BUILDING WITH STONE AND EARTH

PART II

In part one Richard Tufnell explained how to build a rondavel out of stone. In this second part he demonstrates the same techniques on a square building, and describes an alternative 'single skin' wall.

You know from Part I how to build a round rondavel; it is even easier to build a 'square rondavel'. The only difference in the equipment is that you will need four straight poles and four short pegs (or more poles) to use for measuring, instead of one. Decide what size you want your square rondavel to be, and place a long pole upright on the outside of each comer. Attach strings right round the square, about one hands' width off the ground. Then hammer in a short peg on the inside of each comer, leaving a space the desired width of the wall, and connect these up with string in the same way (below).

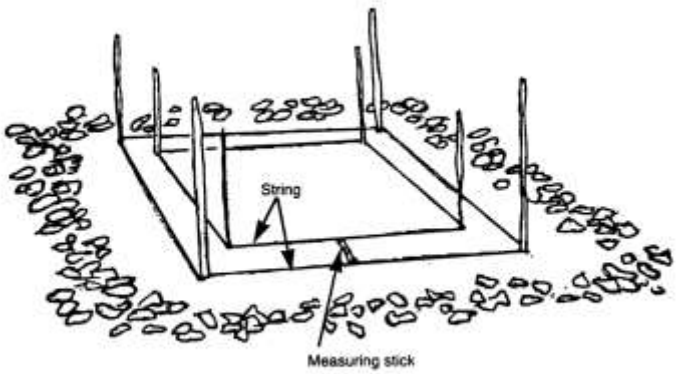

Figure 1: Marking out for a square building

Just as with the round rondavel, you must lay a foundation layer of stone without using mud. This is done by laying the stones so that each one sticks out from under the string by about three fingers' width. When you come to a comer pole, lay the stones beside it.

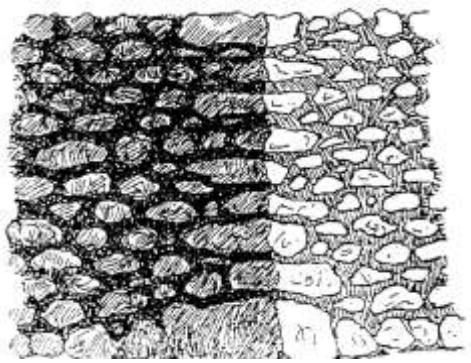

Figure 2: Use longer stones to tie the corners together.

When the foundation is finished, you will have what looks like a stone path a little bit wider than the strings, all the way round.

Next, raise the strings up the poles all the way round by perhaps a hand's width or a little bit more. These strings are now used to guide you as you build the wall. Mix the mud mortar as before, and begin building your wall just as described for round buildings.

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Of course, square rondavels have corners, which round ones do not. For these, try and find stones that are a little larger and longer than the average. These are then laid so that the long side of the first stone goes along one wall, and the long side of the stone on the next row up goes along the other wall. This ties the walls together well and makes for a strong finish. Look at the figure below to see how this works.

Because the strings are fixed to the poles, all you have to do to keep your wall straight is to make sure that each stone is laid so that it almost touches the string. There has to be a very tiny gap between the stone and the string. If the stone does touch the string any-where, it will push the string outwards, so that when you lay the next layer of stones they will be in the wrong position. Using the strings as an accurate guide is extremely important; if you do it correctly, your rondavel will look very good indeed and be very stable.

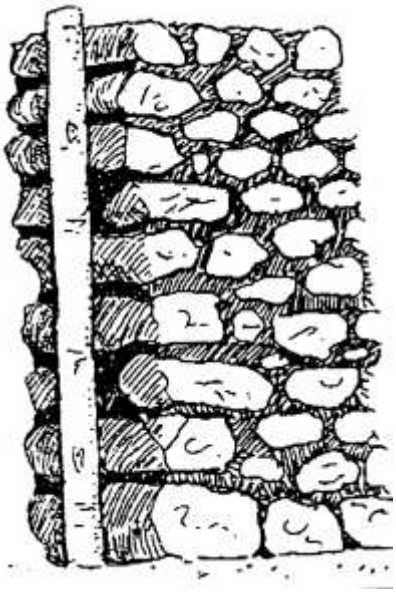

Figure 3: Building up to the door poles

Safety

Building with stone and earth is not dangerous, but there are one or two points that you should bear in mind.

Do not try to lift a stone that is too heavy. Get some one else to help you.

If you have to break stone to get the sizes and shapes that you need, remember that sharp pieces of stone can fly off at high speed. It is very important to protect your eyes, so close your eyes at the moment of impact, hold your other arm up to shield your eyes or, best of all, wear

When you reach the door poles you build the same way as you did for the round rondavel. Try to use a long stone that extends the whole width of the wall, and then balance it with two stones on the next layer.

Every time you have built up to the strings, raise them again by about a hand's width, and continue until the wall is the height you want. Remember to brush the joints smooth with water once the mud is about half dry.

Single walls

The examples given here have used walls with two 'skins' –one inside and one outside, with the middle filled with mud and waste stone. These are usually known as 'double' walls. If you are fortunate enough to have enough of the right size of stone, or you are prepared to search for longer in order to find stones that are suitable, then there is a method of using mud and stone that is even easier and quicker to build. This is known as single, or 'single skin' walling.

