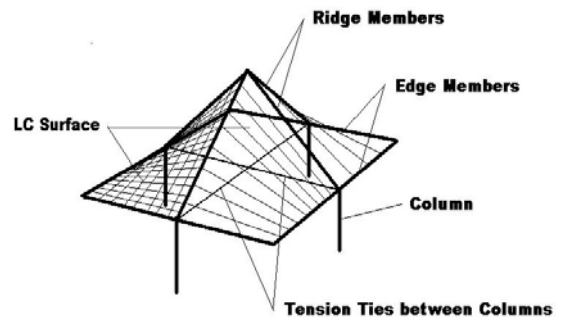


This is a three page manual on low cost, permanent shelter for needy families built using unskilled labor. This construction is a means of fighting poverty. The work can unite war torn communities, and communities disoriented by natural disaster.



A Covered 10'x10' Frame for a Roof::

1. Take four smooth poles or 4x4 struts, two 10' long, and two 10'-6" long, and lay them on the ground to approximate a square with the two longer poles meeting at a common corner.
2. Lift that corner and support it in the air so that it is 3'-4" above the ground. At this point, the poles make a square 10' by 10' in plan. This frame will form one quadrant of the four quadrant roof.
3. Miter the four corners of the poles so that they fit snugly together. Bind them together with long nails, rope or strips of fiberglass cloth.
4. Saw or cut rolls of fiberglass fly screen fabric into strips 12 inches wide and 12 feet long.
5. Mark the two lower poles in 10 equal increments by driving staples into the poles at 12 inch centers. These staples will be later used to align the fiberglass fabric strips as they are stapled onto the poles.
6. Mark the two upper poles by stapling in 10 equal increments, each 12'- $\frac{5}{8}$ " long.
7. Starting at one of the poles lying on the ground, staple a strip of the fiberglass fabric to the pole along its the length, and at each end, stretching the fabric tight and aligning the leading edge of the fabric with the first set of positioning stables. Pull the fabric tight and staple it tightly around the pole at each end.
8. Starting at the other lower pole, run a strip of fabric along its length as above, and staple it down tightly using the positioning staples as a guide for the leading edge of the fabric. The two runs of fabric will be a right angles to each other, and will overlap at the lower end.
9. Add a third strip of fabric parallel to the first strip, overlapping the one below by 6 inches. Place a staple in the center of the strip, then staple the center and four corners of the strip as the strip is pulled tight. Be certain that the strip lies flat upon the one below. Staple the fiberglass screen tightly around the poles at each end.

10. Continue this process of aligning the fabric strips in a herring bone pattern, left and right, aligning the leading edges of the fabric with the positioning staples, overlapping the run below by 6 inches, and stapling them down at their centers, the four corners, and tightly around the poles at each end.
11. Continue this left and right process until the entire four-pole frame is covered with a mat of fiberglass cloth. The surface will be four layers of cloth thick, and all layers should lie flat without gaps, or wrinkles.
12. Take four 3-foot wide strips of fiberglass cloth each twelve feet long, and cover the edge poles and the layered fabric, and staple them down around the edge poles to make a workmanlike, smooth fabric cover around each pole. Use plenty of staples. The tag ends can be cleaned up by nailing a nailer strip along the poles on the inner surface to close the ends, with the excess fabric being trimmed off.
13. Make four such covered frames, one for each quadrant of the proposed roof.

The First Slurry Coat:

1. Mix liquid latex (or latex paint) and water in about equal amounts in a bucket. Add portland cement to the bucket, mixing as you add it until it reaches the consistency of a soupy paste. Spread this paste onto the surface of the fiberglass mesh, spreading the paste out with a long handled push broom. Brush the slurry onto the surface to fill all layers of the fabric. Brush the liquid out on the under side of the mesh as it is forced through the mesh from above. Wear safety glasses and a cap when working under the shell to keep the paste from getting into your eyes or hair.
2. This coating will dry and harden into a surface which can be walked on. Be certain that the layers of mesh are filled with the slurry, and that the slurry has filled the layers wrapping around the poles to fully glue the layers to the poles. Wash out the broom, bucket and tools regularly to keep them in working order.

The Subsequent Mortar Coats:

1. When the surface has hardened, mix additional slurry, but add an amount of clean dry sand to the slurry to give it bulk. Three times as much sand by weight as cement can be used. This mortar slurry should be soupy at application. Broom this mortar mix onto the surface in layers until the surface has been built up to a thickness of $\frac{1}{4}$ to $\frac{3}{8}$ inches in thickness. Paint the slurry completely around the poles.

Tying the Shells Together:

1. After the surfaces have hardened, position the four shells together such that their crown connections meet at the top.

2. Punch holes through the fabric and mortar surfaces adjacent to the four ridge poles and near each end of each ridge pole.
3. Thread 6 to 8-inch wide strips of fiberglass fabric soaked in slurry through the holes and tie them loosely together above the shell.
4. Insert a stick through the loose loop, and tighten the loop by twisting the stick, drawing the shells tightly together. Nail or wedge the twist stick down into the joint between the poles to maintain the fabric tension as the fabric dries.
5. Cover the joint between the shells with several layers of fiberglass fabric, latex slurry, and mortar slurry to seal the joints between the ridge poles to produce a strong, watertight union of the four shells.

Mounting on Columns:

1. Cement four columns 3-feet deep into the ground, spaced such that they will be positioned under the midpoints of the four sides of the roof. Refer to the sketch. Tightly pre-wrap the bottom four feet of each column in slurry coated fabric to provide long term water and insect resistance.
2. Lift or jack the shell assembly up into the air, and set it on the four columns.
3. Anchor the roof to the columns by two steel nailer straps at each column nailed to the ridge poles and the column.
4. Anchorage can otherwise be accomplished by drilling a 1-inch diameter hole thru the column about 1-foot below its top, and threading two 12-inch wide slurry soaked ties through the hole and up through holes in the roof surfaces on each side of the two adjacent ridge poles, and tying them tightly down.
5. Lay the loose ends of the ties out over the roof surface and slurry coat them down.
6. Wrap these slurry soaked ties with additional ties encircling the column top and tied tight, then pull the tag ends up over the roof surface and slurry coat them down, pulling them tight to minimize slack.
7. Cover the roof to column connection with fiberglass fabric and slurry mortar laid on in a workmanlike manner.
8. Add two tension ties spanning across under the roof from column top to column top using four wraps each of 12-inch wide, twisted and parged fiberglass fabric.

The structure can now be occupied by a family who can build walls to suit themselves. This rapid recovery technique is called “*Roofs First*” construction.

Teachers should experiment with large models before full scale construction.