

"TERMITE NEST" CITIES -- the Next Generation

by [Thinkenstein](#) on October 30, 2009

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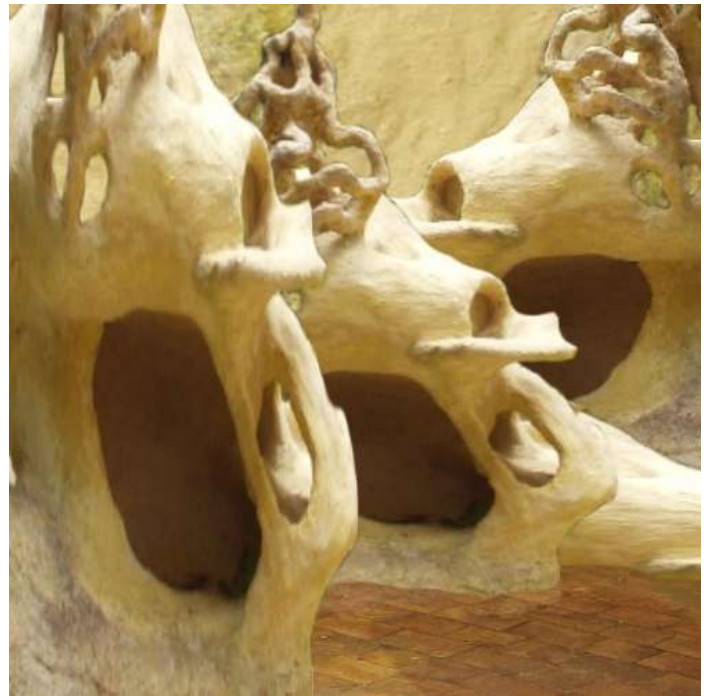
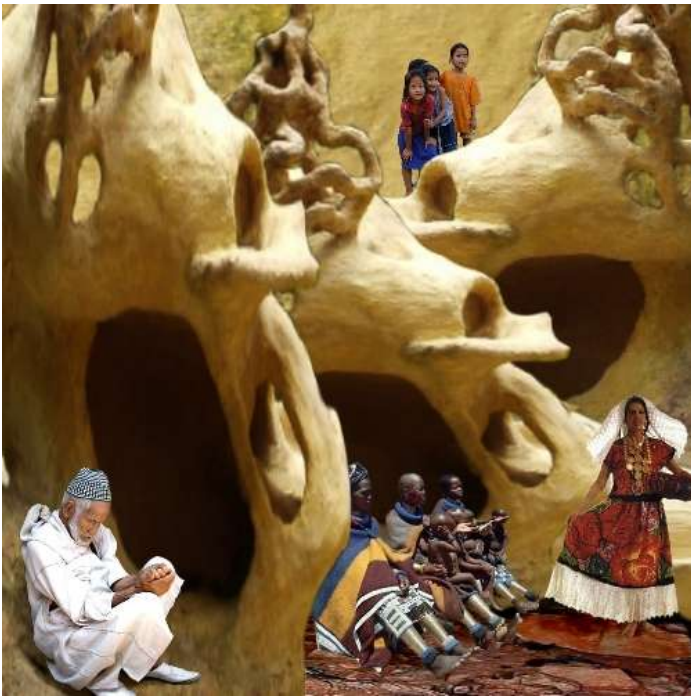
Intro: "TERMITE NEST" CITIES -- the Next Generation

The box came along as the architectural standard because many building materials, such as lumber, are straight and flat. Straight vertical columns supported the roofs. Straight lines are rare in nature, so is it any wonder that our cities stand out from nature like sore thumbs? Boxes stack nicely in square grids. Most cities are laid out in square grids.

Using ferro-cement (iron and cement), or nylon-cement (nylon fishnet and cement) one can make domes and tunnels that are functional and esthetically more natural-looking than boxes are. As tunnels and rooms grow on and around each other, the structure starts to look like the nests made by termites.