You will need a good number of building stones that are not less than about 30cm long, and the flatter and more regular they are, the easier it will be to build with them. It should be noted that using this method will give a strong house or other building of one storey, but it is not suitable for

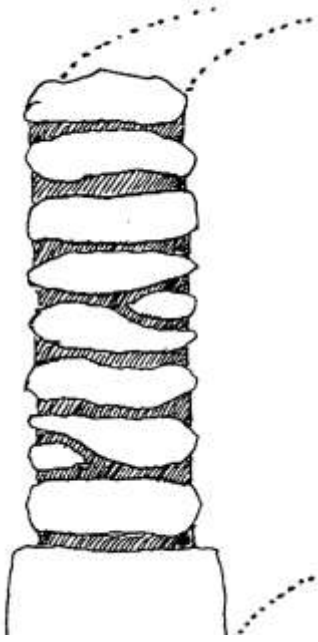

Figure 4: The foundation layer is wider than the wall

taller structures.
For your foundation layer, you will need enough stones that are even longer than 30cm, so that the foundation layer is wider than the wall itself.

Marking Out

For a round rondavel, you will need at this stage a central pole but for a square rondavel you will only need the four long outside poles described earlier, not the inner pegs, when you build a 'single' wall.

Let us assume that you are building a round rondavel, and that you have carefully placed a straight pole in the centre. Mark out the size of the building on the ground as described in the previous article, using a string and peg, except that you will only need to mark one circle on the ground, not two. This circle will mark the outside of the foundation course. Next lay a single layer of large stones, 35-40cm long, as the foundation course. Each stone is placed against the rim of the circle you have drawn on the ground, with the stone inside the circle. Ensure that they are all touching each other and are pinned securely so that there is no movement when they are tested by being walked on. If any of the stones do move, secure them by putting small wedge-shaped pieces of stone underneath, until the foundation stone is stable After this, tie a marker knot in the string about 4 to 6cm in from the outside of the foundation circle to guide you as you build.

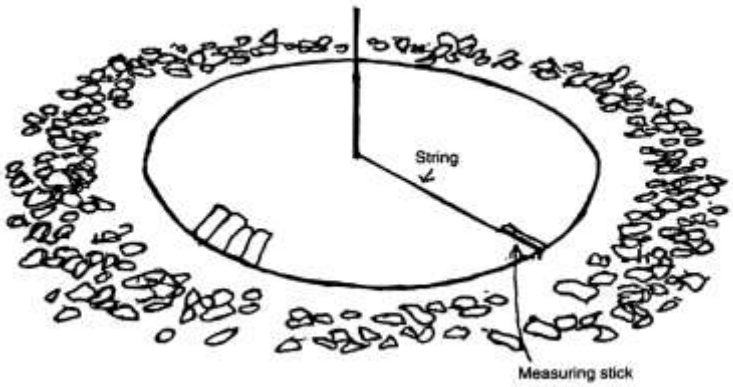

Figure 5: Only one circle is needed for a single skin wall

Place a thin layer of mud on an area of the foundation stones and place building stones on the mud one by one, breaking the joints by placing each stone so that it covers a joint of the stones in the layer below. Use the guide knot on the string to measure the outside face of the stones only. The stones will each be a slightly different length, so the outside will have a smooth face, and the face on the inside of the rondavel will be slightly irregular. (You can always plaster the inside afterwards if you wish.) Remember to use only enough mud to sit the stones securely. Do not use thick layers. If part of the stone you are laying touches through the mud onto the stone below, so much the better.

When you come to the doorway, try to alternate long stones with shorter ones, so that the door opening is tied well into the wall.

You can build this type of building in only three or four days if you have the right materials. But you do not often get something for nothing, and a fast building time is usually balanced by the extra time it takes to find the right type of stones. On the other hand, you will need much less stone overall for a single skin wall than for a double.

Finishing the wall

How you finish your wall when it is built is entirely up to you. Some people like to plaster the inside to make sure there are no places for insects to hide, although if you have brushed the joints smooth, this should not be necessary. Others like to plaster both sides. This can be

done with either pure mud mortar (remember to wet the walls to help the plaster stick if this is done after the wall is completely dry) or with a plaster made with cement. Cement-based plaster does help prevent minor damage in the rains, but if it is difficult for you to get supplies, do not worry; your building will still be good and strong. If the outside is plastered, some people paint their rondavel a single colour, and then decorate it with a simple design. In parts of Africa, some family groups are known by the different pictures each one uses. Painting the rondavels white helps keep them cool in the hot season, and makes them look very smart and cheerful.

Maintaining your building

Your building will last very many years -almost certainly much longer than you! There should be very little need for any maintenance or repairs, provided you have made built a roof which hangs over the walls as much as possible, as explained in the previous article. You may need to mix up a little bit of mud mortar and press it in between the stones after the rainy season, but it is unlikely. The roof will probably need more regular maintenance than the building.

Further reading

Building with Stone and Earth - Part 1 Practical Action Technical Brief
Building Dry Stone Walls Practical Action Video
Stone: An introduction A Shadmon Practical Action Publishing 1996

This article was originally written for the *Appropriate Technology* magazine 24/Number 3 Dec 1997 by Richard Tufnell, a dry stone mason with many years experience of dry stone, and illustrated for the *Appropriate Technology* magazine by Bill Holmes, also a mason

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