

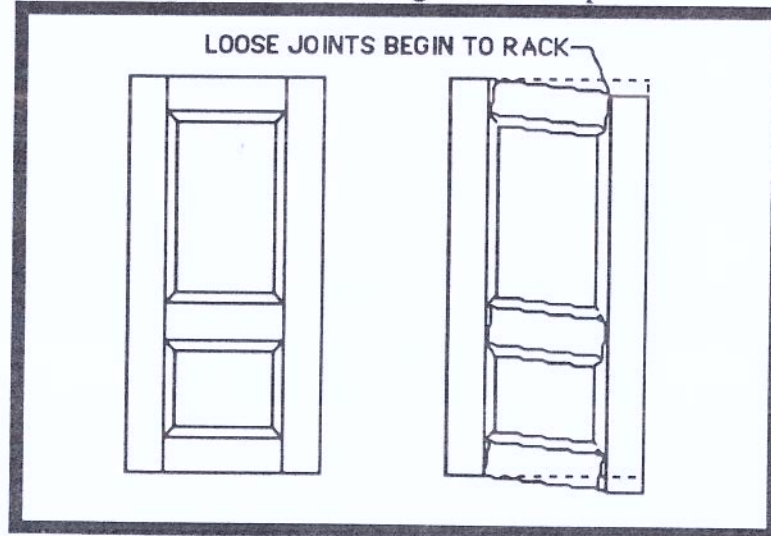
9. DOORS AND CABINETS

C O M P O N E N T S

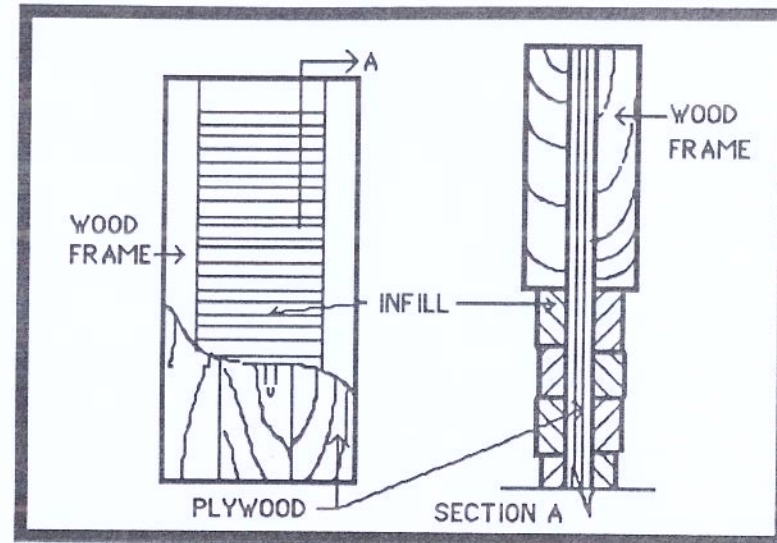
THE SAME BASIC GUIDELINES OF SIMPLICITY, ECONOMY, AND DURABILITY THAT DICTATE THE DESIGN OF THE EARTHSHIP, ALSO APPLY TO THE DESIGN OF EARTHSHIP DOORS AND CABINETS. EACH EARTHSHIP IS FUNDAMENTALLY SIMILAR IN CONCEPT AND GENERAL DESIGN FORMULA, BUT DIFFERENT IN THE FINAL CUSTOM EXECUTION. THIS IS ALSO TRUE OF THE DOOR AND CABINET WORK OF EARTHSHIPS. THEY ARE SIMILAR IN PRINCIPLE YET OPEN TO INDIVIDUAL INTERPRETATION, EXPERIMENTATION AND PERSONAL TASTE. LIKE THE EARTHSHIP ITSELF, THE DOORS AND CABINETS REQUIRE ONLY BASIC TOOLS AND SKILLS THUS MAKING THEM MORE DIRECTLY AVAILABLE TO MORE PEOPLE.

DOOR CONCEPT

Much of today's housing has light, hollow core doors that you can put your foot or fist through. They are cheap and do the job but they are bland and do not shut out much sound. Conventional solid doors are expensive and usually involve major skills and equipment to make. They depend on glue and complicated joints to keep them solid. Still, over time, many doors loosen up and begin to rack or sag and fall apart.



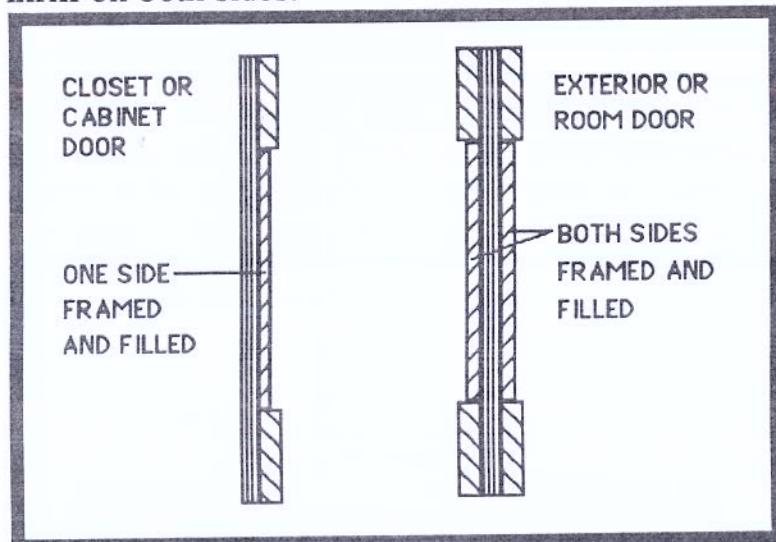
Earthship doors have a plywood core which acts as a solid, structural diaphragm. A wood frame and infill is then installed on either or both visible sides of the diaphragm.



The sandwiched plywood diaphragm makes for an extremely strong door that will never droop or sag and can be filled with almost any material that the maker wishes. Part of the original concept of these doors was to use up various wood scraps from the construction site in the middle infill areas. There are no special tools or skills, such as those involved in dado cuts, tongue and groove, etc., needed to make these doors. The main ingredient, plywood, can be found in any hardware store. These doors are among the most solid, sensible and uniquely beautiful you will see anywhere. They require only a measuring tape, hammer, square and a conventional skill saw.

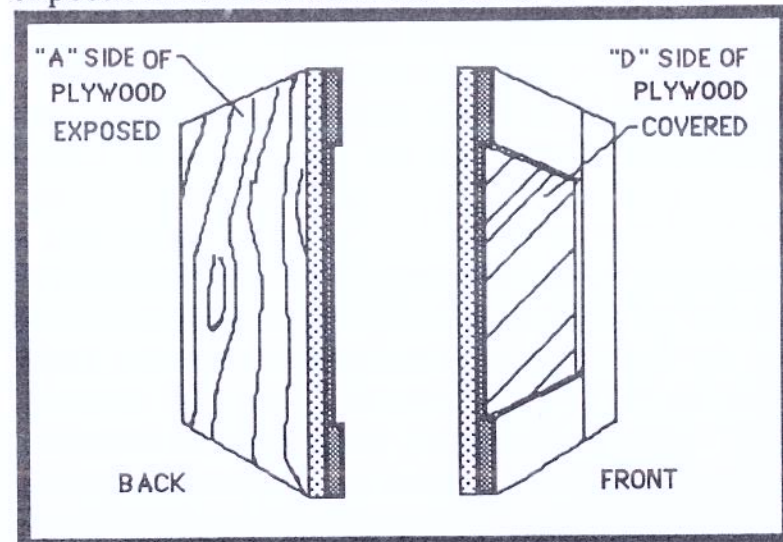
TYPES OF DOORS

This chapter will discuss four different door types: exterior, interior, cabinet and closet doors. All are similar in design but different in detail. The four types of doors are different in their functions, how they are built and how many sides are covered with decoration - one or both. Whereas closet and cabinet doors need only one finished face, exterior and interior room doors usually have a wooden border and decorative infill on both sides.



Closet and cabinet doors will require "A" grade plywood on the exposed side. On exterior and room doors both sides of the plywood will be covered so you can use "CD" plywood. Plywood comes in grades as per the quality of the surfaces. "AD" plywood has one good side, "A" and one rough side, "D". This type of plywood is used

for closet and cabinet doors with the "A" side exposed on the inside of the closet or cabinet.



"CD" plywood has two rough sides, the "C" side being slightly better than the other. This plywood is cheaper and used for exterior and interior room doors as they are covered both sides.

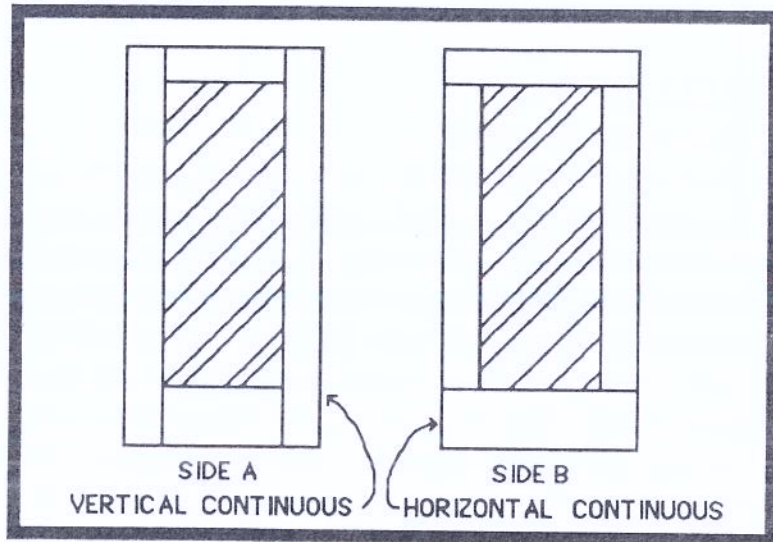
CONSTRUCTION

EXTERIOR DOORS

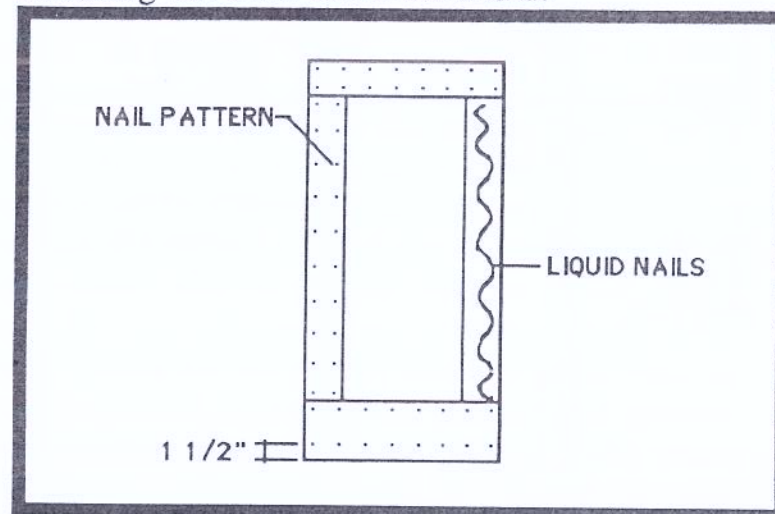
The first step in the construction of any door is to lay a suitable piece of $\frac{5}{8}$ " plywood against the jamb and trace the opening directly on to the surface of the plywood. Make sure the plywood is pushed tightly against the jamb on all sides as this will determine the width and height of the finished door. Since most jambs (door frames) are rarely perfectly square, this procedure of tracing and fitting the door to the jamb is

important. It makes the eventual hanging of the door easier. Label both sides of the plywood. Once you have cut out the plywood diaphragm and checked its fit to the jamb, you can begin to cut and fit the border on to it.

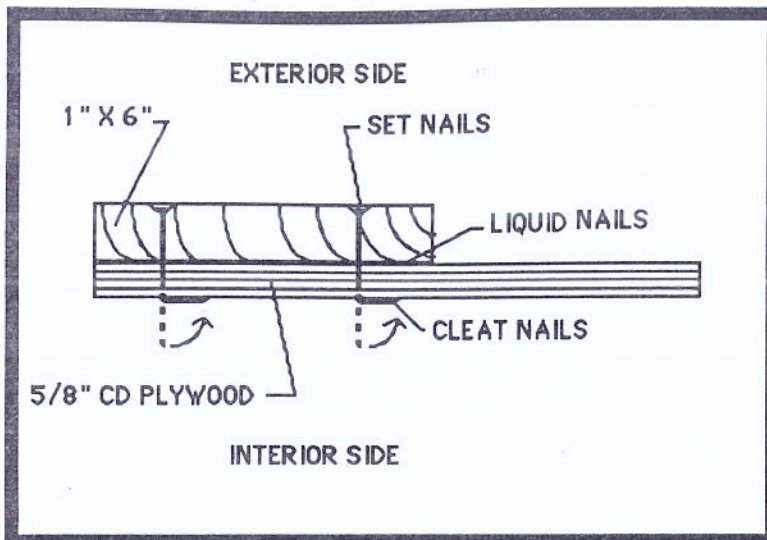
The border is made of 1"x 6" pine, nailed and glued around the perimeter of the plywood core. The bottom piece is 1"x 12" for more durability. This work should be done horizontally on a flat and level work table to insure flatness and ease of construction. This is also done to insure that the door is not constructed in a warped position as it will stay that way. The two vertical border pieces should run flush and continuous from the very top to the very bottom of the door on one side and the horizontal pieces should be continuous on the other side.



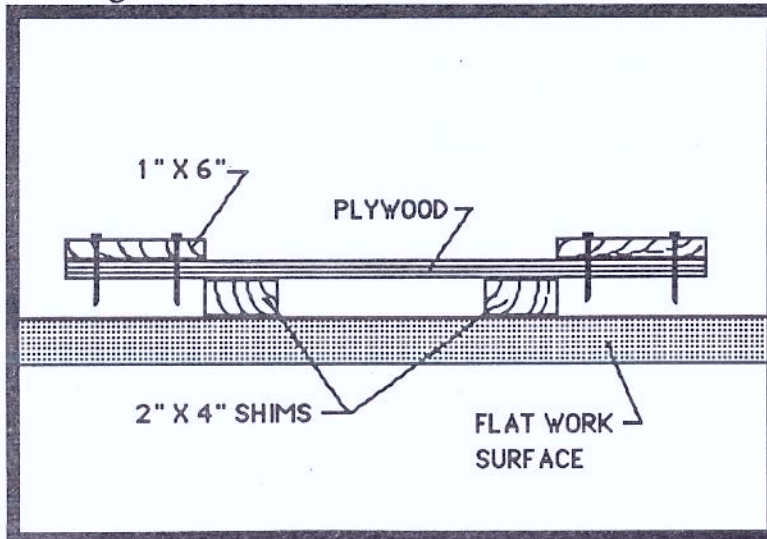
This is to avoid the same joint location on both sides of the door making a weak spot. The remaining horizontal and vertical borders should fit between and flush to the continuous borders around the door. The borders of both sides of the door are usually completed first and the infill added later. An exterior door begins with the installation of the outside border. 4d nails are used in a pattern to nail these borders on. Keep the nails 1 1/2" off the bottom to allow for trimming the door for a threshold.



In addition to the 4d nails, use any good exterior carpenters glue or Liquid nails (a type of glue). The 4d nails are spaced a maximum of 8" apart on the exterior to keep the wood from cupping with weather abuse. They are then set and cleated (bent over) to cinch the exterior boards to the plywood in a way that weather abuse can have little effect.



Start the exterior side first. The plywood should be set up on a flat work table with 2x4 shims under it to allow the nails to extend through for cleating. Set them first and then cleat them.

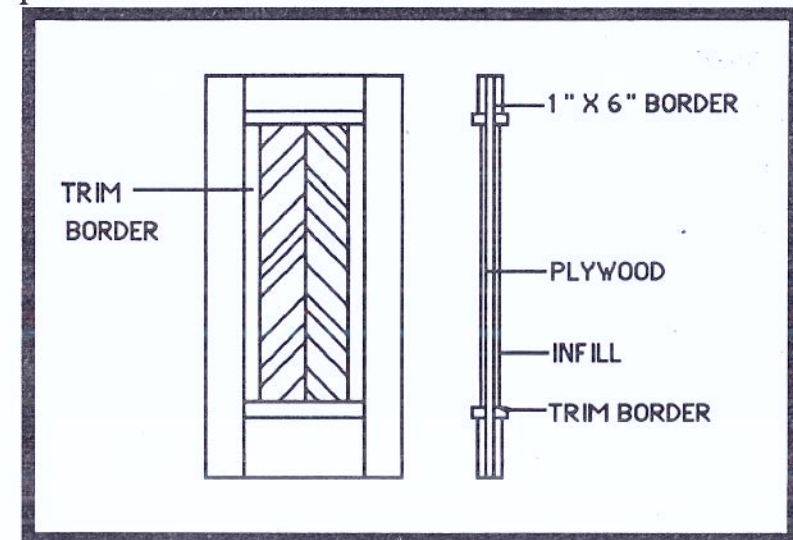


After the exterior wood border has been installed,

flip the door over, cleat the nails and install the border on the opposite side. Remember to run the joints the opposite of how they are on the outside (see diagram previous page). The nails on the inside can't be cleated but remember to use liquid nails or glue. Set the nails in with a nail set. Now you are ready for the infill work.

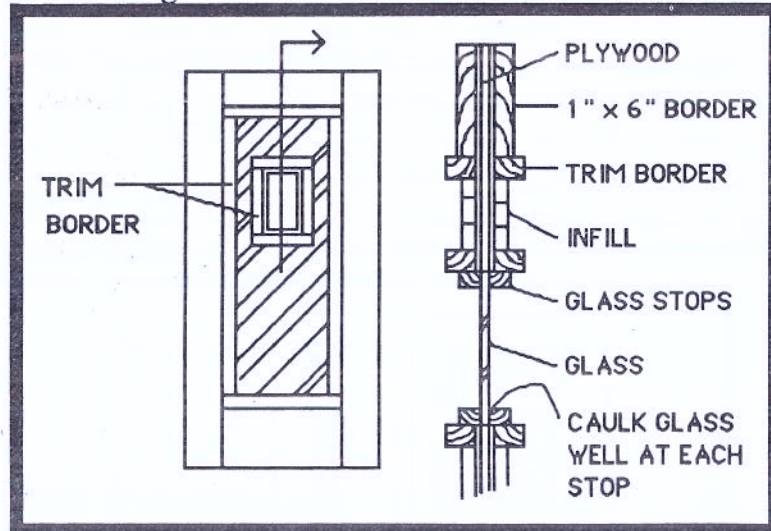
All the infill work follows the same procedure. Do the outside first. Glue the pieces then set and cleat the nails. Then do the inside and set the nails. It is a good idea to cut and fit all the infill pieces before nailing or gluing any of them. This way your patterns will come out exactly how you want before they are attached.

Sometimes a thick border to frame your "center piece" works well.