The same iron rebar framework that supports the cement can support the growth of vines, which provide shade and food here in the tropics. Global warming and an era of agricultural failures may be on its way. Shade and food are good. The trellises can be converted into cement structures later.

Using examples from two houses I have built, this instructable will show how to get started today on a termite nest city of tomorrow.



step 1: Materials

To build a termite nest city, you will need a lot of sand and cement. Iron rebar is used to define the basic forms. Chicken wire, or nylon fishnet covers the rebar form and provides a fine enough mesh for plastering with cement. The cement to sand ratio is the standard 1:3 mix used for plastering.

Since iron rusting is a problem with the rebar, longevity is improved by painting the rebar first with a good primer and rust preventative paint. If cost was not a factor, one could use stainless steel, or perhaps something like Cor-ten steel, which forms an oxide coat that protects from further oxidation. It would be ideal to use immortal materials, so that a city could keep growing without ever having to use demolition on the old parts.

The old parts of the city, at the bottom, would be protected from the weather by the younger parts above them, improving their longevity.



Image Notes

1. This is 1/4 inch diameter rebar. It comes in 20 ft. lengths.
2. Fishnet comes in different size meshes. I got tons of this fine mesh fishnet free, discarded by the tuna industry once it had a few larger holes in it. They used it to separate layers of tuna in the hold, not to catch the fish. They unloaded the fish by hoisting it out of the hold with the fishnet.

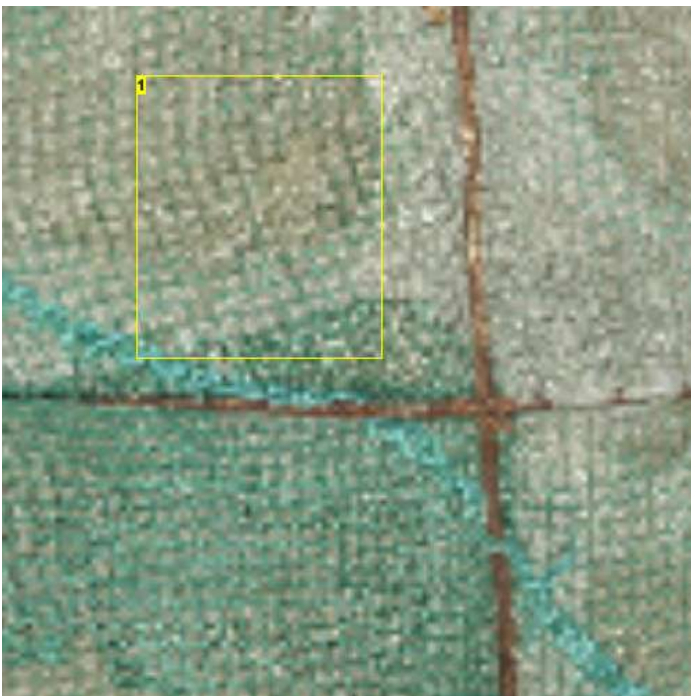


Image Notes

1. The fishnet has been plastered from one side. Plaster this side to finish it. It ends up being about 1 1/2 inches thick.



step 2: Painting the rebar

I used to build with unpainted rebar. Iron rusts, though, and can expand and break cement. For any major cement construction now I paint the cement for better longevity. Some people use a brush or roller. I made an invention, like a dip tank, using PVC pipe.

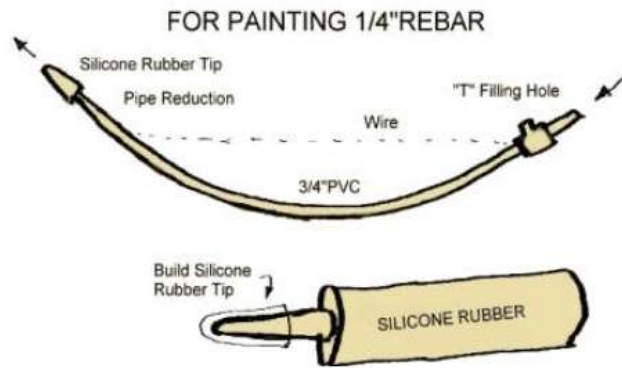
The rebar goes in one end of the pipe, passes through the paint reservoir and comes out the other end painted.

