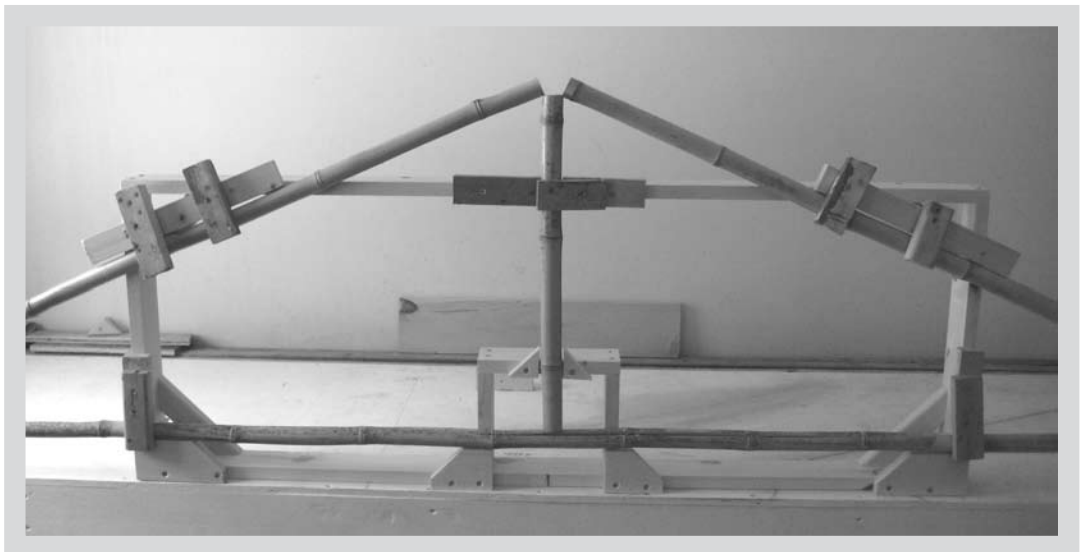


Chapter Nine : Wrapped Joints

The next joint examples use Ceramicrete, a new material developed at the Argonne National Laboratory, in Chicago. It is also known as ceramic base concrete, it is a phosphate base binder ($MgKPO_4$), some call it phosphate. The photos illustrate its interesting possibilities, at this point it is proven completely worthy for bamboo or sapling joint attachments used in truss or wall frame construction or manufacture.

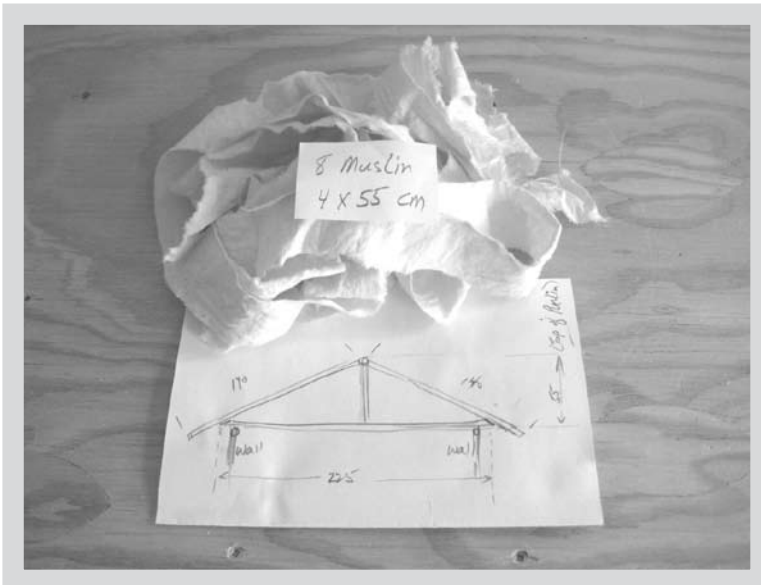
Two clarifying points are needed before proceeding. First, roofs remain the primary focus because supporting walls are comparatively easy, a point brought up because some people have suggested association with wall specialists. Second, these frame and truss joints could also be made with acrylic and cement mix, plain cement, or cloth treated with carpenter's waterproof glue, a process described in chapter five and long known to stage prop designers. Ceramic concrete is a good binder because it hardens rapidly and the jig which holds the frame material can be used again much sooner. The jig is not expensive, it is only complicated enough to leave room to work the wrap around each joint. The gap at the peak is where the top purlin runs along the ridge line of the roof.



The first test of a wrapped joint was with burlap, the burlap proved too bulky, as a result of that, the second truss was made using muslin.



The joints are wrapped and do not use fiber packing as was illustrated in the previous chapter examples, this technique is much faster. This truss is 2.6 m width, including 30 cm eaves, with 5 cm on each side for lashing to a bamboo wall framework.



This jig could also be made from bamboo. Noticing that the truss joints are easily reached and there is room to make full wraps, similar to bandaging a knee or wrist joint of a person, one will dig holes under joint locations if the jig is made from pegs hammered into the ground and the framework is done on hands and knees.