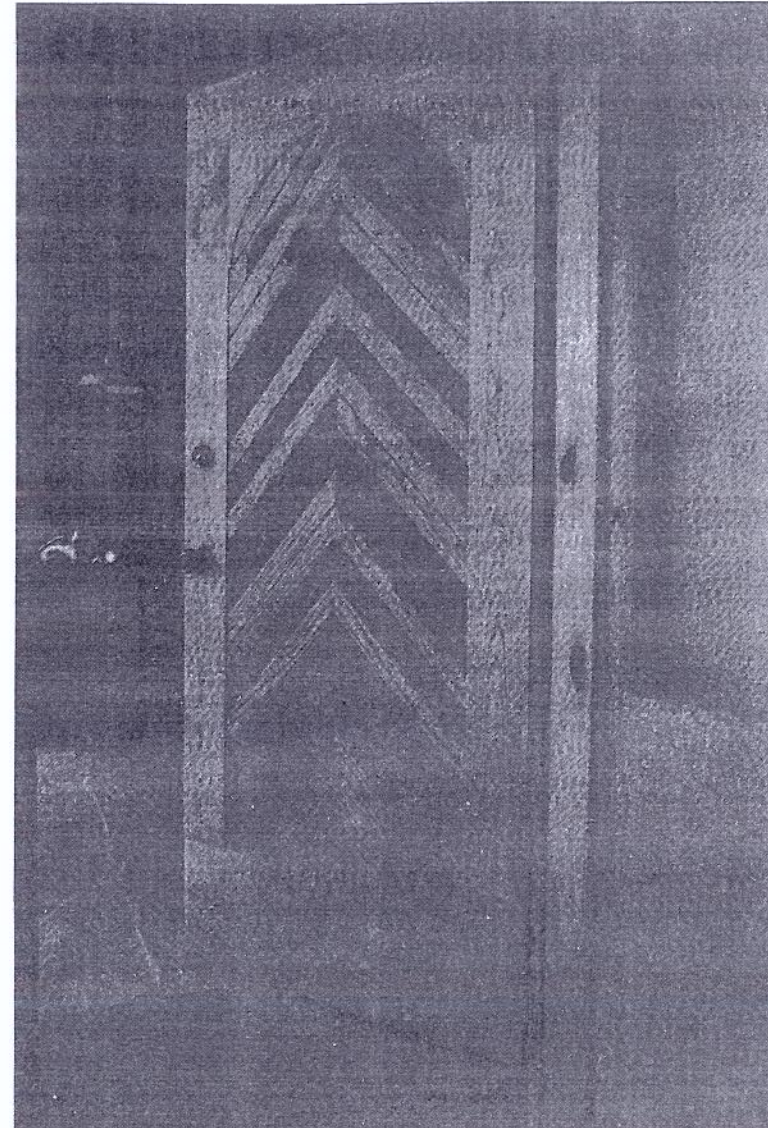


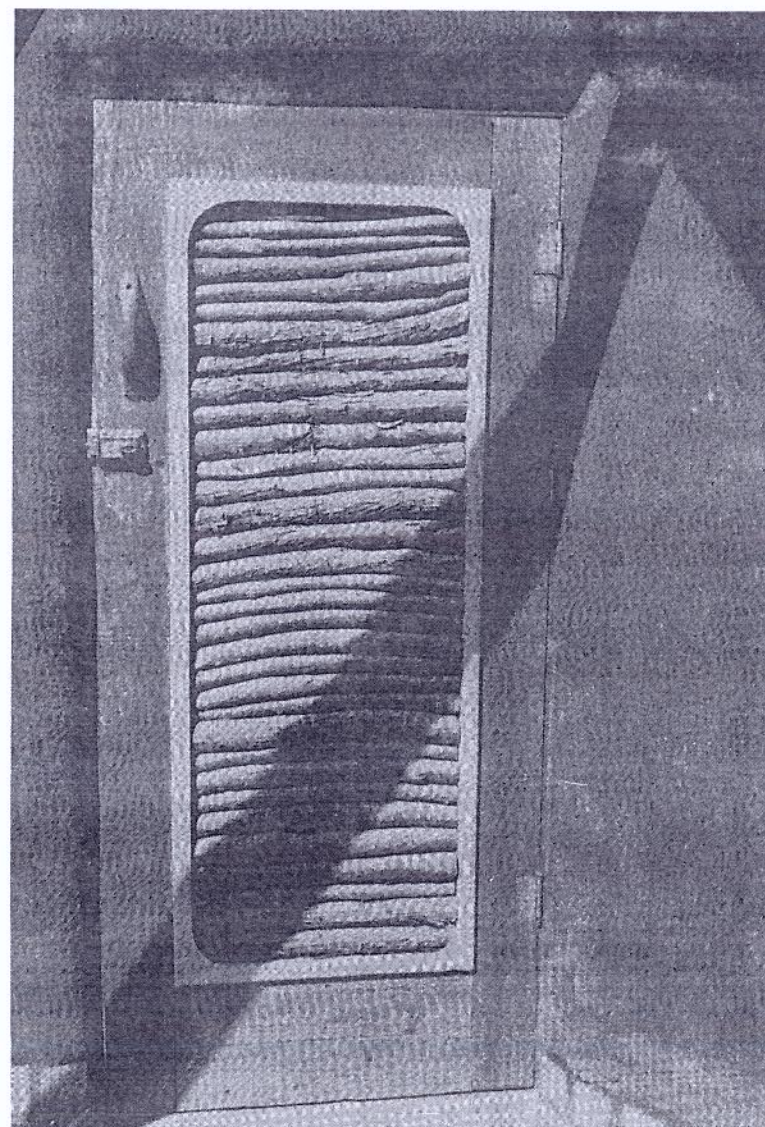
The infill patterns can be anything you can dream up. We have used willow reeds, small aspen poles ripped in half, scrap lumber, etc.

Windows can be added by simply cutting a hole in the plywood the shape of the window you want and trimming out the window as part of the design. Glass is held in with stops both sides just like a regular window. Be sure to seat the glass well in silicone caulk as the door slamming can cause the glass to rattle if it is not seated well.



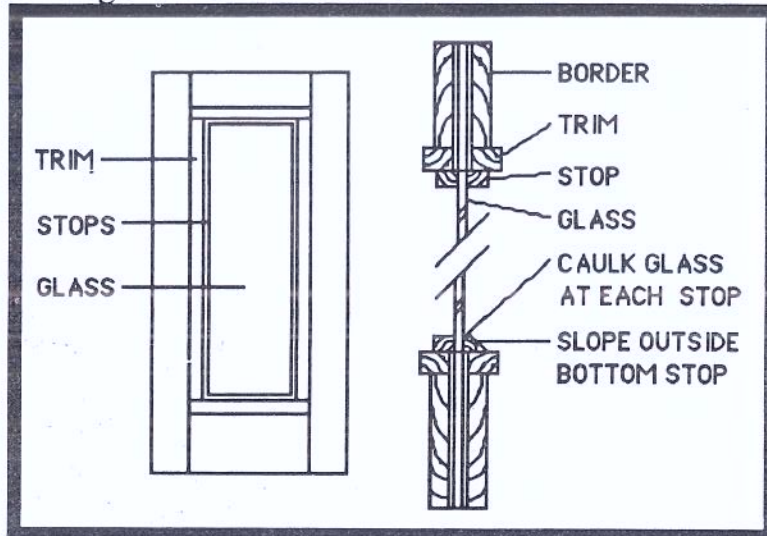
Following are some examples of exterior doors.





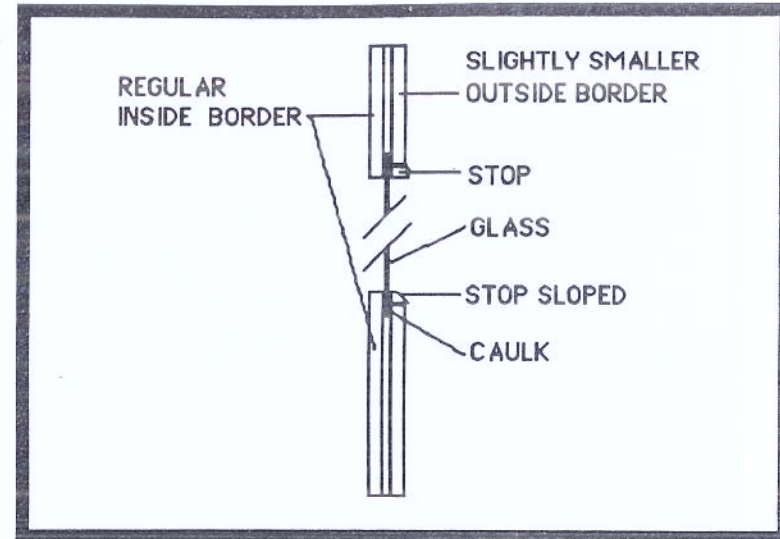
Glass Exterior Doors

Glass exterior doors follow all the same procedures. However there are a few detailing options. One way is to detail large glass just like small glass.

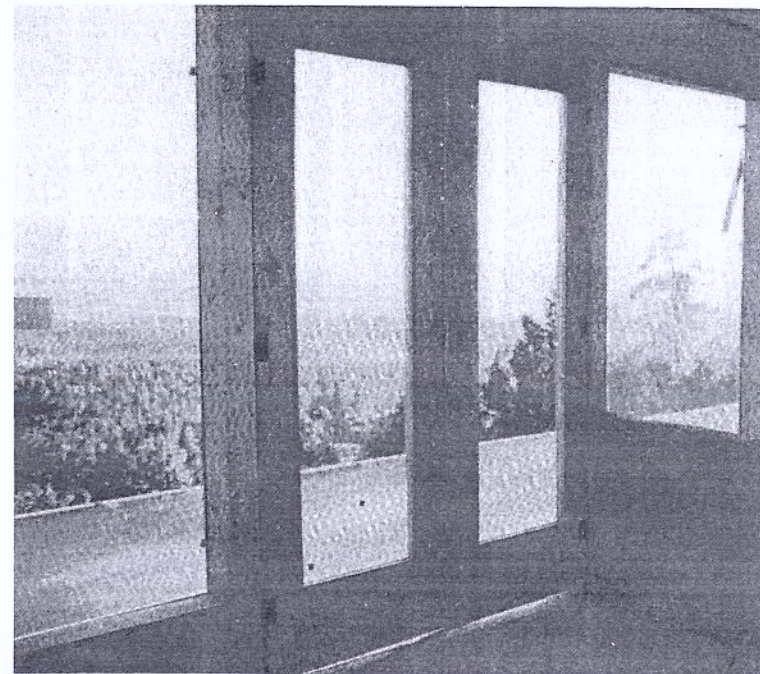


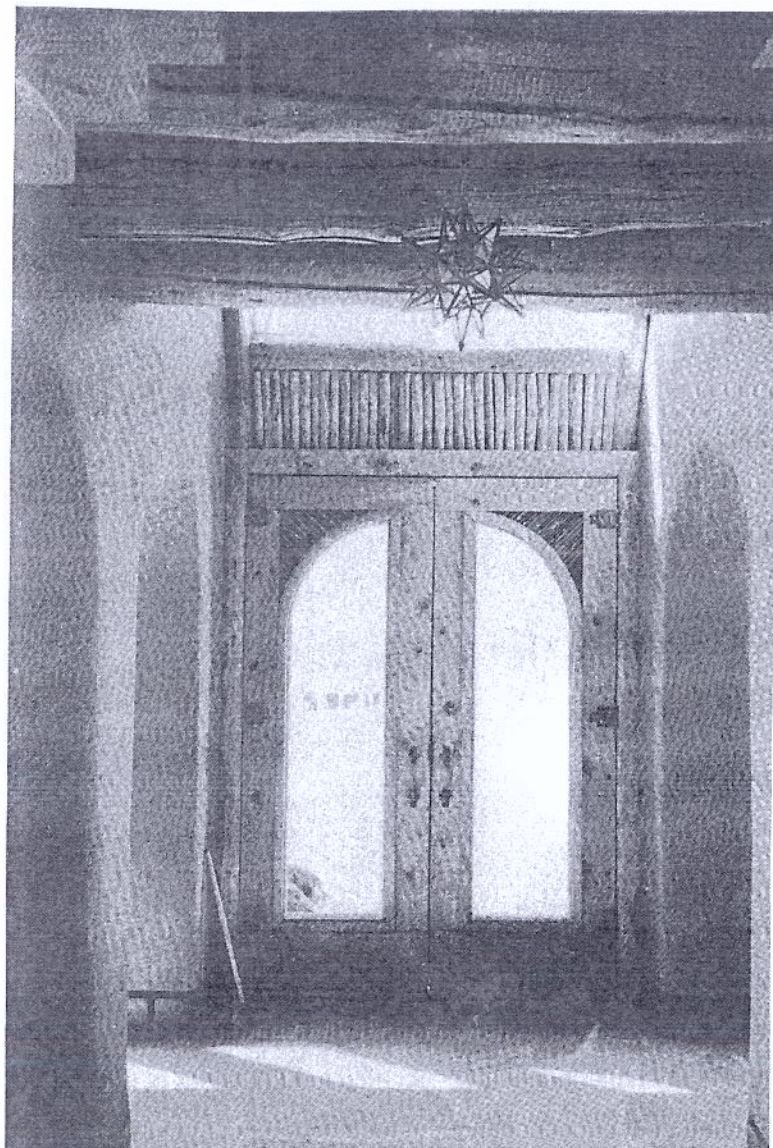
Always seat the glass in a generous caulk bead to avoid rattling. The outside bottom stop should be sloped for water runoff. Caulk the stops against the glass as you install them. The stops are tacked in with small, 3d finish nails.

Another exterior glass door detail incorporates the border 1"x 6" pieces as the stops on the inside. The outside is then stopped with 3/4" x 3/4" stops. Be sure to seat the glass in caulk. Glass doors can be as elaborate as your imagination allows based on this theme.



Following are some examples of glass doors.



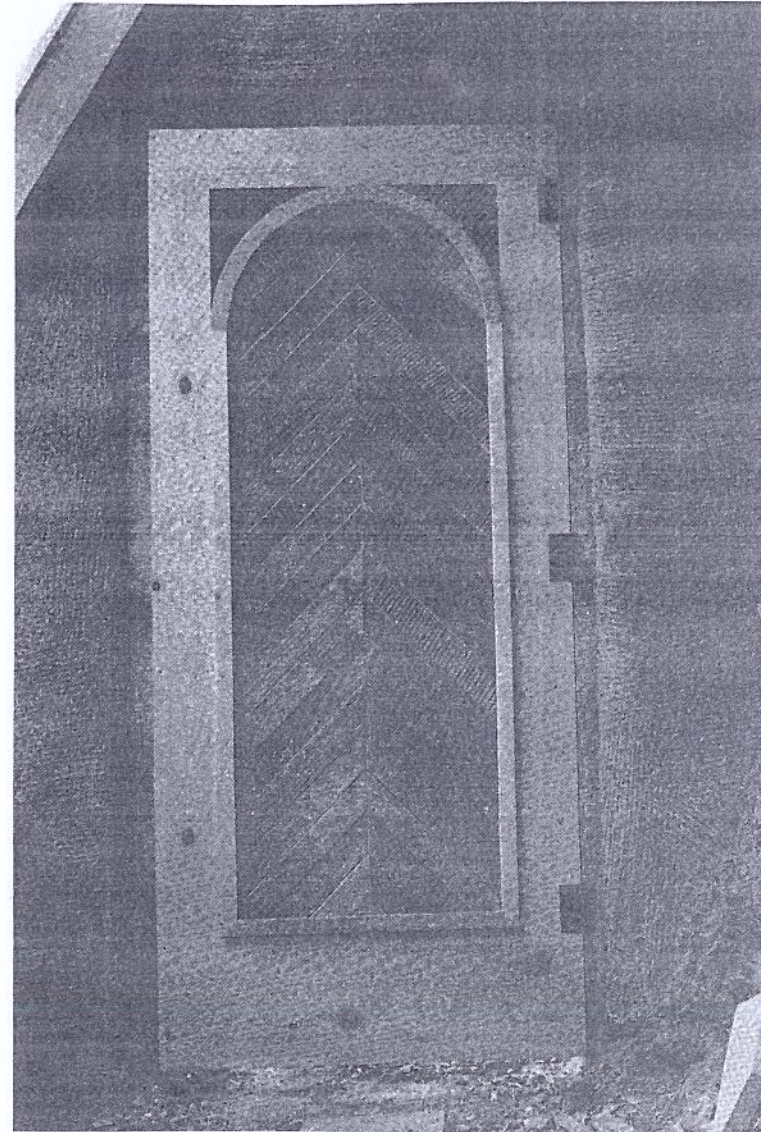


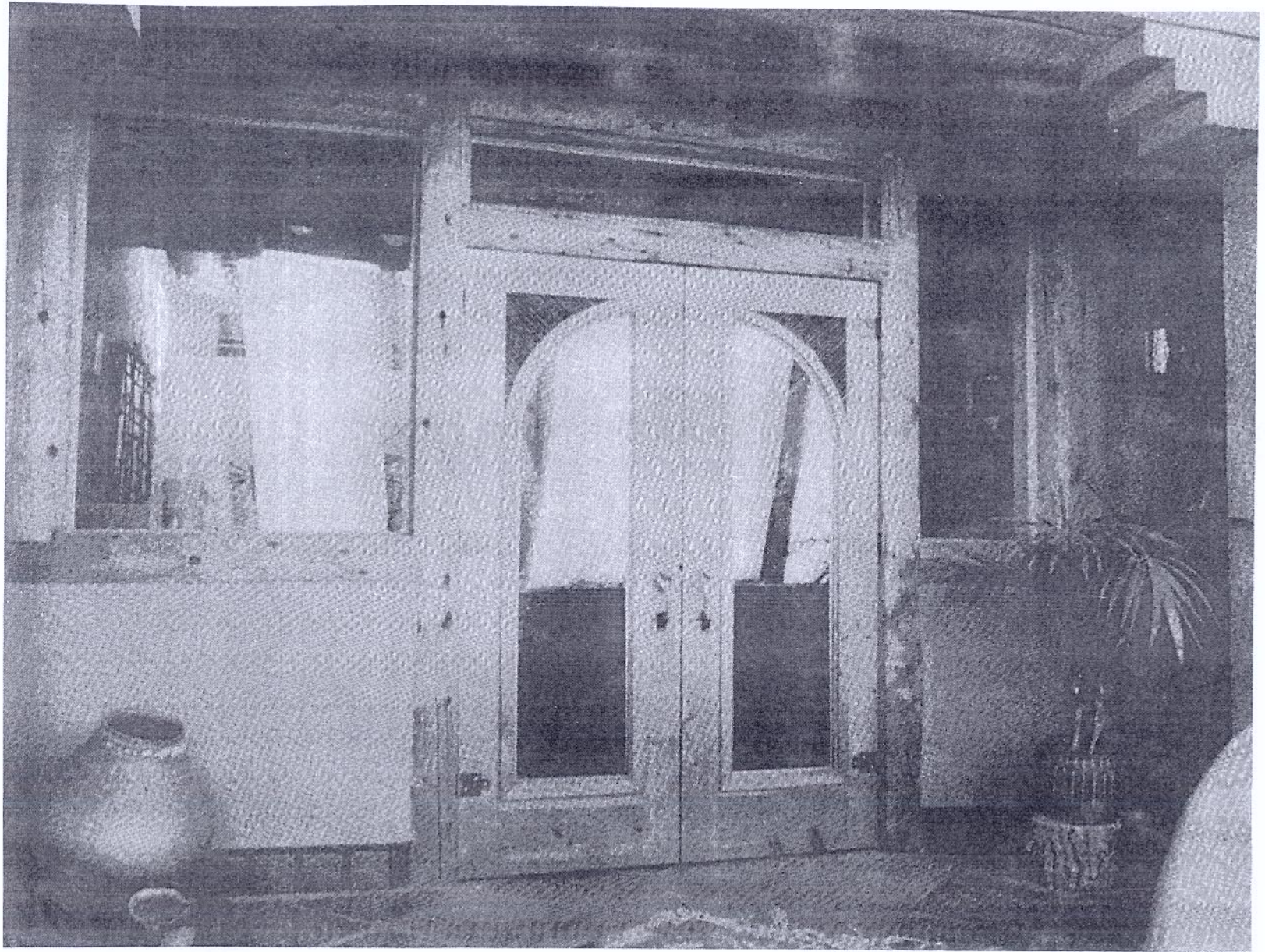
INTERIOR DOORS

Interior doors follow all the same procedures as exterior doors except in this case it doesn't matter which side you cleat the nails on. On both interior and exterior doors the edges should be sanded smooth so the plywood and frame pieces are all flush and smooth to the touch. Sanding and/or planing is also necessary for final fitting of the door to its specific opening.

