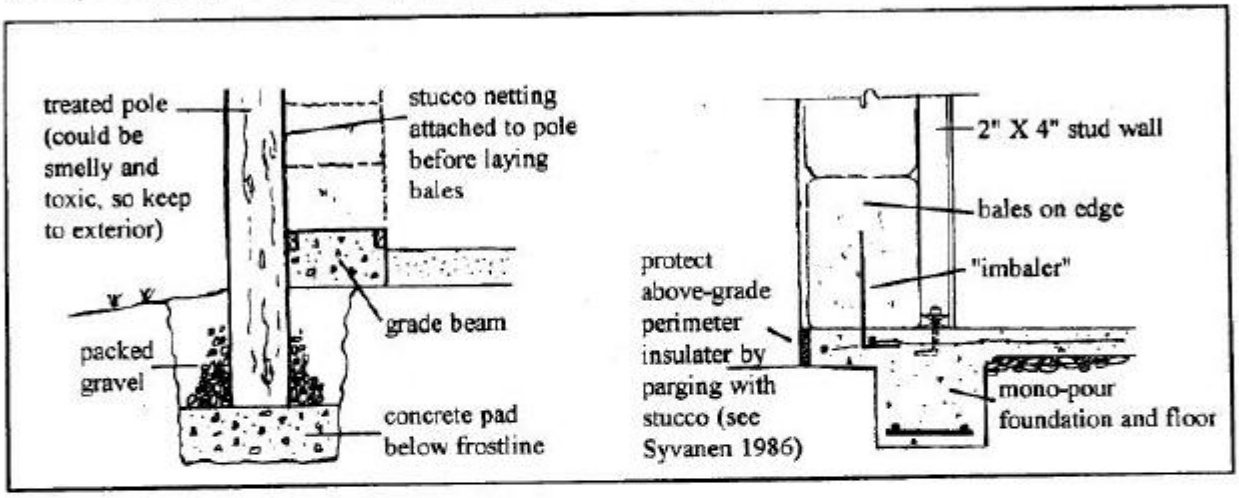
Step 5. Use pre-fabricated panels to build walls. Different sizes of panels are required near door and window openings. Conventional roof methods were used to complete the building.

The Non-Loadbearing Option



Step 1. Foundations

Challenge: basically the same as in a design with loadbearing walls. The details differ, however, since the roof weight is now transmitted to the foundations by some kind of framework. If the framework involves widely spaced vertical posts, the foundations must be designed to handle the concentrated loads transferred at these points. The foundation must also properly elevate and carry the bale walls.



Step 2. Building the Framework

Challenge: to create a rigid, loadbearing framework to carry the roof weight and transfer it to the foundation. It should safely resist any horizontal (aka lateral) loads from wind or earthquakes. Multi-story structures become easily possible.

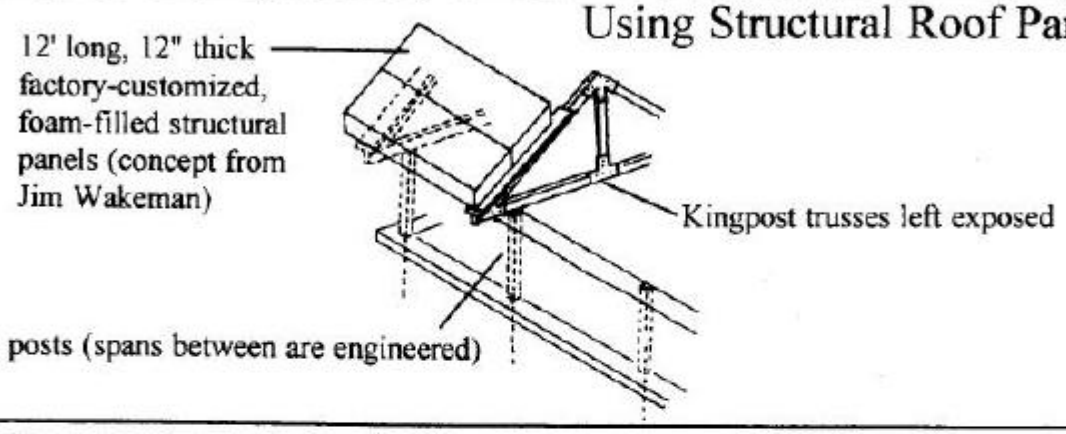
Possibilities for Loadbearing Frameworks