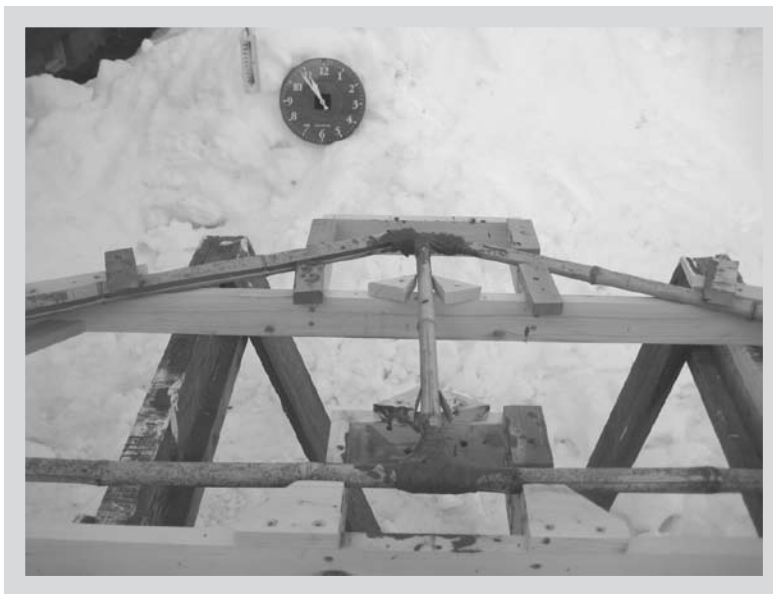
The 2.6 meter (8.5') truss is shown clamped in its jig. Cut strips of muslin are at the mixing station, everything is ready at 29 minutes before the hour.

The ceramic concrete is mixed to a consistency slightly thinner than used with the concrete mixed with acrylic, a thin milk shake is closer to the consistency than the thin pancake batter description for acrylic and cement mix. This thinner aspect as well as material differences allowed for thorough penetration of the fiber by the binder material. It was almost as if there was a wetting agent or perhaps some ionic or acidic state which overcame the repulsive tendency of the fabric fiber surfaces. The fabric became thoroughly soaked at least as rapidly as in plain water.



The strips were first laid into a bucket of mix, one at a time. Avoid any twisting and folding so the muslin doesn't stick to itself (a small measure of slow motion care at this point is required because if the material folds on itself it is difficult to separate while wearing rubber gloves. When the strip is wet, hold it above the small bucket with one hand and slide the excess off between the thumb and finger of the other hand. Then lay the strip flat on a piece of plastic and roll it onto a short piece of scrap bamboo, as in the photo above. Place them back in the bucket and take the now easy to use strips to the frame jig where the joints are to be wrapped.

The eight strips shown above used approximately 280 grams of dry binder (10 oz). There are four joints on the truss, $280 \div 4 =$ each joint used 70 grams (2.5 oz). This material bought in small quantities cost at \$10/lb, which is about €15/kg. The cost figures given on the laboratory product data sheets indicates a large reduction in cost could be realized from large volume purchasing. I've come up with figures ranging from 2 - 5¢ per joint, so, I am naming this the 5¢ joint whether it's made from ceramic base material, acrylic mixed with portland cement, or plain glue.



Elapsed time from start is 23 minutes. Subtract time for photos and changing gloves etc and call this 25 minutes, including clean-up.





Here the truss is shown removed from the jig a little less than an hour from start to finish. The temperature is 3.5° Celcius (38° Farenheit). It was less comfortable for the people displaced by earthquake in Pakistan but they could have benefited with a few hundred pounds of ceramic base cement for their bamboo fabrications.

There is not enough space in this book to show pictures from presentations of the struggles faced in the mountains during winter. Their travail inspired me to make these experiments in similar conditions and I hope some day they will help. These joints are strong, once they have become incorporated into a completed structure they will become even stronger.

One aspect of the manual is to provide insights for the huge number of small-scale

enterprises which will be required to build hundreds of millions of shelters, in a timely fashion. The pattern jig shown at the left cuts identical bottom chords for this truss. The far angle guide is fixed in place the near one slides along the wood between the guides and is fixed at a chosen length, in this case, 2.25 meters. A common hand saw cuts a nice angle better than the one shown.

Clamp the bamboo in position and cut each end. Many identical pieces can be made and provided to the assembly area jig in size labeled kits. The same techniques are suitable for much easier wall assemblies.



This simple work is of interest to scientists who understand the purpose as well as the idea of treating a chronic ailment before it becomes an unmanageable emergency. All suggestions will be appreciated. Send ideas or questions to ferrocement.com or self-sheltering.org.

I once jumped into a huge avalanche and grabbed my wife's hands before she was swept away. We were deposited behind a tree with our legs just above a monster melting mountain as it roared by. If you have an idea, I know beyond doubt you should share it. Synergy is serendipitous.



Notes:

A note on saplings is included here because I'm not sure yet how to include this topic. I was a tree farmer at one time and can say through experience that I believe if one plants poplar seed in a row like corn, and fertilizes as heavily as one does with corn, the result will be straight saplings, which, when covered with fabric as in chapter seven, should provide a fruitful direction for further research into very low cost housing.

Poplar is used as an example only because it is common and to stress that the strength quality of the wood is not the primary goal. Each country has at least one and often more sapling varieties which resists rot and which will grow rapidly if tended in a rich garden environment. I have personally grown ceonothus as a staight sapling in such conditions, this plant is normally a hardwood irregular brush in the chaperal ecology of California. Slow and interesting conversations with wise elders about this and other topics usually provides several varieties to choose from.