Since interior doors do not require a threshold, the 1 1/2" space before nailing at the bottom (see pages 166 & 167) is not necessary.

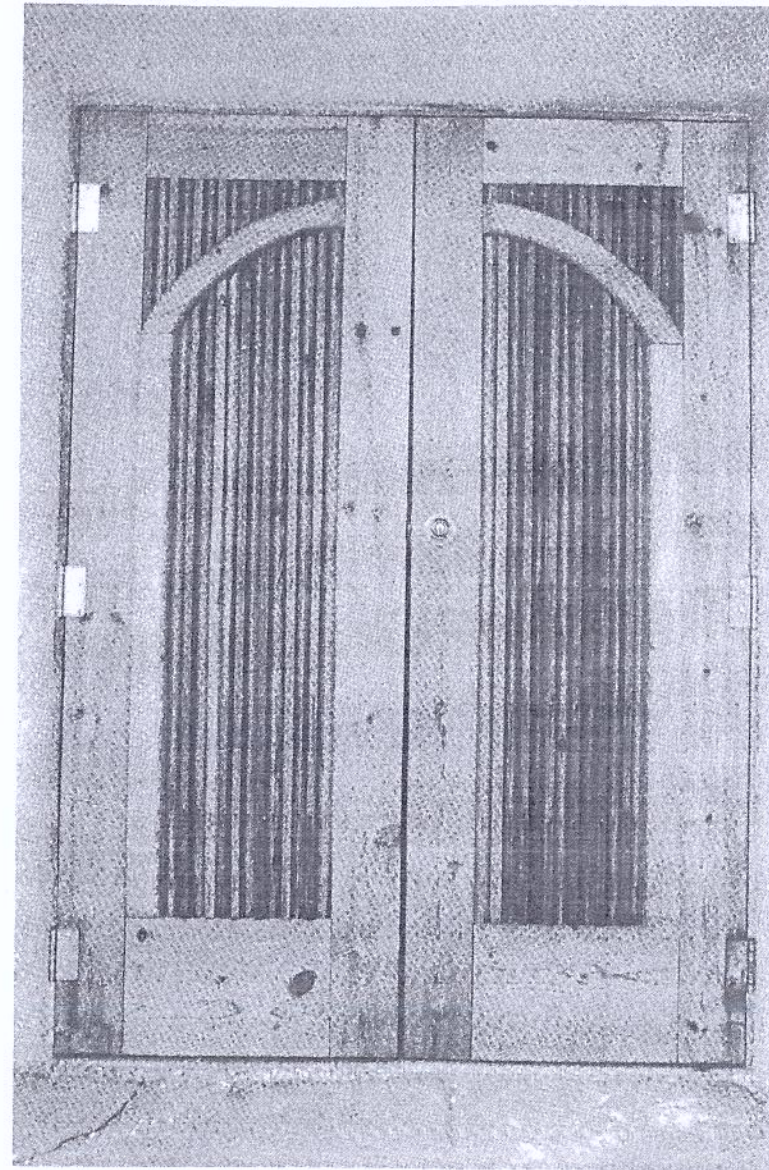
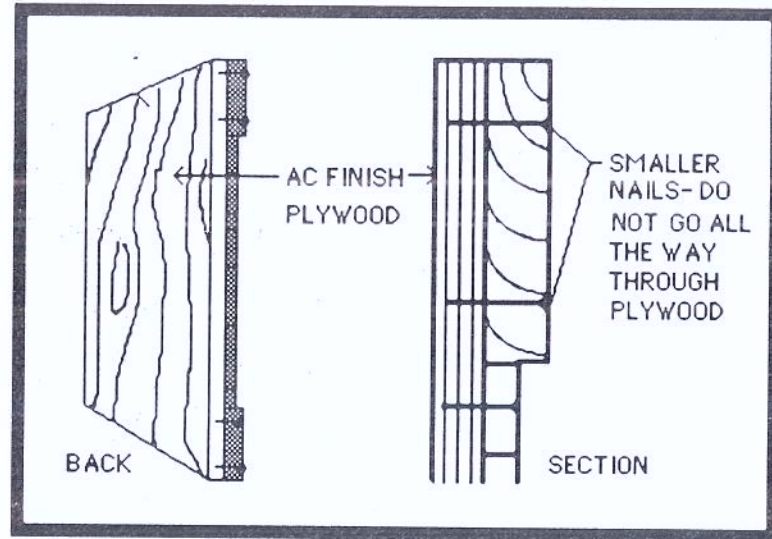
Both types of doors should be oiled on both sides with one or two coats of boiled linseed oil cut half and half with mineral spirits. This seals the door and reduces the possibility of any warping before installation. Following are some examples of interior doors.

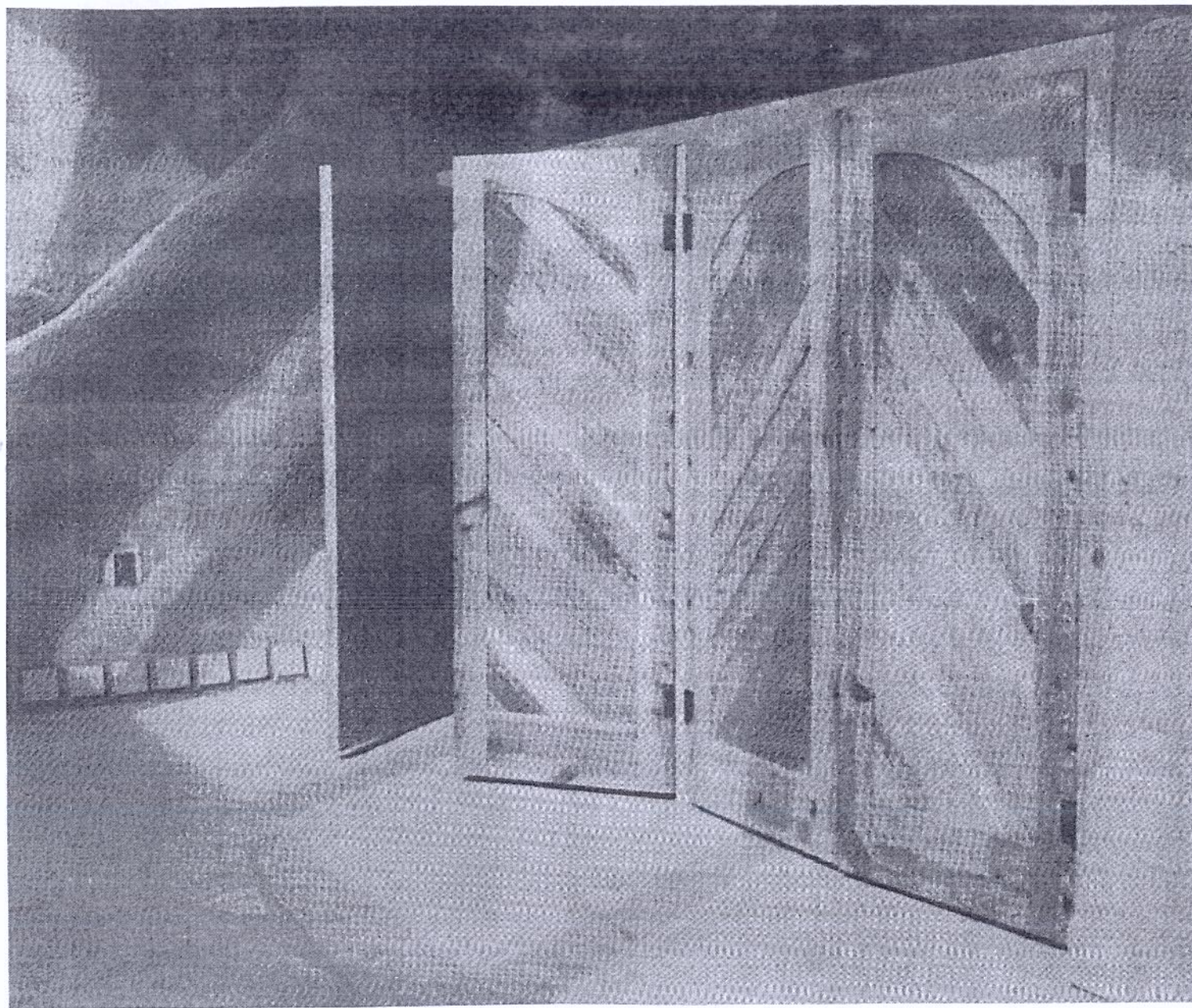




CLOSET DOORS

Closet doors do not require framing and filling on the closet side. This means you must use a finished plywood (AD) as described on page 165. A smaller sized nail (3d) should be used so the nails will not come through to the finished side of the plywood. Remember to use liquid nails or glue as well.

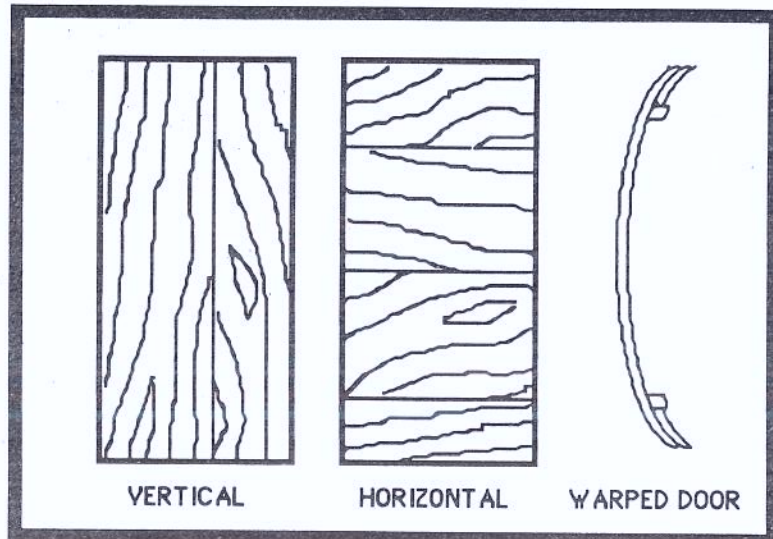




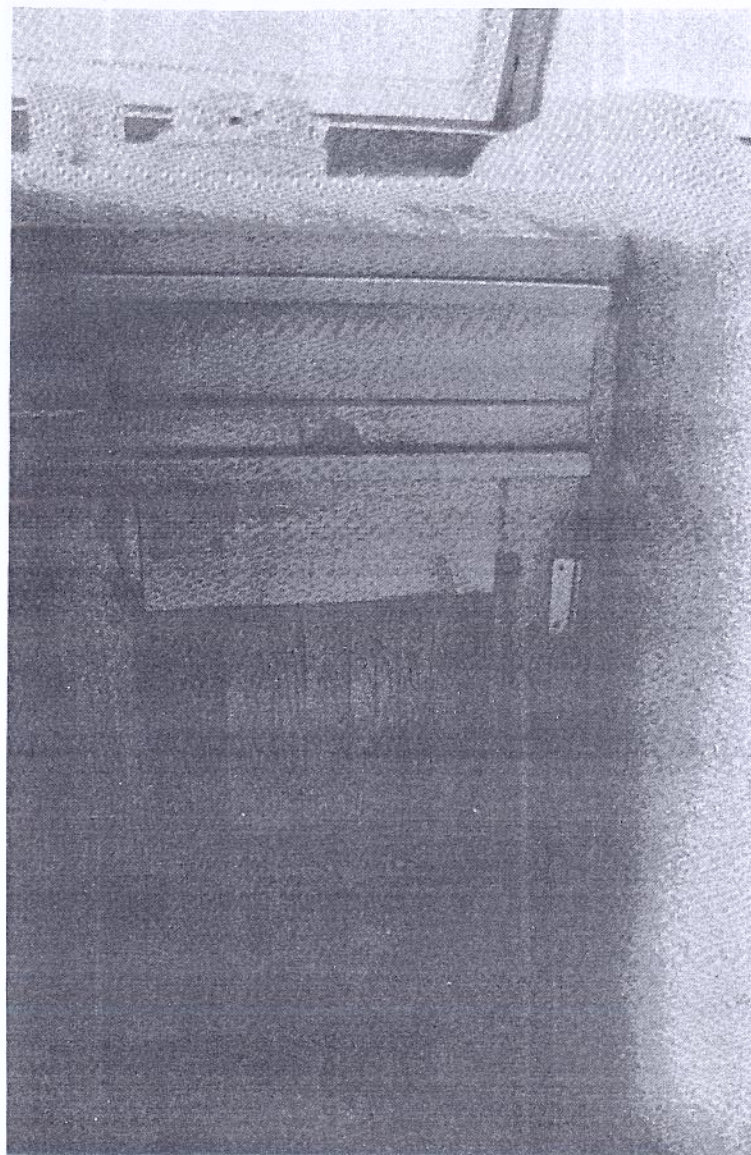
CABINET DOORS

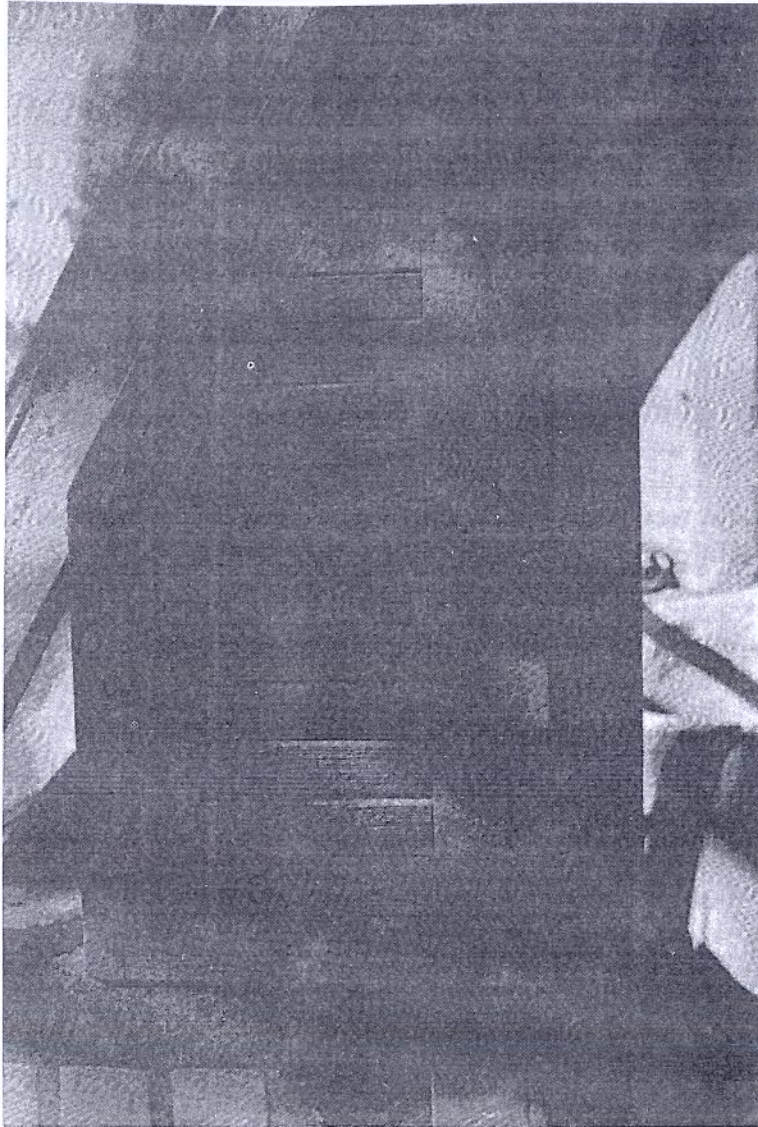
Cabinet doors follow the same procedure as closet doors with respect to the finished plywood side and the shorter nails. The major difference here is the size. Cabinet doors are smaller so the width of the frame pieces will be smaller. Since cabinet doors are smaller there is a tendency to use plywood with the grain going horizontally. Do not let this happen. Nine times out of ten, doors made this way cup or bow.

On all doors make sure the grain of the plywood is vertical. If you allow the grain to be horizontal the plywood has a tendency to cup or bow.



Following are some examples of cabinet doors.

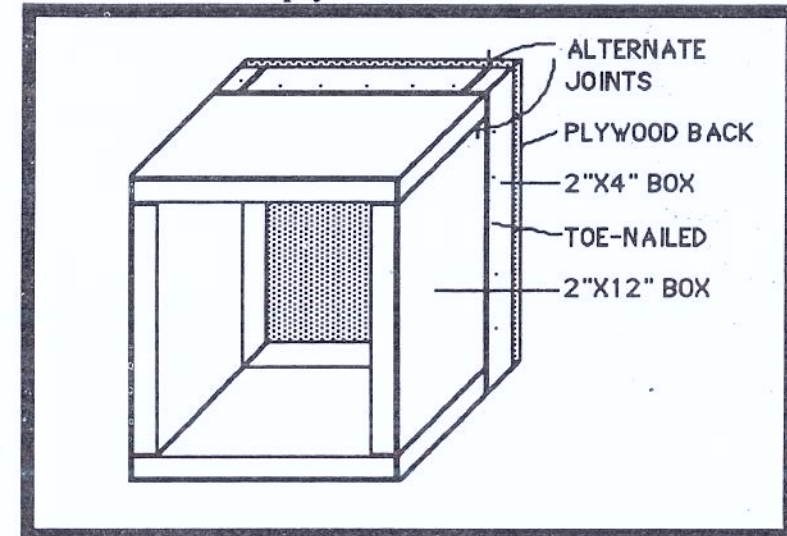




CABINETS

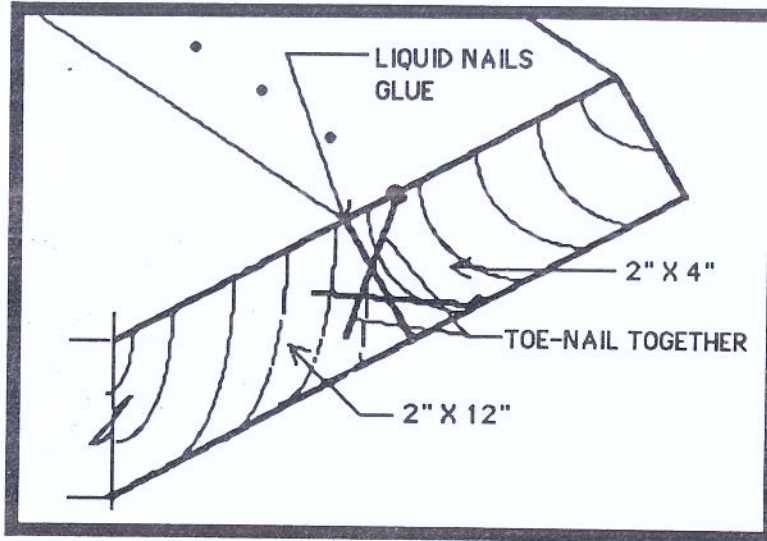
UPPER WALL CABINETS

The basic look of an Earthship is massive with thick walls and heavy timbers put together in a very simple manner. Cabinets can be built to look just as basic and massive. Light veneer cabinets sometimes look out of place in an Earthship aside from being more difficult and expensive to build. The most visible part of cabinetry is the doors, which you already know how to build. Most upper cabinets in kitchens or bathrooms are simply wood boxes. These boxes are nailed or screwed together out of 2x12 and 2x4 lumber with plywood backs.