A conical silicone rubber tip, formed over the conical tip of a silicone cartridge is trimmed so that the inside hole is just the right size to scrape off excess paint and keep it inside the paint reservoir.



Image Notes

1. This is the silicone rubber tip, with a nail in it as a plug when not in use.
2. Some painted rebar.



Trim any inside obstacles, such as ends of pipe, so that the rebar will stay centered in the pipe.

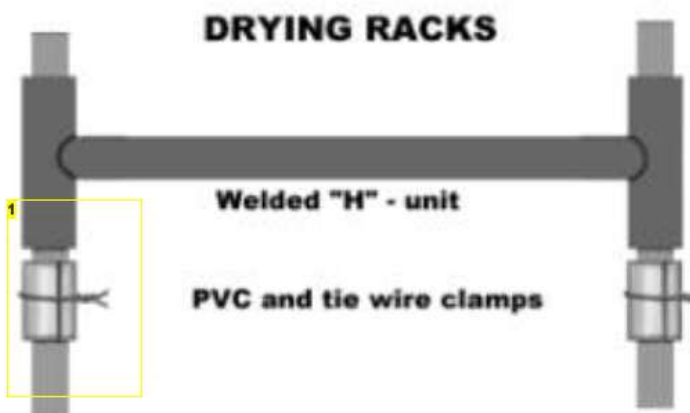


Image Notes

1. These drying racks have adjustable height . The clamps are sections of PVC pipe cut on one side, held with wire.

step 3: Termite nests

I used to think of soap suds as a model for this kind of architecture, but soap suds are like a closed-cell foam and they maintain their shape because of internal air pressure. The termite nest is a more accurate representation.

Termites build their nests out of a paper-like substance they produce. They cover their trails up the sides of trees, like tunnels, to protect themselves. The nests in the trees are irregular, globular masses with this foam-like structure.

A termite nest city would grow over time, layer upon layer.



Image Notes

1. This is a termite nest. It is like a foam in a way; very light weight. Instead of building an apartment house, for example, with a lot of square boxes (boring), a free-form architecture like this could be used.