The possibilities run the gamut, from structural bamboo (a grass like straw), to traditional wooden frames (studs, timbers, poles, etc.), to steel posts topped with glue-laminated beams, to thin masonry walls or panels. Most of these techniques are widely used and information on their "how to" is readily available. Recommended resources include Sherwood and Stroh (1992) and Wahlfeldt (1988) for wood frame; Benson (1990) for timber frame; NRAES (1984), Kern (1981), and Wolfe (1993) for post and pole.

Step 3. Adding the Roof

Challenge: basically the same as in the loadbearing option, although the use of a non-compressible framework does release you from some of the floor plan and roof weight constraints imposed when the walls are loadbearing.

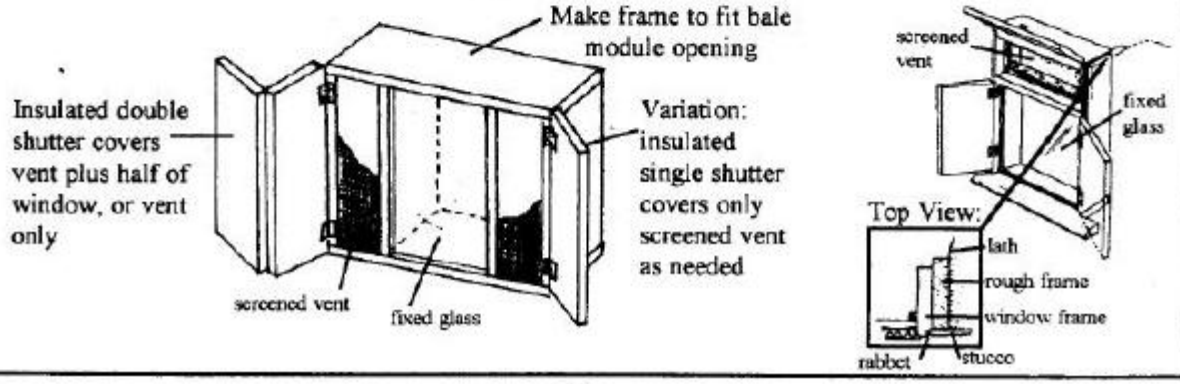
Using Structural Roof Panels



Step 4. Window and Door Frames

Challenge: the same as for a loadbearing design. However, since no portion of the roof load is carried by the frames in a non-loadbearing design, and since all the needed wall rigidity can be built into the framework, there is freedom to make the openings larger and/or more numerous. The perceived desirability of this must be balanced against the relatively low R-value of doors and windows (even in the most expensive, high-tech models), and their effects on the performance of your superinsulated building.

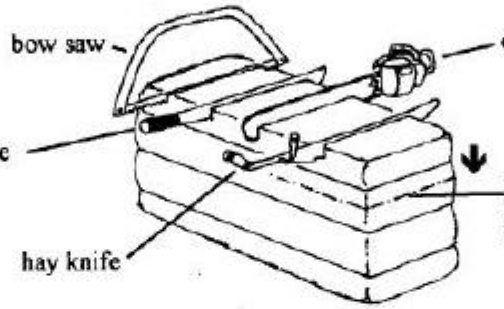
Homemade, Double-pane, Fixed Glass Windows



Step 5. Adding the Bales

Challenge: similar to that with loadbearing walls, but the job of maintaining verticality as one stacks the bales is made much easier by the presence of the framework. On the other hand, you have the added task of fastening the walls to the framework. For certain designs, the bales must be notched to receive the posts.