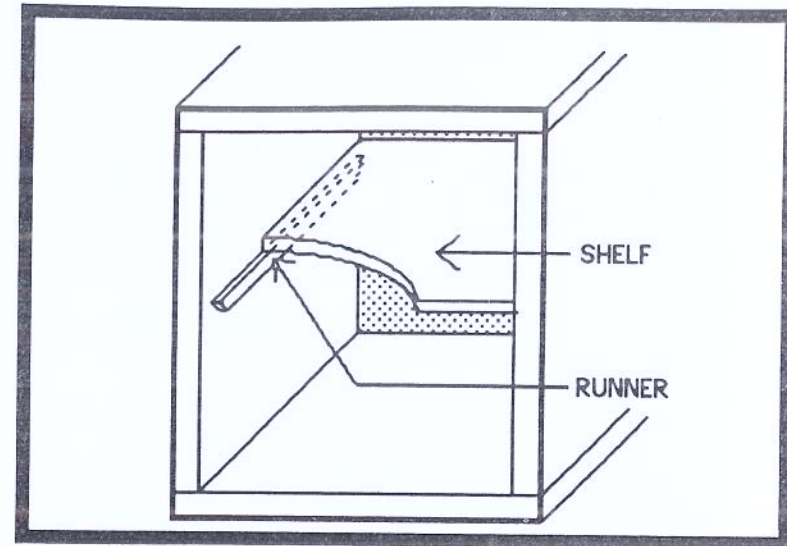
The desired depth of the cabinet is achieved by joining a 2x12 box and a 2x4 box. Note that the joints are alternated - one way on one box and the other way on the second box. This keeps the

same joint from happening in both places. Sometimes this is not done if the side or sides of the cabinet are in a prominent place visually. The two boxes can be "toe-nailed" or screwed together as shown below. Toe-nailing can be done neatly in a pattern and set with a nail set. Do more toe-nailing on the top and bottom where it doesn't show.

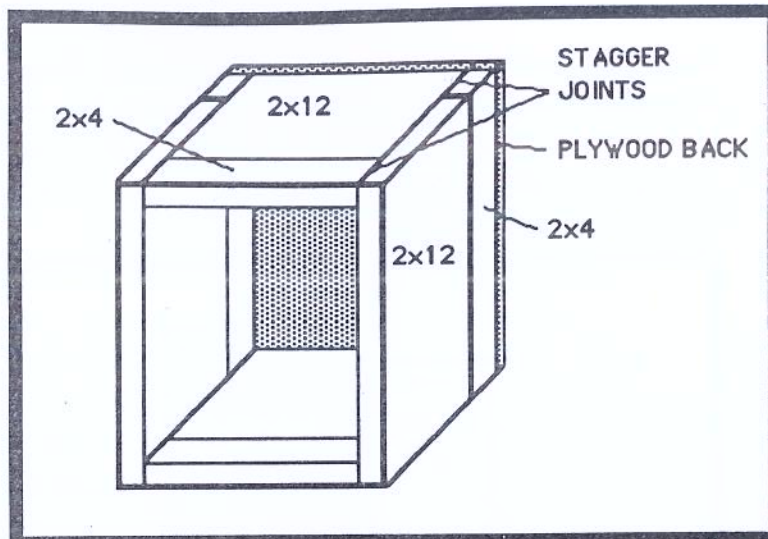


The two boxes should also be glued during this process with liquid nails or carpenter's glue. Make sure the unit is square and then nail on a plywood back.

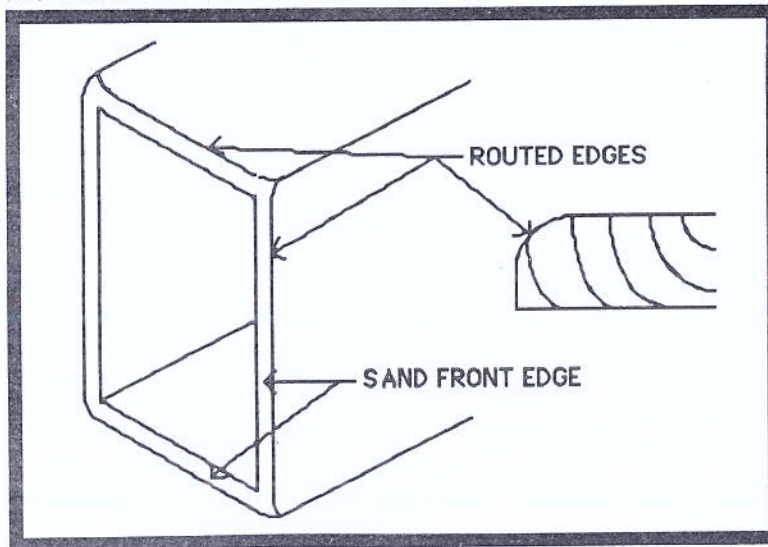
Shelves can be added as desired on 3/4" x 3/4" runners as shown. The shelf runners, which are nailed into both boxes, can also be used to help hold the two boxes together.



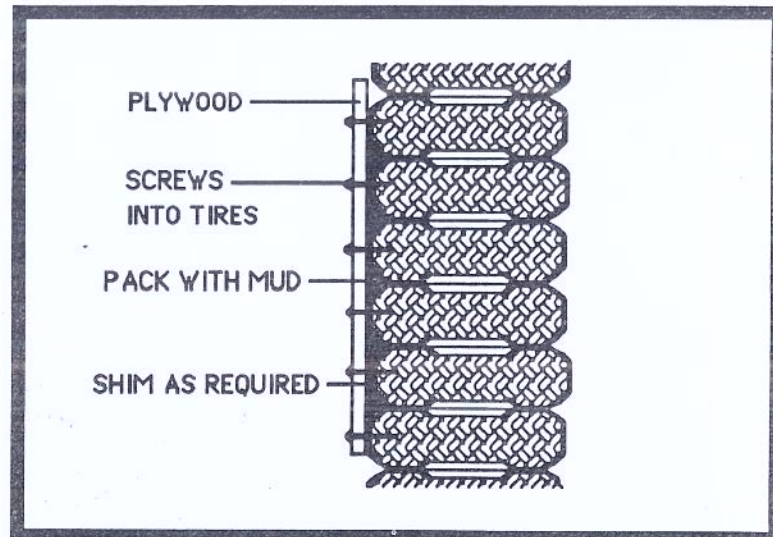
There is also an alternative method of putting together the same cabinet which eliminates the need for toe-nailing. The same pieces can be put together in a staggered arrangement the very nature of which integrally connects the boxes. This is a little more difficult to assemble.



Since the front of the cabinet is the most visible, the front edge is usually sanded and sometimes routed to give it a round, soft effect. The doors are then set inside this front edge and framed by the structure of the cabinet itself.

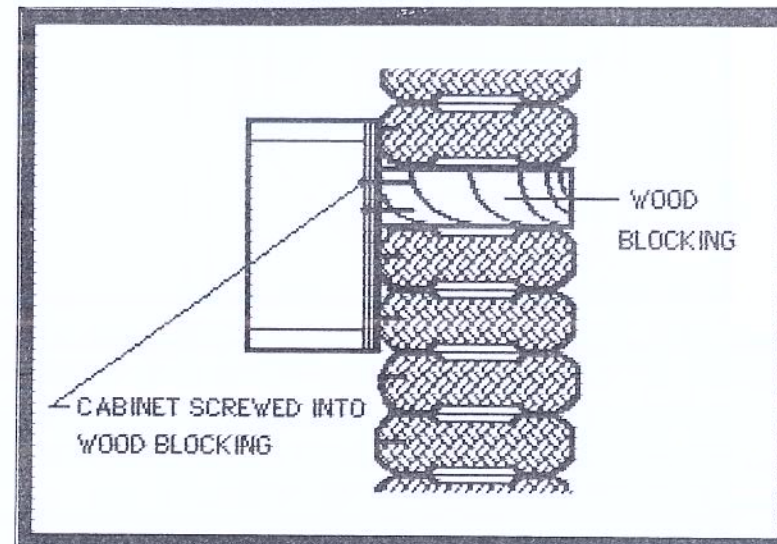


The best way to mount the cabinet or cabinets on a tire wall is to first cover the mounting area with a 3/4" piece of plywood screwed (in many places) to the tires.



This piece of plywood must be shimmed into a true plumb and level position as the tires are not always perfectly plumb and in plane. Be sure to fill and pack the tires out to a plane first (see Earthship Vol I, page 175). Regular screws will hold into the front edge of the tires. Be sure to use a lot of them. Make sure they are long enough to go through the plywood and the rubber and be sure to hit tires, not mud fill. If you plan ahead, you can lay in wood blocking where the cabinets will go and have a solid wood block to screw the plywood into.

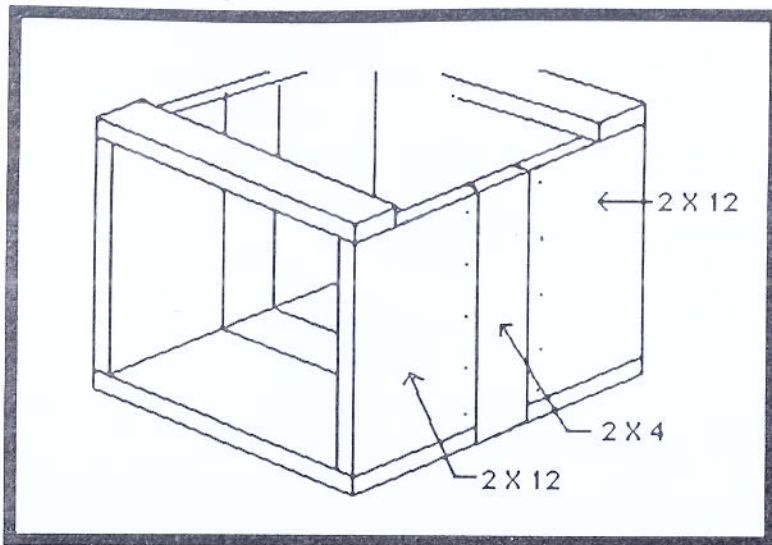
Now the cabinet unit can be screwed into this plywood mounting surface. Cabinets have also been hung from vigas or beams and attached directly to wood blocking placed strategically in the tire walls as shown below.



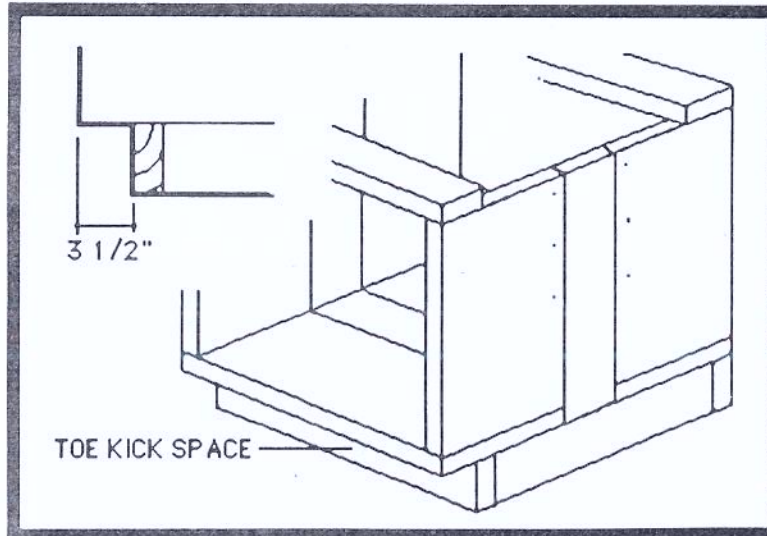
This method requires you to know where this blocking is going to be and install it as the tire wall is constructed.

COUNTERTOP CABINETS

The same box type unit is used here only the units are usually deeper and require a 2x12, a 2x4 and a second 2x12 to get the required depth for lower counter cabinets. 2x4's are used on the top of this box as the plywood top will ultimately make the top solid.



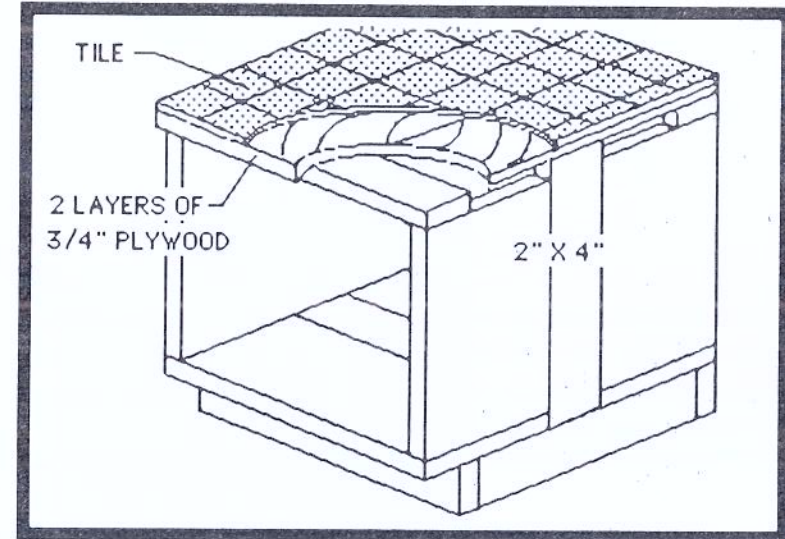
There is also the addition of a toe kick space at the bottom. This can be achieved by making a small 2x4 box recessed in from the front of the unit about 3 1/2".



This raises the unit off of the floor and

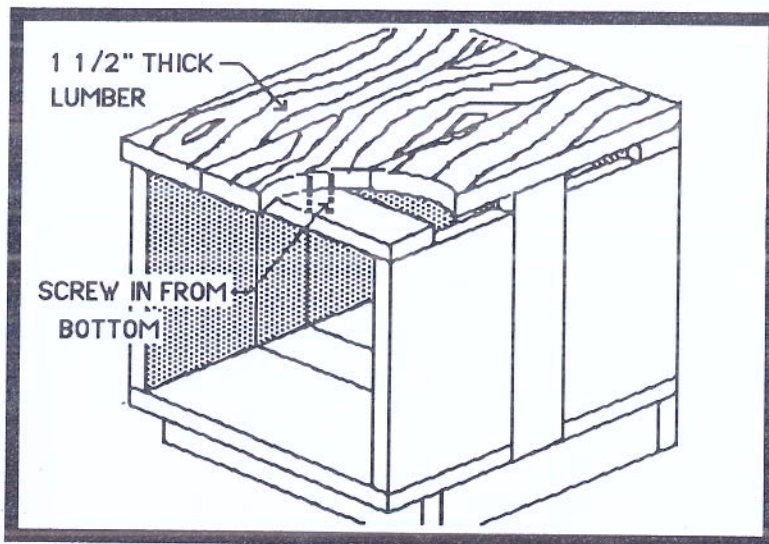
provides a toe kick space.

For countertops use a double layer of 3/4\" plywood if you plan to do tile work. This gives you a thick 1 1/2\" edge to accommodate tile details.

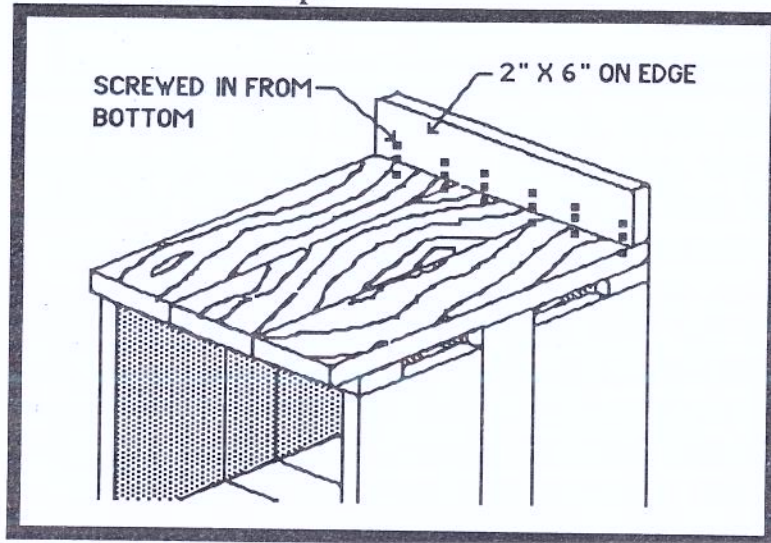


This is why the top structural pieces of your unit can be eliminated except for a 2x4 at the front and back as the plywood takes over the job of the other wood.

If you want a wood counter top, have a carpenter dowel and glue the countertop together for you out of dried 1 1/2\" thick lumber to your required size specifications. It can be screwed in from the bottom to your simple wood box unit.



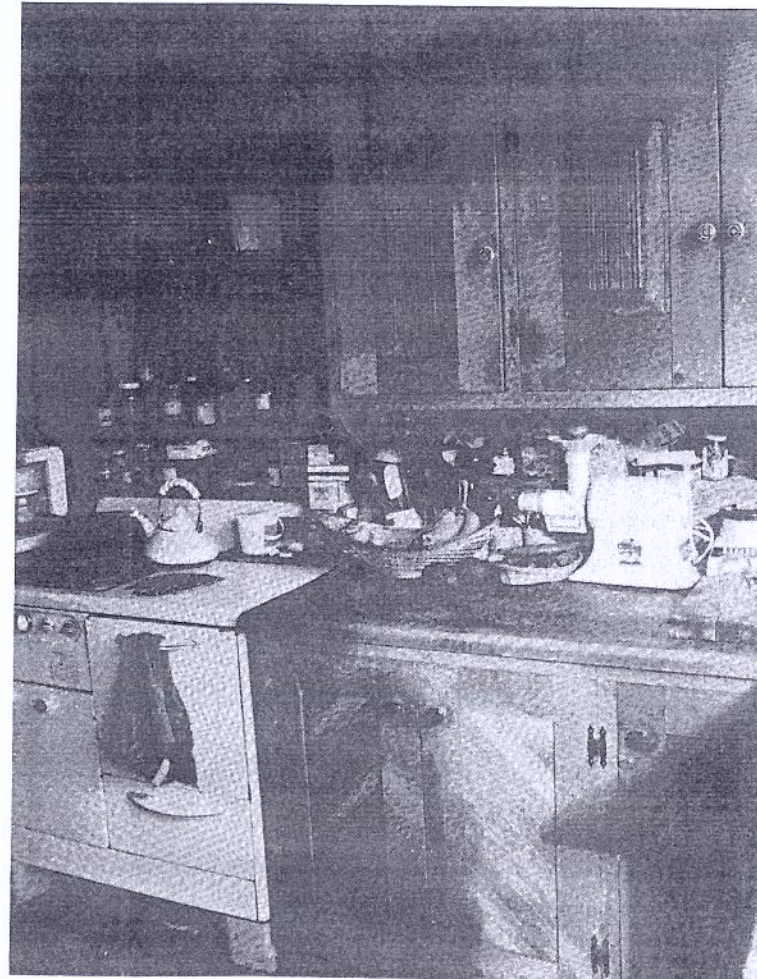
These units also have plywood backs and in most cases a back splash which is simply a 2x6 on edge screwed into the top.

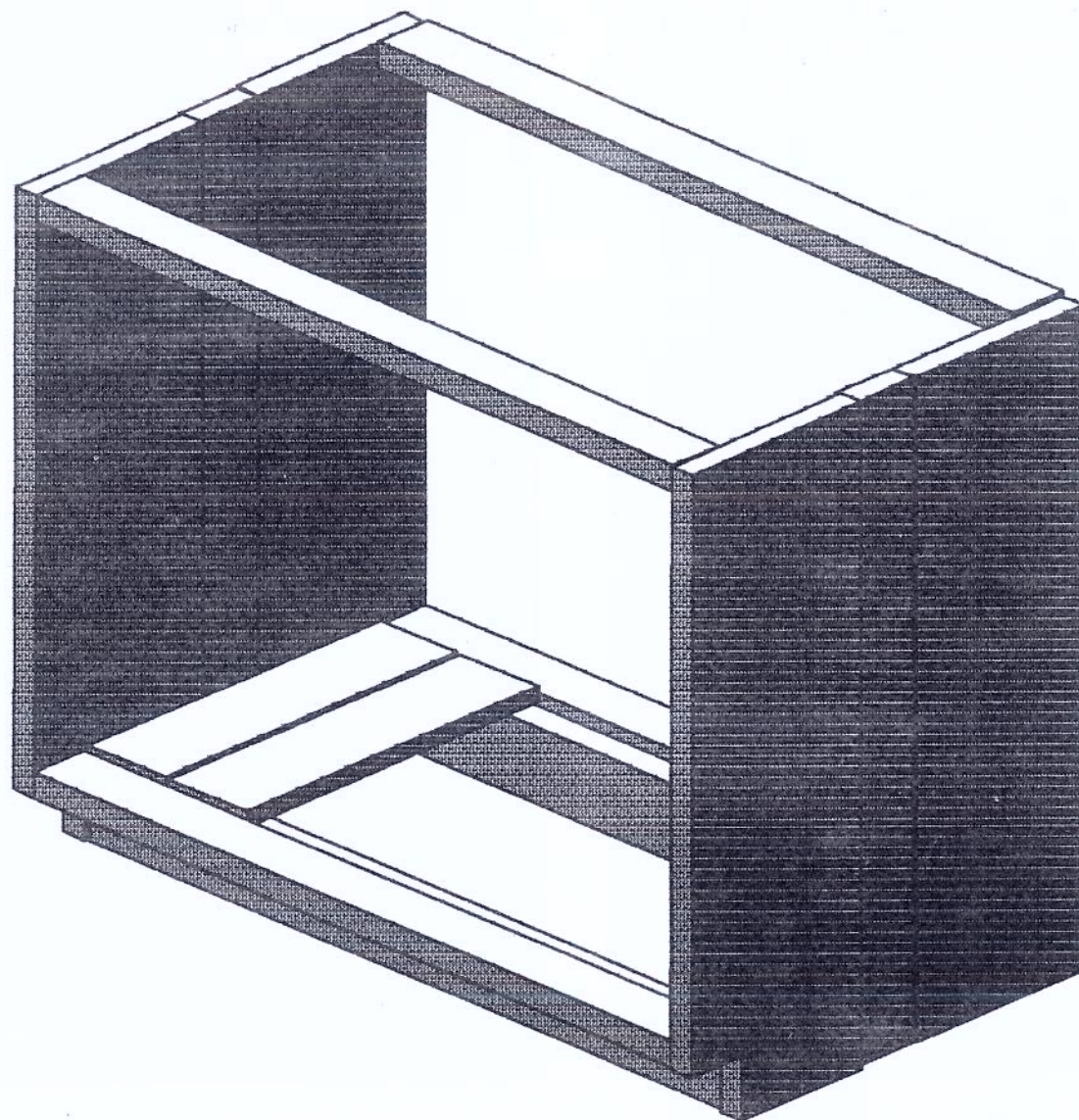


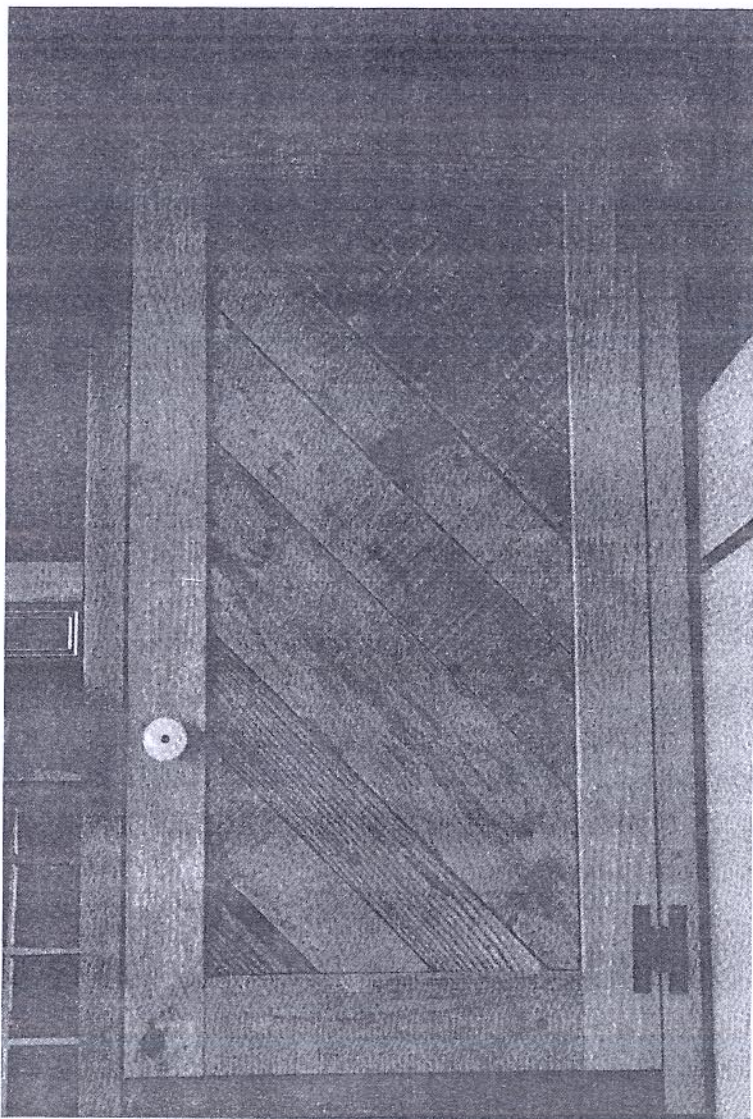
This is the basic idea of Earthship cabinets - wood boxes with pretty doors.

Like the Earthship itself, this method can be elaborated upon relative to ones own particular skills and budget. The accompanying diagram illustrates a somewhat more refined and difficult version of this same concept.

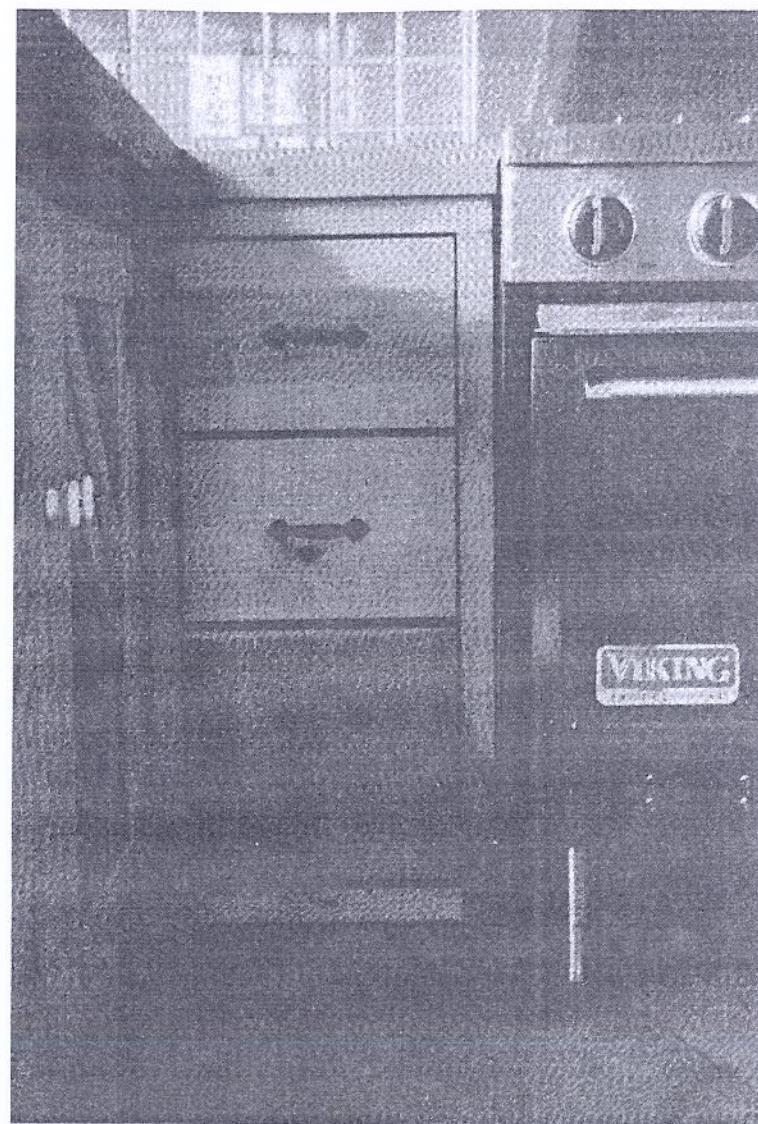
The following photographs illustrate some of the many examples of these kind of cabinets.







The upper and lower cabinets are simply a series of individual boxes built as described earlier in the chapter. When a drawer bank is desired, the



initial box is built the same way. Drawers are then built in a conventional manner to fit into the box. Have a carpenter help you with drawers.

APPENDIX

Liquid Nails

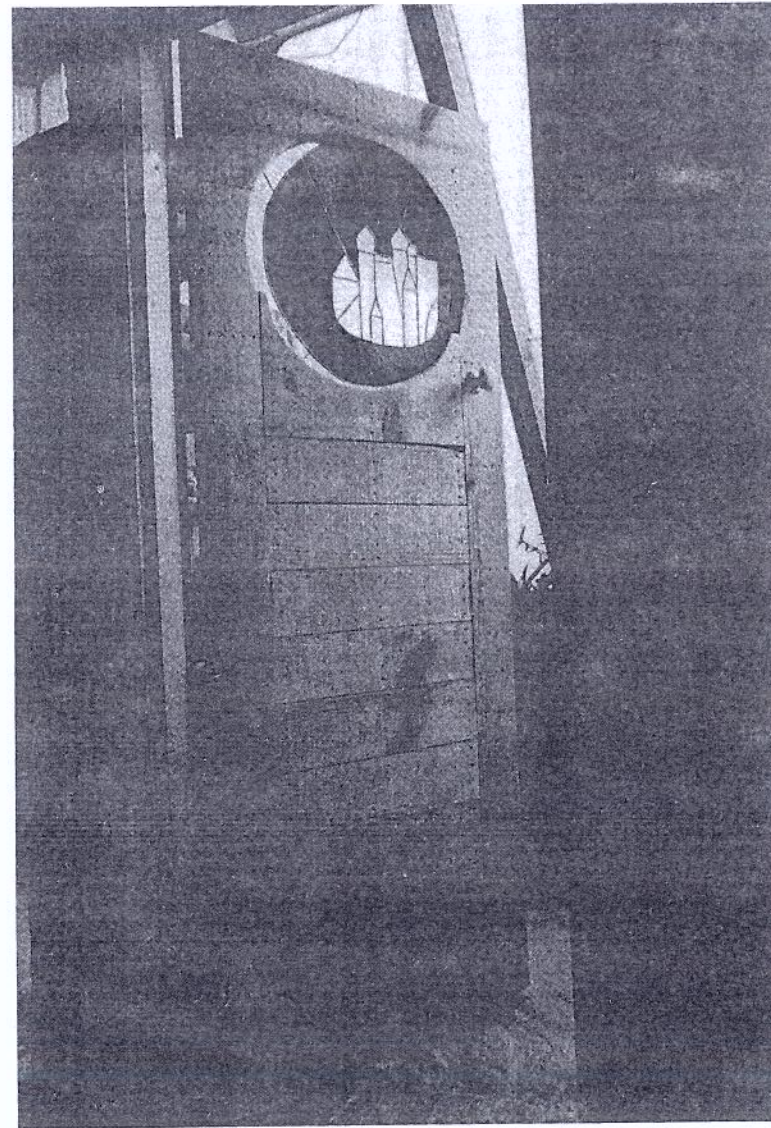
Available at most hardware stores
Macco Adhesive, Glidden Co.
Cleveland, Ohio 44115

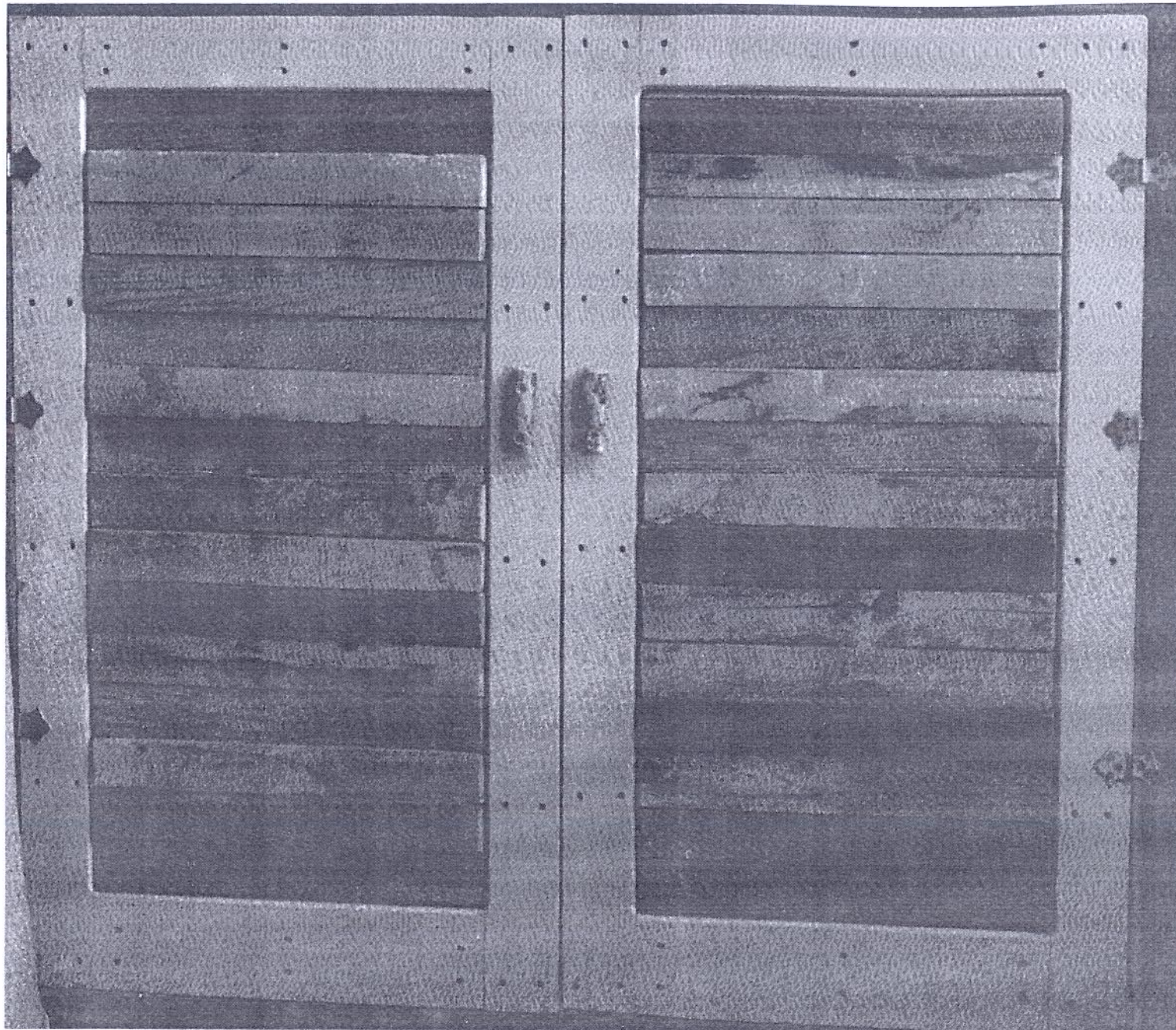
Nails

"d" is the symbol for "penny" - a "3d" nail is a "3 penny" nail.

Plywood

It comes in 1/2", 5/8", 3/4", and 1" thickness. Sides range from A to D - "A" is a finished side and "D" is a rough side. "X" means exterior glue is used. Most regular doors use 5/8" CDX. Cabinet and closet doors use 1/2" ADX so the "A" side can be exposed.

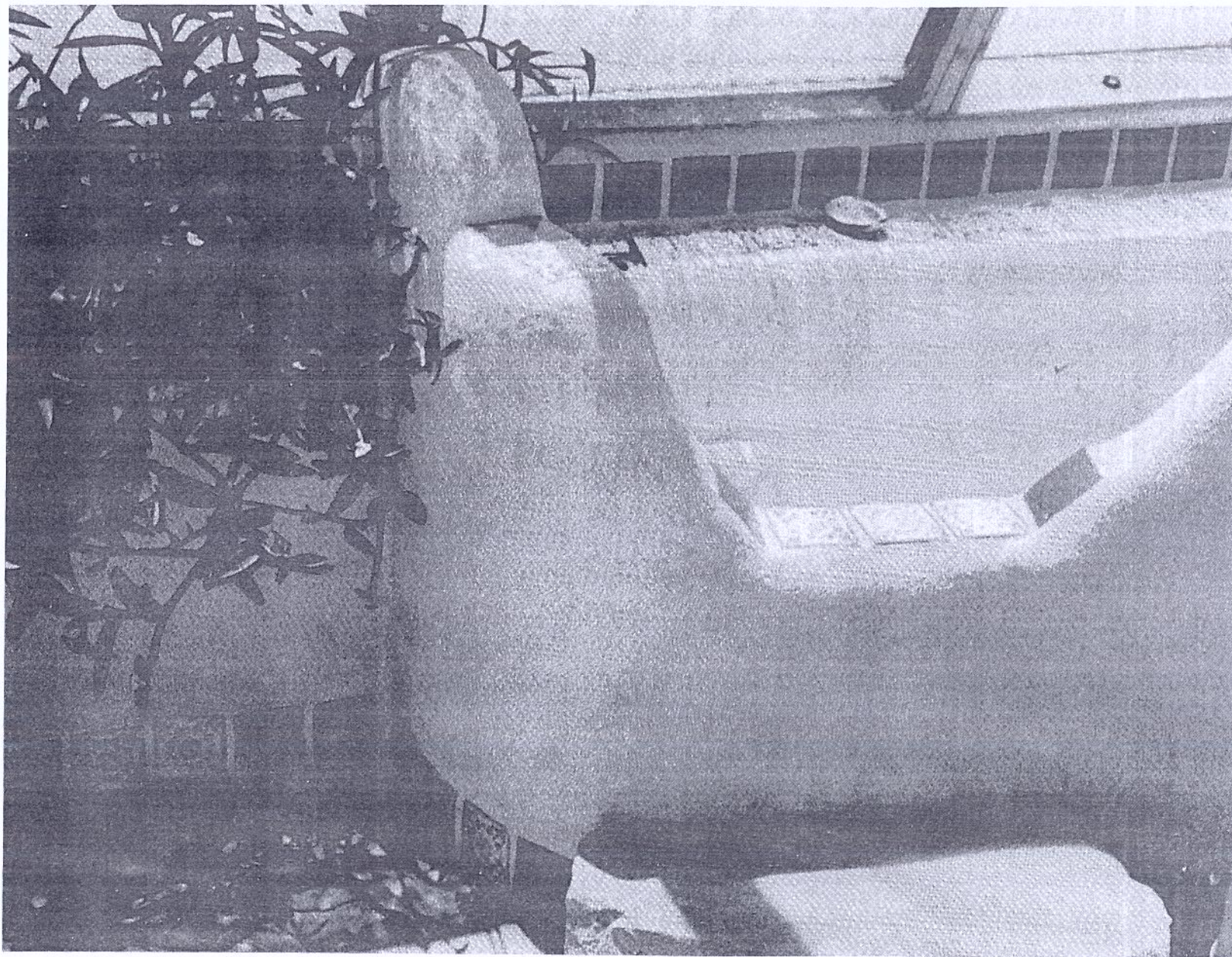




10. BATHTUBS, SHOWERS, VANITIES

C O M P O N E N T S

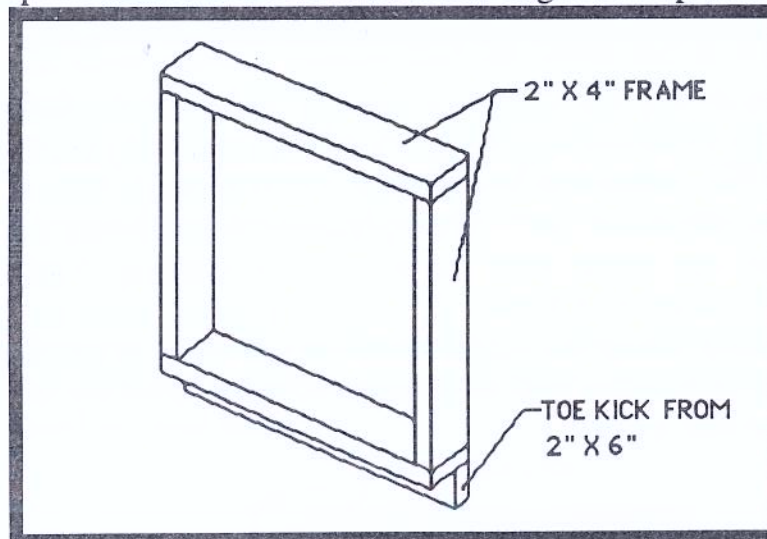
MOST EARTHSHIP BATHROOMS ARE PLACED RIGHT UP AGAINST THE SOLAR FRONT FACE AND ARE FILLED WITH PLANTS AND MOISTURE. IN THIS SITUATION, THE BATHROOM BECOMES A WHOLE DIFFERENT EXPERIENCE FROM CONVENTIONAL BATHROOMS. IT BECOMES A CAPTURED EXTERIOR GARDEN TYPE SPACE. BOTH THE SHAPE OF THE SPACE AND THE NATURE OF THE SPACE DESERVE SOMETHING MORE THAN WHAT CONVENTIONAL BATHROOM FIXTURES HAVE TO OFFER. FOR THIS REASON WE HAVE DEVELOPED METHODS OF SCULPTING TUBS, SHOWERS, PLANTERS AND VANITIES OUT OF THE SAME MATERIALS THAT THE BATHROOM WALLS ARE MADE OF - CANS AND CEMENT. THIS ALLOWS YOU TO BOTH DESIGN AND BUILD YOUR OWN FANTASY INDOOR/OUTDOOR BATHING SPACE.