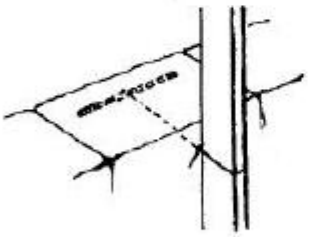
Tools for Cutting Notches



Not illustrated: 4" grinder with Lancelot cutter blade

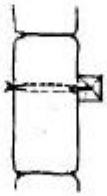
Attaching to the Framework

Many approaches have been used. Use your creativity.

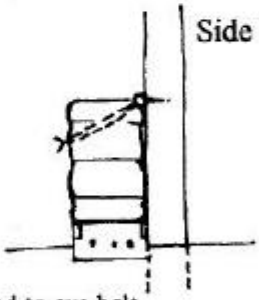


rebar stub wired to frame

Top View:

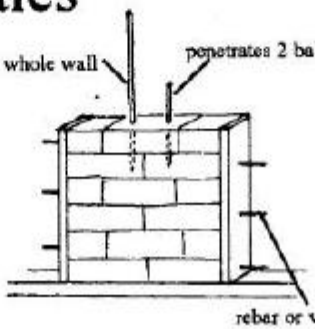


Side View:



bales wired to eye bolt

Pinning the Bales



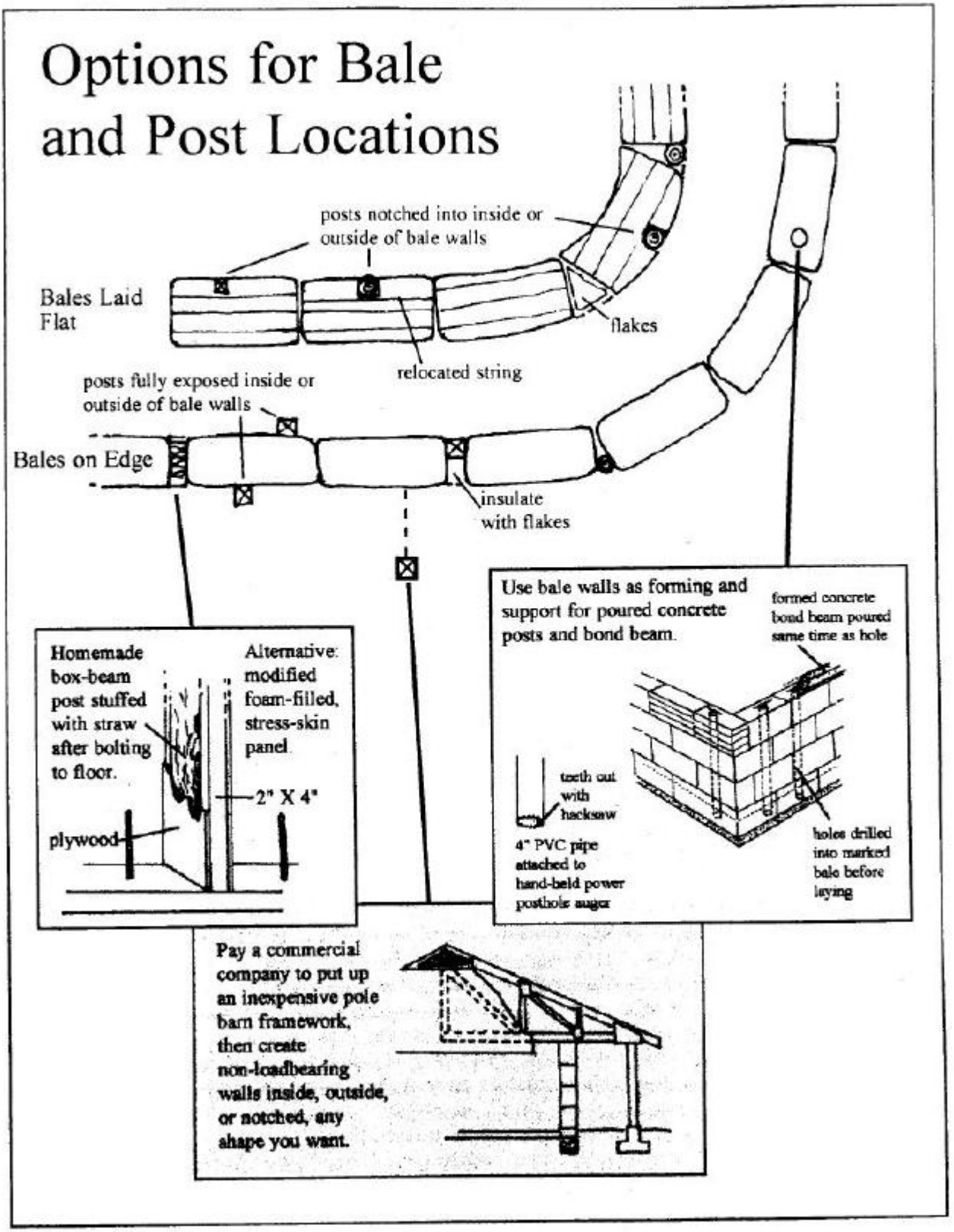
First Option:

1. attach box-posts to foundation
2. insert all bales
3. drive long pins, 2 per bale
4. install roof beam

Second Option:

1. drive two short pins per bale, starting with the 2nd course
2. finish wall
3. install roof beam

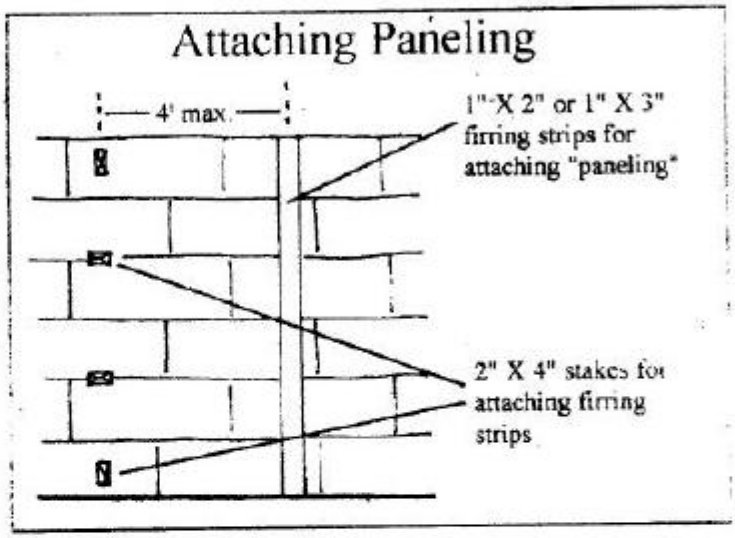
Options for Bale and Post Locations



Step 6. Pre-Surfacing Preparation

Challenge: to accomplish any task that needs to proceed surfacing the walls, as dictated by the surfacing material chosen, decisions about use of moisture barriers, reinforcement, etc.

The techniques are the same as used in preparing loadbearing walls for surfacing, except that, in some cases, you will have vertical "posts" to attach wire reinforcement to



Step 7. Surfacing the Walls

Challenge: same challenge, same considerations, same options as with loadbearing walls.

Step 8. Finishing Touches

Challenge: same as with loadbearing, including resisting the temptation to move in until the interior is really completed. Once you're moved in, life has a way of providing what seem to be higher priorities than getting that mortician-gray concrete floor stained and waxed, or caulking and painting in the bedroom (nobody but you sees it anyway, right?). Reconfirm your wedding vows, if any; your relationship has survived a formidable test!