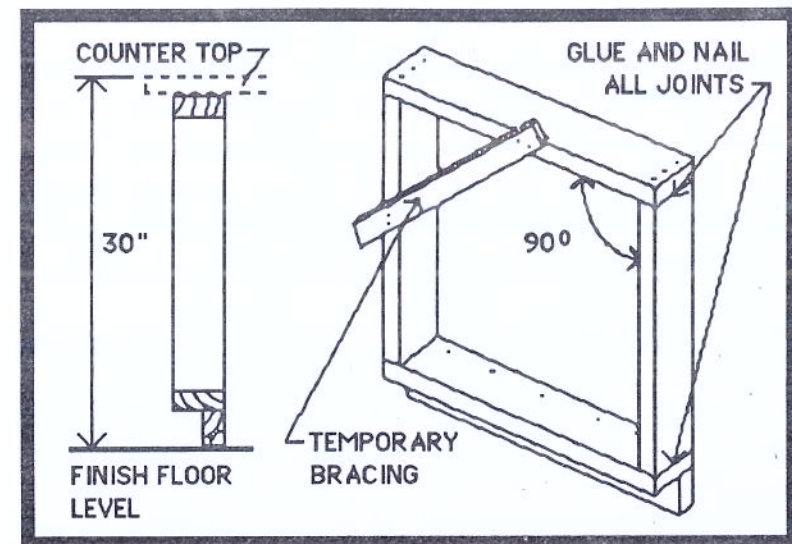
The previous photo illustrates the sculpted effect of tub and planter all custom built of the same materials with stucco and tile finish. We will take these units one at a time and discuss the procedures involved in their construction. Then, how you sculpt them together is up to your own imagination.

VANITIES

The vanity is a wooden door frame laid into two can walls on either side. The first step is to make the door frame out of 2x4 stock with a toe kick space as in the kitchen cabinet design in chapter 8.



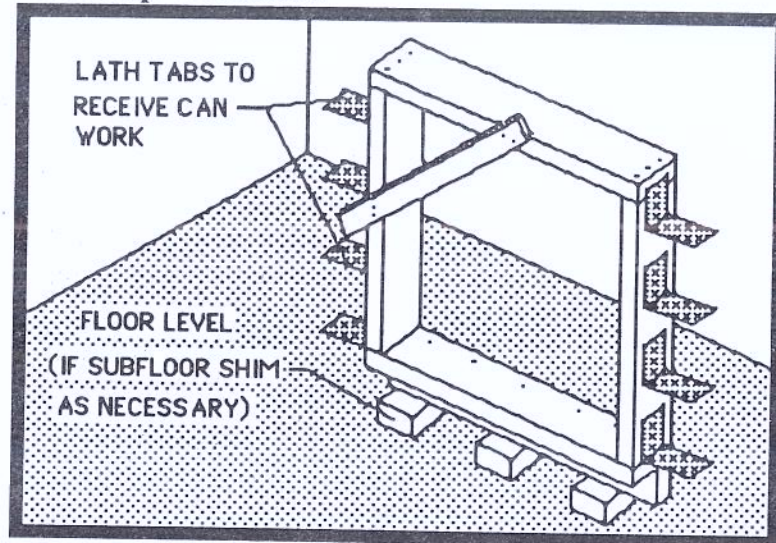
The toe kick is also made from a 2x4 screwed or nailed to the bottom of the door frame box.



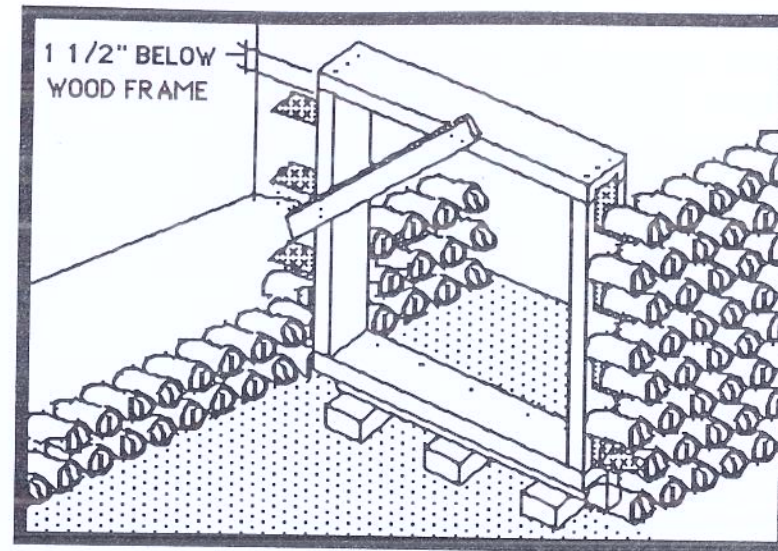
Sink counters are usually about 30" high. After you deduct the toe kick and a couple of inches for the top detail, you are left with about 25" for the overall height of the door frame. The width is your desired width of the overall vanity minus 5" either side for the can walls. Make sure the frame is square and braced in a square condition with a diagonal. Also notice that the top and bottom pieces are continuous. This is stronger. Glue the joints with Liquid Nails* or carpenters glue in addition to nailing or screwing.

* 1 See Appendix, Chapter 10

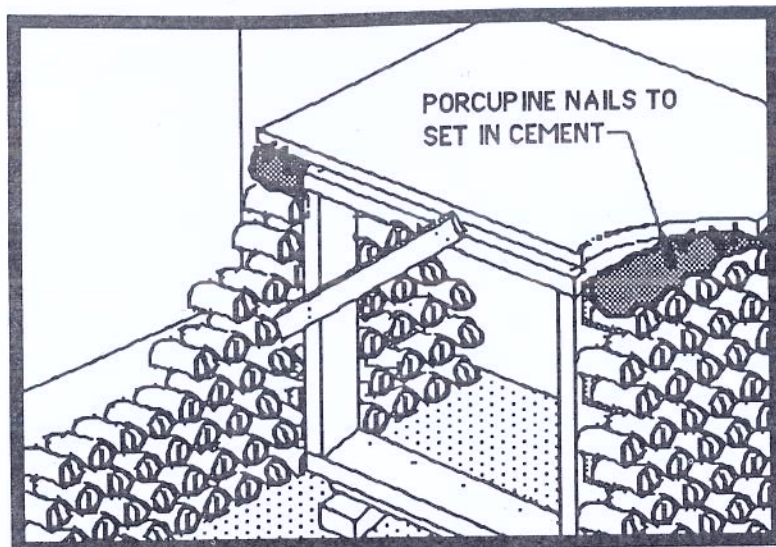
Now the frame is positioned on the floor where you want the cabinet. If the finished floor is not in yet, you have to prop the frame up to where the bottom of the toe kick is on finish floor. Metal lath tabs should be installed on either side of the cabinet frame as described on page 166 of Earthship Volume I.



These tabs will hold the can work to the frame. Now you are ready to lay the can work on either side of the frame. Refer to Earthship Volume I, page 158-160 for can laying pointers. Lay the cans up to about 1 1/2" from being flush with the height of the wooden frame. The can work is what stabilizes the door frame. An attachment to the floor is not necessary.

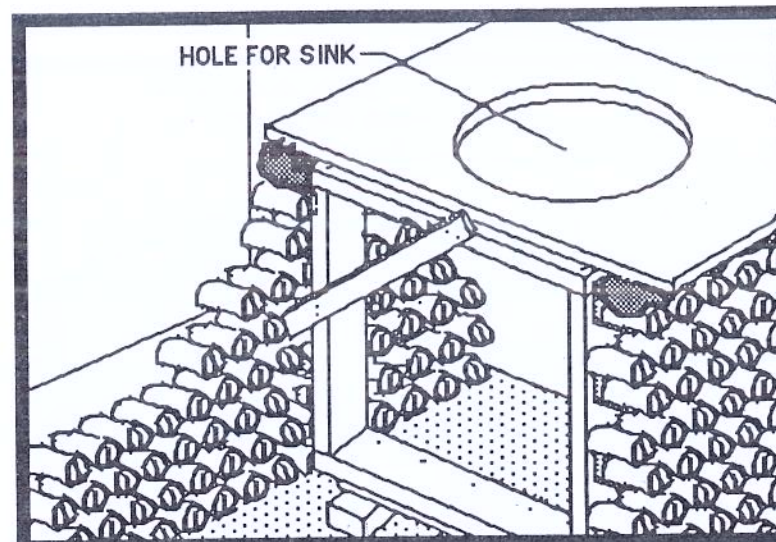
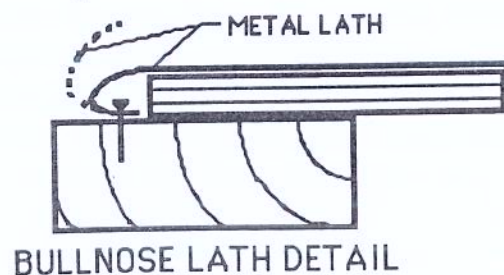


Now you are ready to put the plywood top on. The plywood can be 5/8"cdx (exterior) plywood if the cabinet is fairly small. If it is large, make the plywood 3/4". The plywood is anchored to the can work with the porcupine technique (as described in Chapter 7). Small roofing nails are nailed along the edges then the plywood is set in an inch and a half thick patty of cement on top of the can walls.

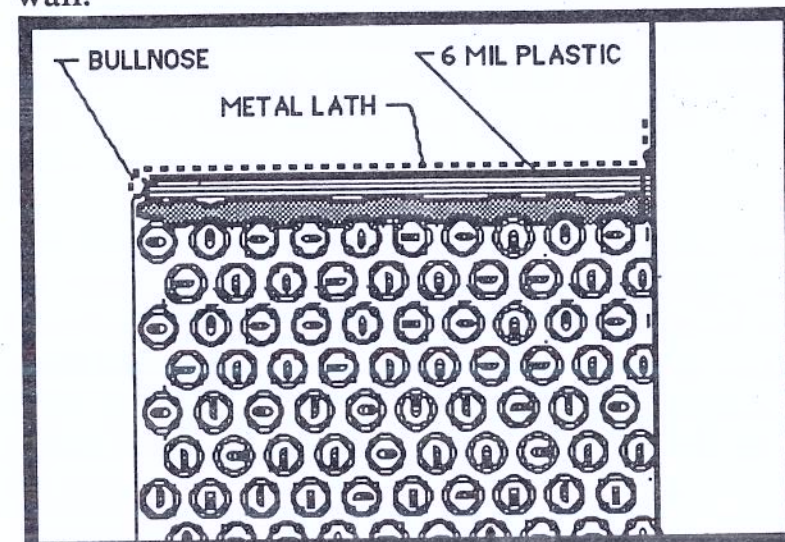


This makes the plywood set flat on the surface of the door frame. Notice that the plywood is set back about 1 1/2" from the front of the frame as well as the sides of the can walls. This allows the plaster to achieve a rounded effect later. The plywood can be nailed or screwed to the top of the door frame.

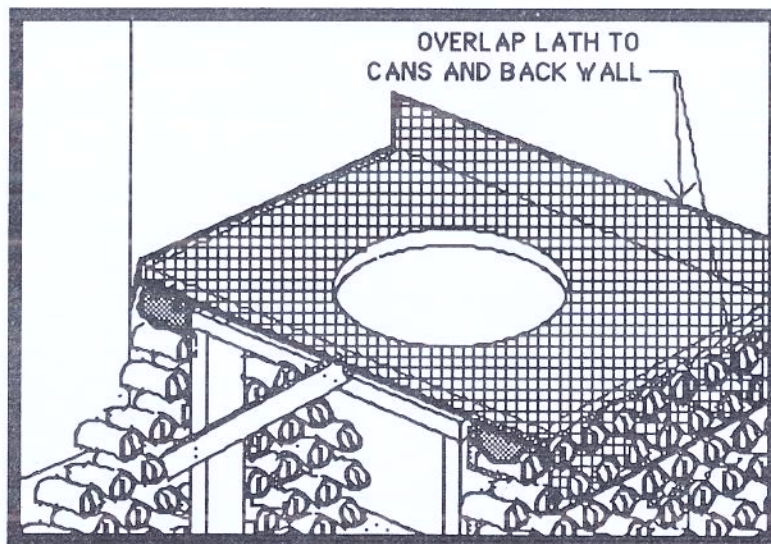
Now cut the hole for the sink to fit into. All sinks are different sizes so you must have your sink on hand for this step.



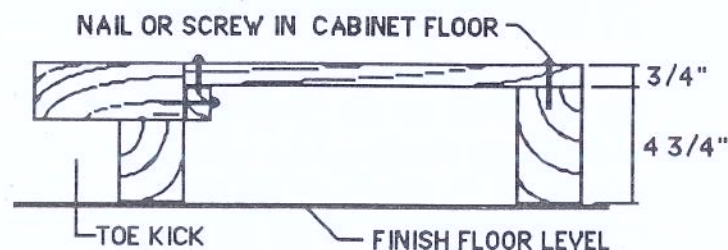
The plywood must be covered with 6 mil plastic and metal lath to receive plaster. Make sure the metal lath extends and overlaps well onto the can wall.



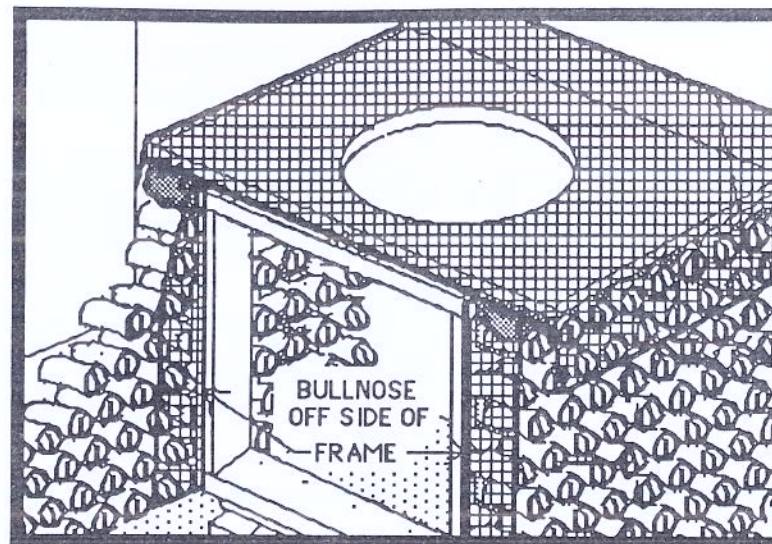
Use a bullnose lath detail in the front.



Lap the metal lath up onto the wall in the back as well. Do not allow any breaks in the metal lath as a crack will occur at this location. A bullnose lath detail must also happen around the door on either side in order to anchor the plaster to the door frame.



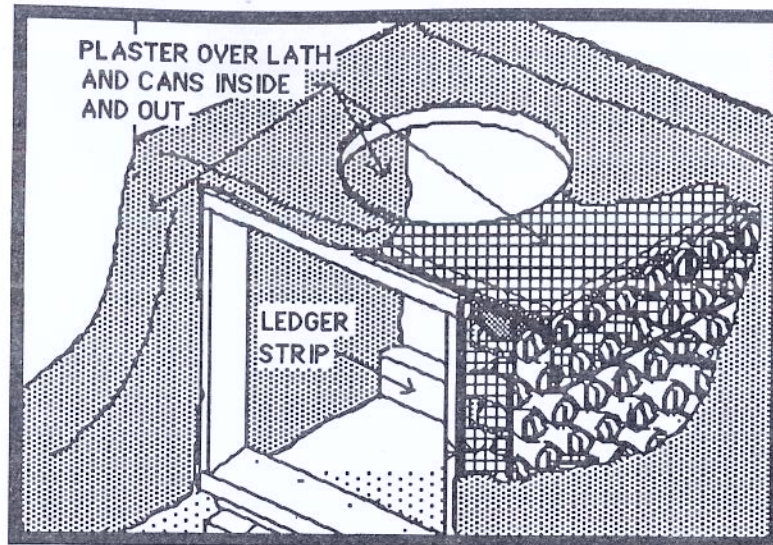
CABINET FLOOR



Now you are ready to plaster. First a scratch coat. This should be a mix of one part portland cement to three parts plaster sand with engineering fibers*. Plaster the unit inside and out.

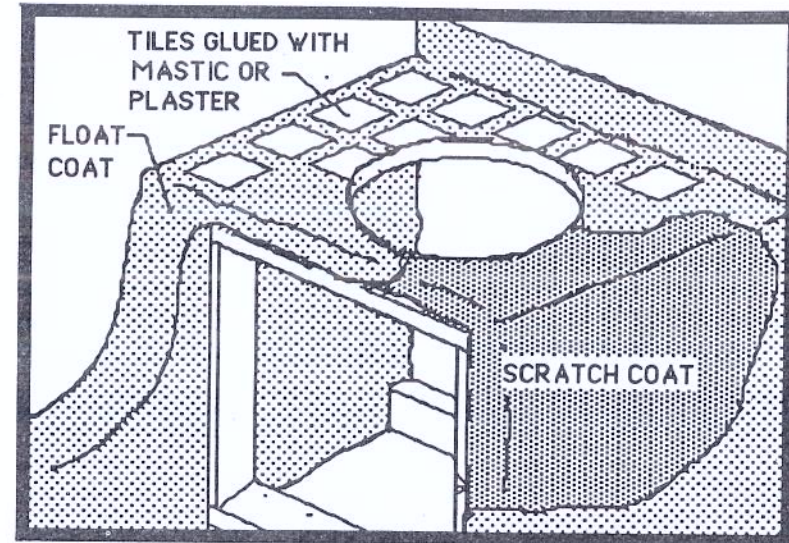
A ledger strip should be installed in the back of the bottom of the cabinet to receive the floor of the cabinet. This piece should be installed $\frac{3}{4}$ " below the bottom of the cabinet door frame as these two pieces together receive the 1x6 floor installed later. This ledger strip can be glued to a finish floor with Liquid Nails or porcupined (see page 190 this chapter or Chapter 7) to a small cement patty if the floor is not in yet.

*2 see Appendix, Chapter 10



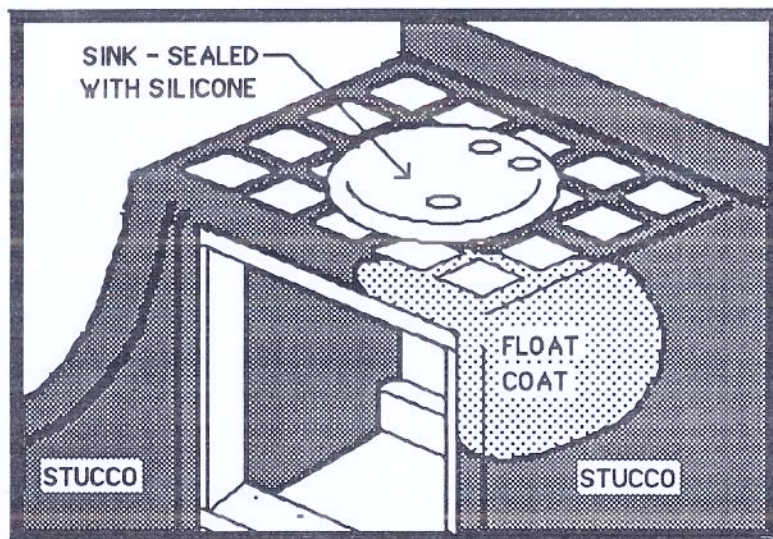
You can now apply the float coat of cement plaster using the same mix. See a local plaster contractor for plastering hints and consult Chapter 9 of Earthship Volume 1. Now tiles can be installed in any pattern you want. Keep them away from the rounded edges. Let your pattern occur only on the flat surface.

Tiles are glued down with regular tile mastic or a rich mix (1 cement to 2 sand) of regular plaster. If you use mastic, make sure your cement has cured a couple of days first. If you use a cement mix make sure you wet the tiles and the counter surface before laying them. Don't let the mastic or the cement "glue" get too thick and elevate your tiles too much. The next layer is stucco which will crack when applied too thick. Elevated tiles require a thick stucco coat.



Sometimes the sink is installed with the tiles as if it were a tile. This requires cutting the tiles around the sink. It can also be siliconed down last. This is easiest. Different sinks require different methods of installation. It is best to get a sink with faucet holes then it will not be necessary to make faucet holes in the tile work.

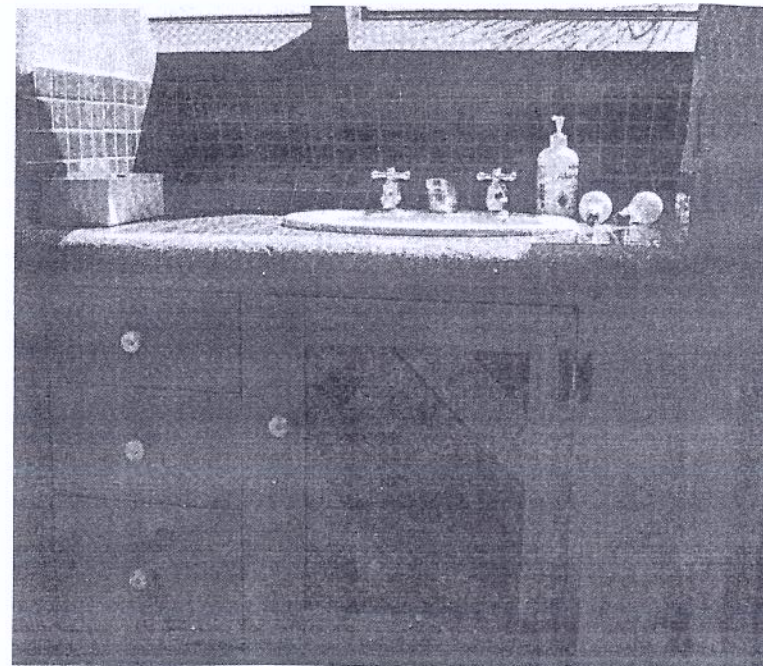
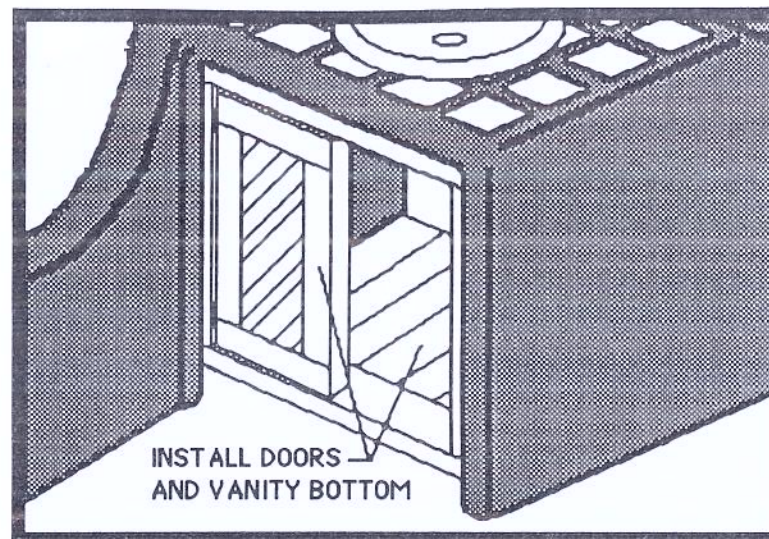
The stucco is now applied in a similar manner to the plaster. The real art in stucco work is knowing how to float it to a smooth surface so it won't be scratchy. You let it slightly set up and then "polish" it with a firm wet sponge or a plaster float from a building supply store. Work the stucco in around your tiles to grout them.

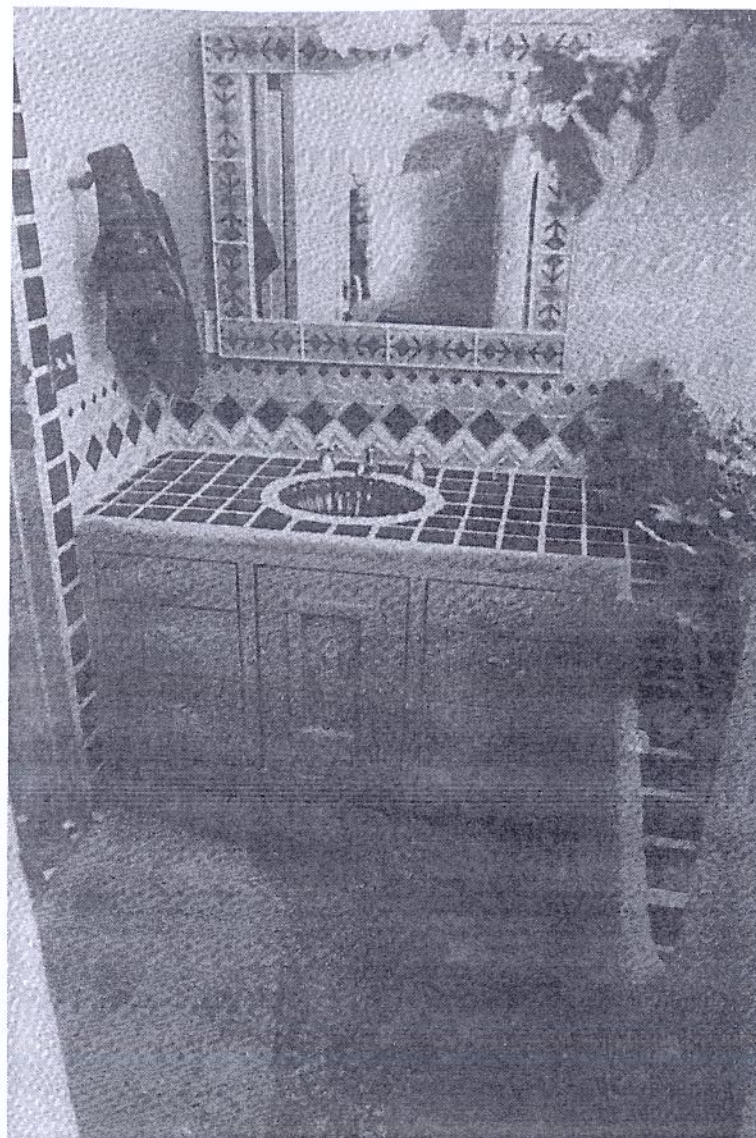


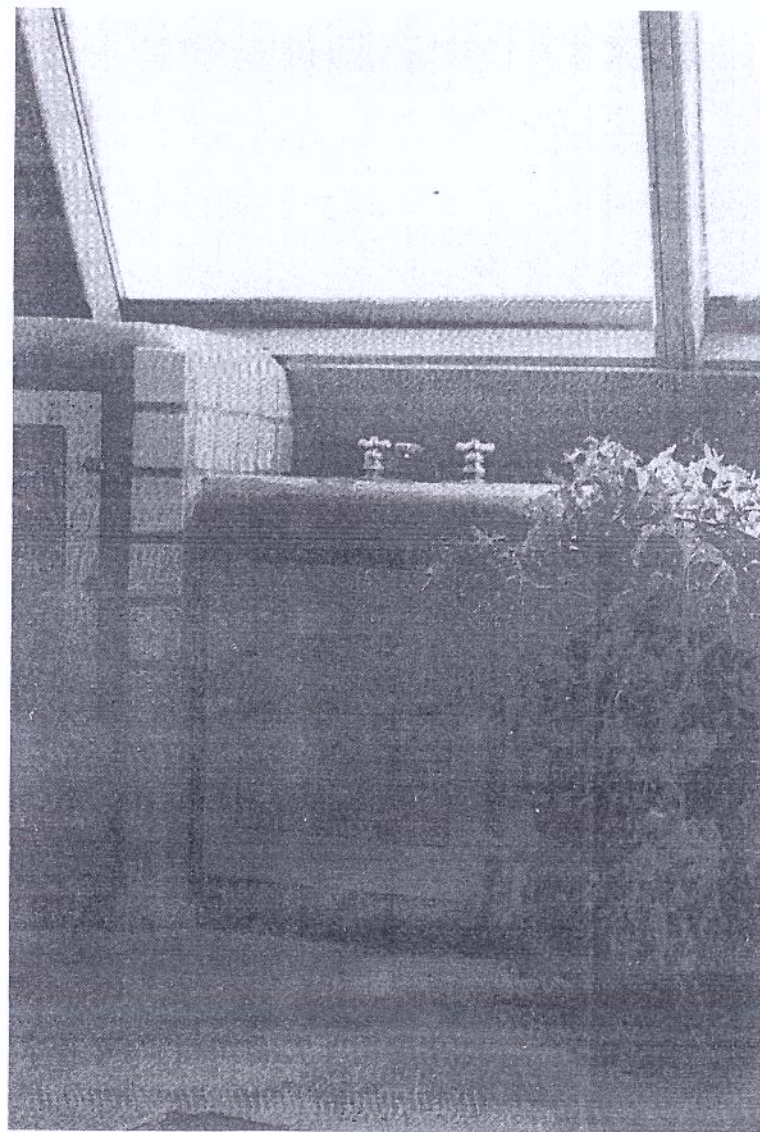
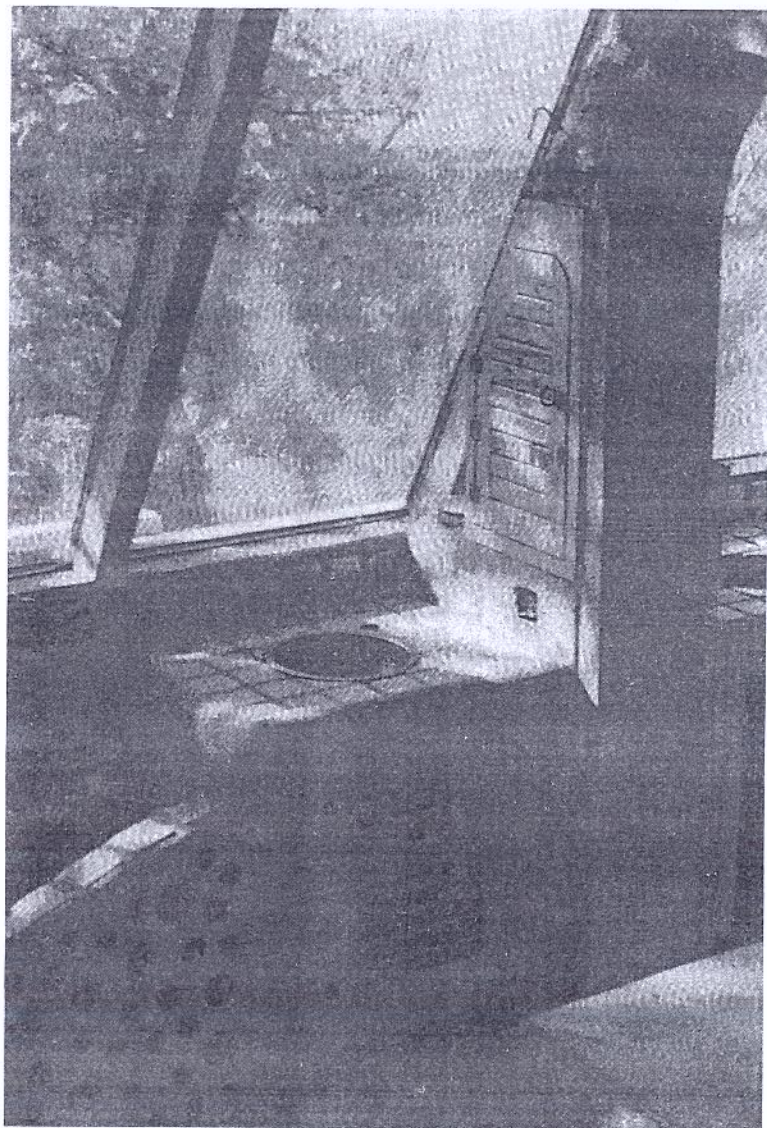
Stucco grouted tiles require at least 1/4" between tiles. Anything less will cause the stucco to crack. Clean the tile immediately as dried stucco is very hard to get off. Keep polishing the tiles with damp and dry rags until they look just like you want them to look.

Stucco can be cleaned with a brush and cleanser and will give you a finish that will last forever. Your stucco should be worked until it is fairly smooth to avoid a scratchy surface. If a local plaster contractor has any experience with stucco, discuss its application with him as stucco takes a little practice to get good at.

Now you can install the floor deck of your cabinet as well as a door as per Chapter 9.

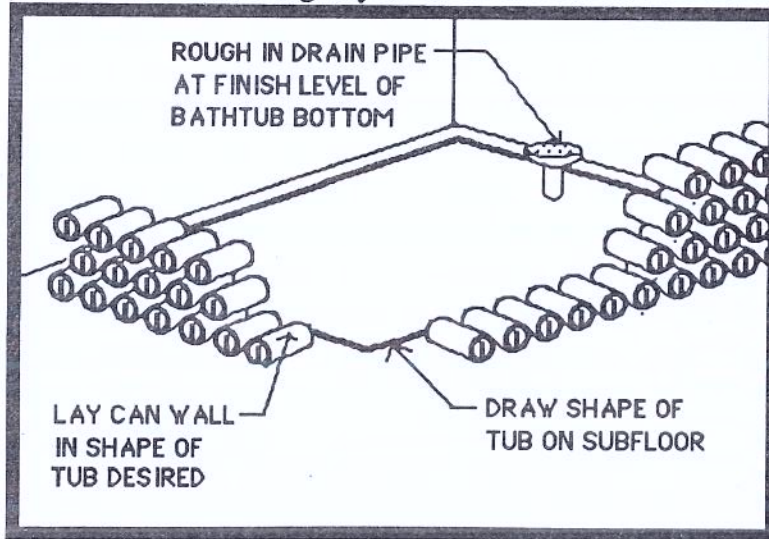






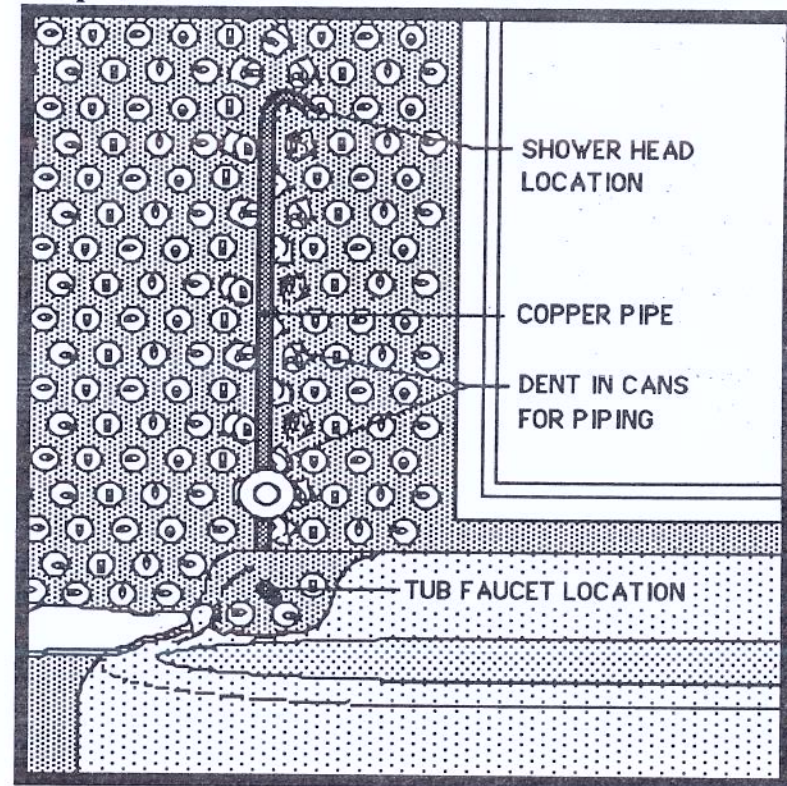
BATHTUBS

Bathtubs are started simply by drawing the shape on the floor or subfloor. This is a guide for roughing in the drain. If you are not familiar with plumbing, have a plumber do your rough in. If a grey water system is used, the drain needs no vent or trap. This makes it very easy to rough in the drain pipe and head it toward your grey water planter (see Chapter 3). A plumber will want to put in a vent and trap. Have him read Chapter 3 so he will understand what you want. Code may still require a vent and trap. It can be done but avoid it if possible since it is an unnecessary expense. Next, establish the location of the finish bottom of the tub and install a flush finish drain plug*. Now lay a can wall in the shape of the tub you want to the height you want.

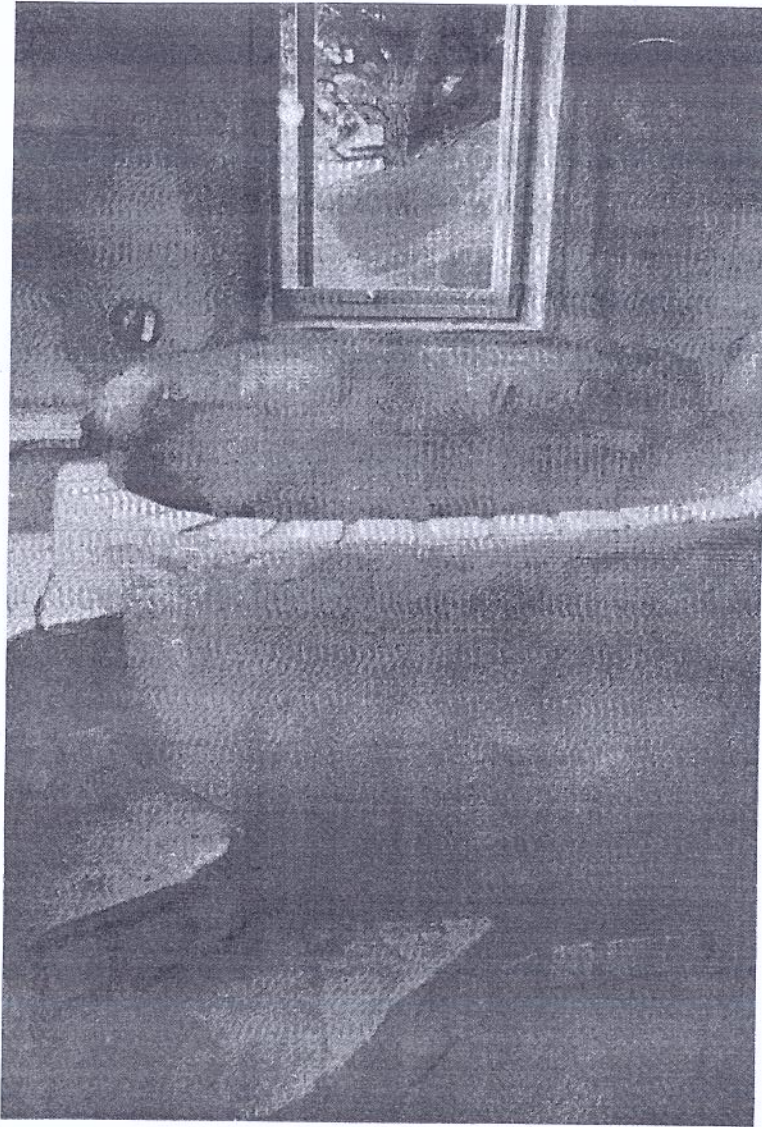


*3 see Appendix, Chapter 10

The rough-in plumbing for the water supply should happen now. If it occurs in an aluminum can wall of your bathroom it can be attached to that wall. Slightly dent in that can work to allow this rough-in copper pipe to recess somewhat into the wall. The Moen Company* now has fixtures that can be serviced from the front so typical pipe chases are not required. The following diagram and photo shows this Moen fixture recessed into the plastered can wall.

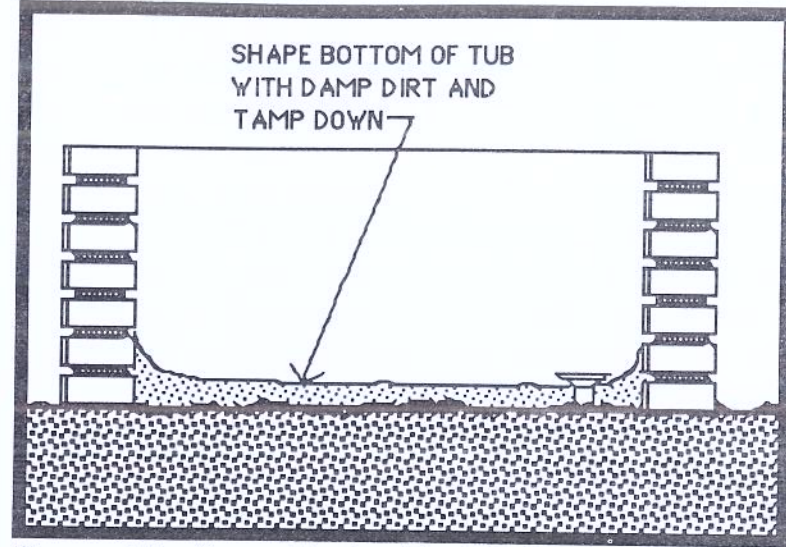


*4 see Appendix, Chapter 10

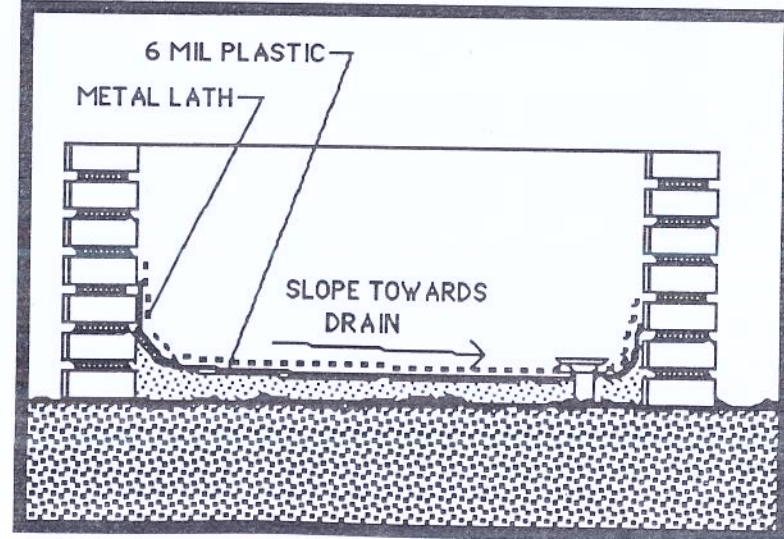


Now take some slightly damp dirt and shape the bottom of the tub to fit your own body or imagination.

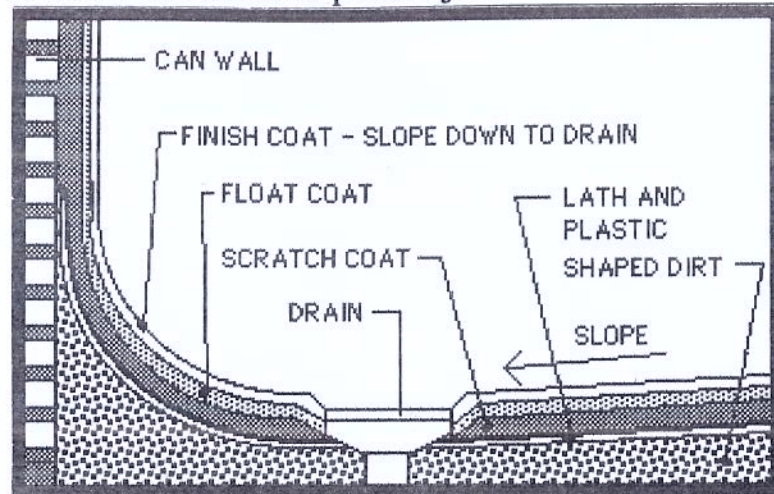
Sculpt it and drape it up to the can wall and then tamp it down well.



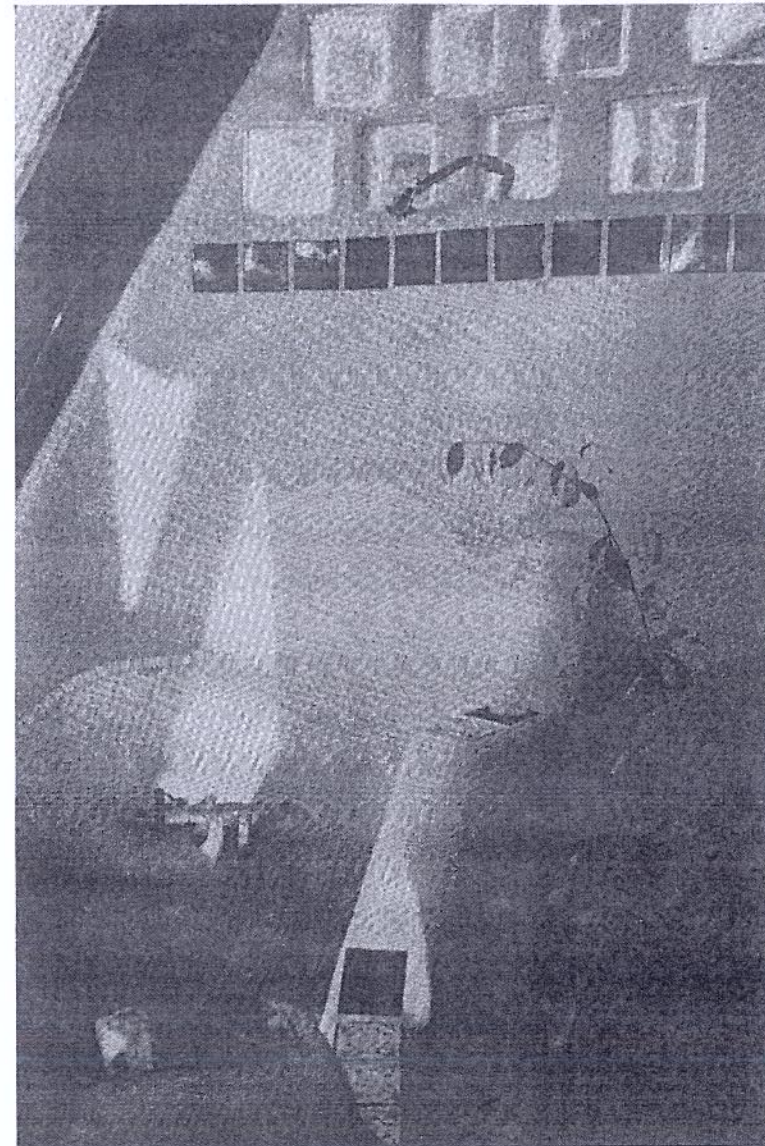
Cover this dirt with 6 mil plastic and cover that with metal lath. Lap the lath up onto the can wall.



Be sure to keep a slope going towards your drain. Also keep this work about 1 1/2" below the drain to allow for a 3 coat plaster job.



Now apply a scratch coat of 1 cement to 3 sand mixed with engineering fibers* and plaster the entire tub inside and out. Scratch it well to receive the next coat. Next apply a float coat of the same mix. Get the shape you want with this coat. Tiles can be installed after this float coat wherever and however you want. It is important to realize that the inner tub must have a smooth finish coat of some kind whereas the walls and outer tub can be stucco to match the rest of the room and vanity. This may influence your tile work as you may want to use the tiles to separate the two materials.

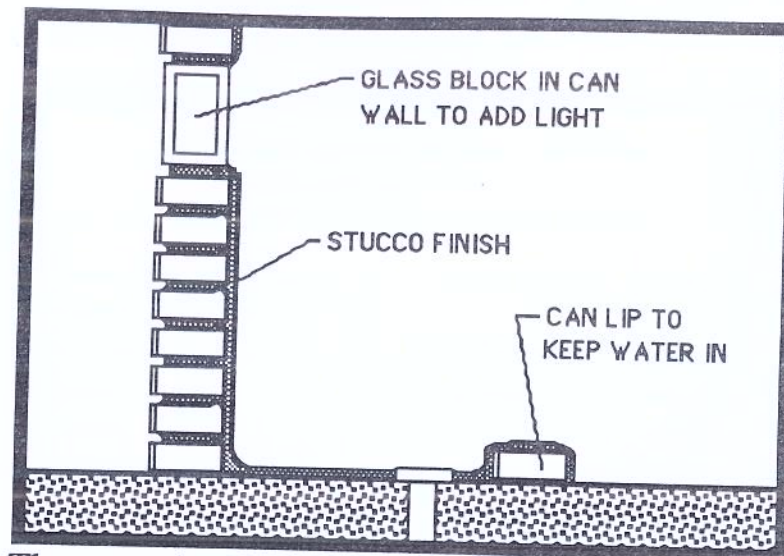


*4 see Appendix, Chapter 10

After tiles are installed (see discussion for vanities) the tub can be stuccoed anywhere except for the inner water holding part. Be advised that stucco finishes should never have cold joints between work done in different work sessions. You must stucco to a corner or an obvious stopping place. If you stucco part one day and part the next day you will have a crack between the two days work. The inner tub can now be plastered with a smooth plaster using fine sand and smooth troweling. The best final finish for this plaster is an acrylic material made by one of the stucco companies*. This acrylic material is basically painted on and holds up better than anything else we have tried. It comes in all colors and is expensive but you don't need much. Some people have done their whole bathroom with this finish, however, it is difficult to use around tiles.

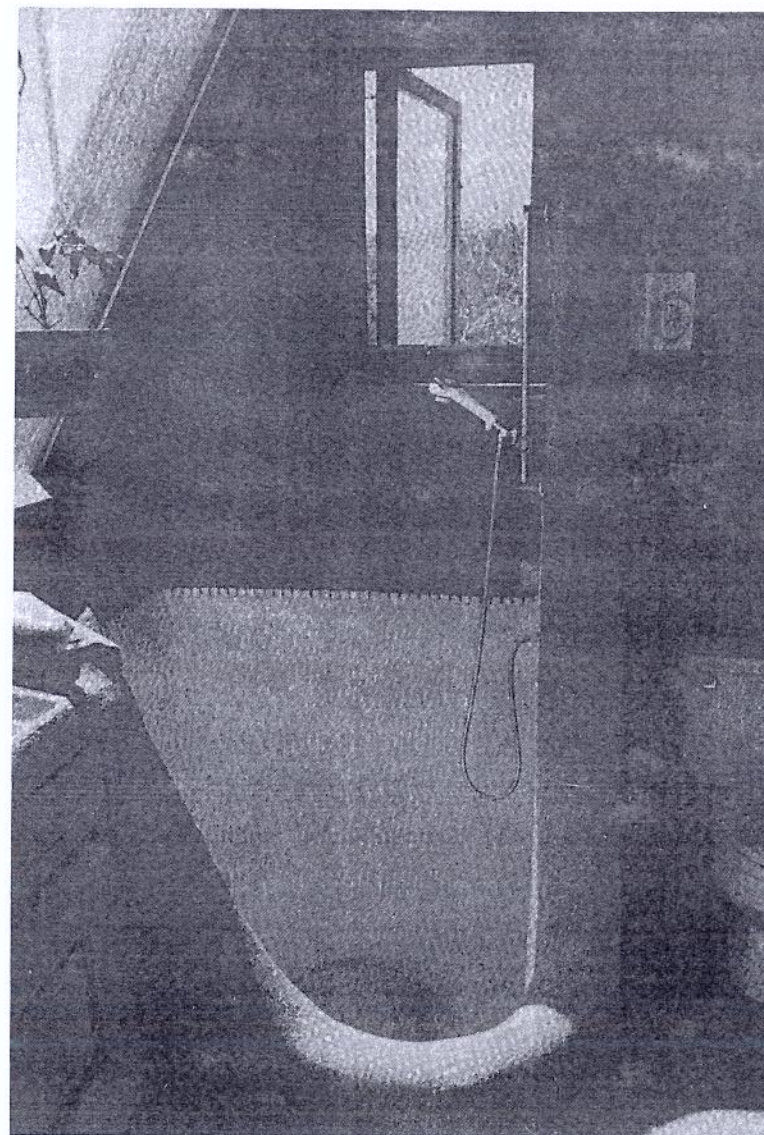
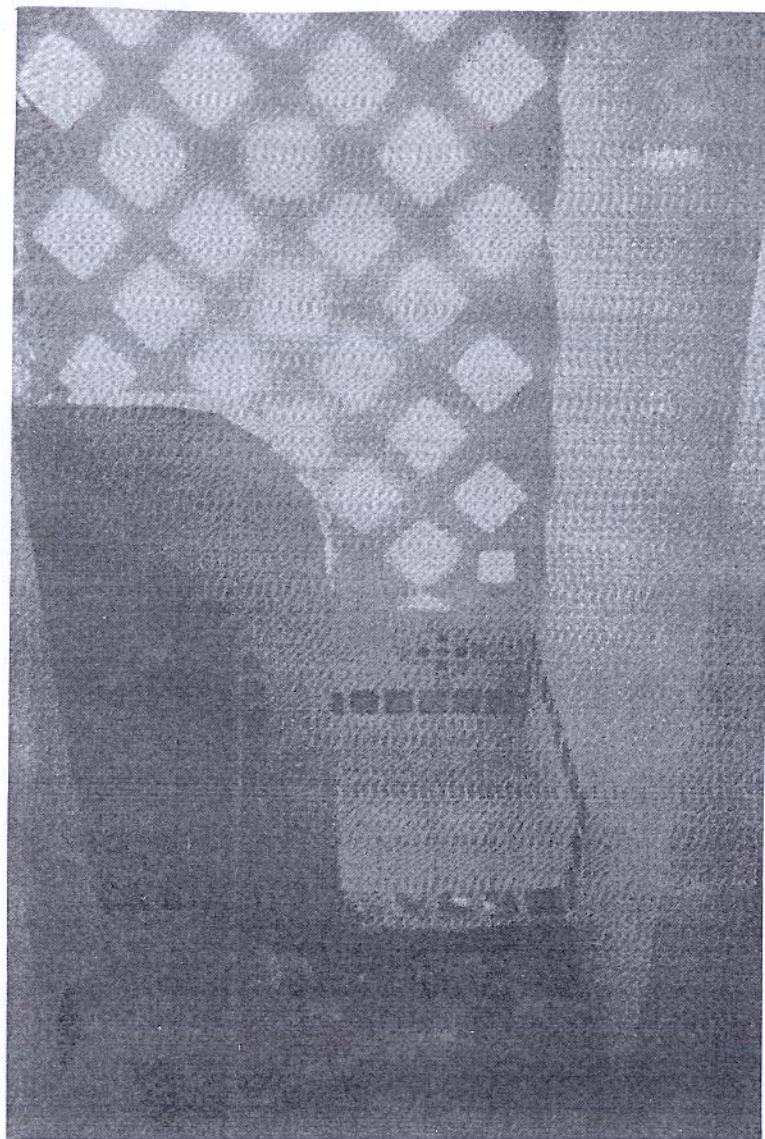
SHOWERS

Shower spaces can be built with can walls, tiled, plastered, and stuccoed similar to the previous discussion on bathtubs. Often glass blocks are used in shower spaces to add light. A floor lip (made of cans) is also a good idea.



The procedures are all similar to other can wall and plastering discussions. Closed in shower stalls are not necessary and seldom used in this type of bathroom as the whole bathroom is full of plants and waterproof. You can literally hose down your bathroom. This requires a floor drain into a greywater planter (see Chapter 3). In fact it is best not to contain your water in a conventional shower stall as the plants love it. An Earthship shower needs only a light definition of space. Let your imagination take you into the experience and out of plumbing catalogs.

*5 see Appendix, Chapter 10





APPENDIX

Faucets

Made by the Moen Company - see your plumber.

Engineering Fibers

Fibermesh Company
4019 Industry Drive
Chattanooga, TN 37416

Stucco

El Rey
4100 Broadway SE
Albuquerque, NM 87105
(505) 873-1180

Acrylic (Tinted Polymer Based Finish)

El Rey
4100 Broadway SE
Albuquerque, NM 87105
(505) 873-1180

Drain for Bathtub

Roman Drain
Order from SSA
Box 1041, Taos, NM 87571
(505) 758-9870

Liquid Nails

Macco Adhesive
Glidden Company
Cleveland, Ohio 44115