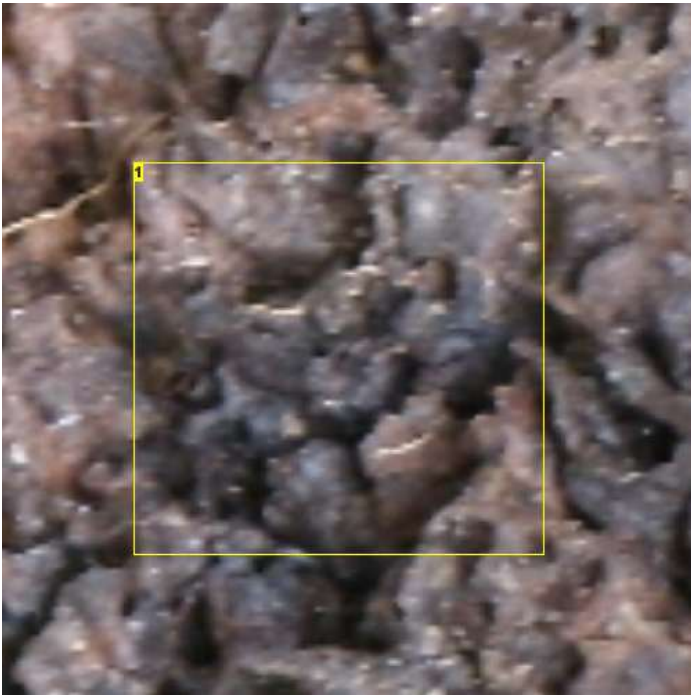


Image Notes

1. Sorry that my close-up photography is not the best. Basically, tunnels and rooms can go anywhere.

step 4: Design considerations

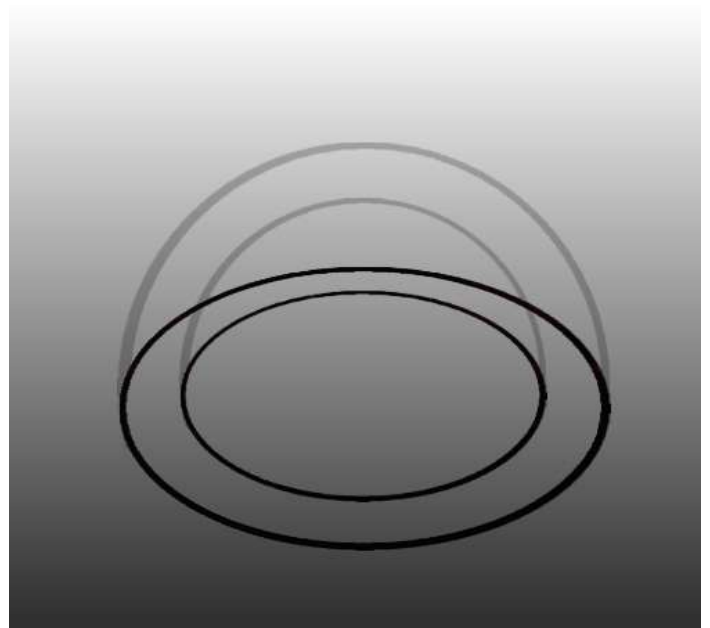
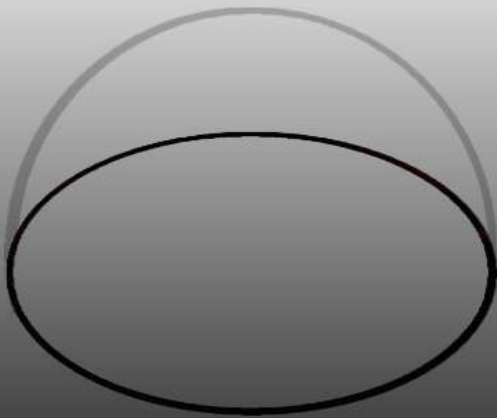
Like a true termite nest, a termite nest city might be built with nothing but free-form rooms and tunnels that all support each other. I have no idea how high that might grow, but my house is two stories high and I could imagine it growing higher.

Domes are very strong shapes since all the parts of the dome are under compression and cement is strong in compression. Cement is relatively weak under tension, such as on the bottom side of flat roofs. Flat roofs need internal walls or columns to help support them. Dome roofs do not.

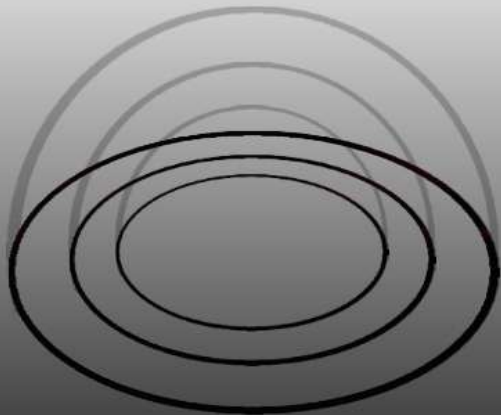
A termite nest city might grow as a series of concentric domes, with the spaces between the layers filled with free-form construction like termite nests.

Because domes are self-supporting outer concentric layers would not necessarily crush inner layers.

A dome can support itself
without internal columns or
walls.



Concentric domes are all self-supporting.



step 5: Underground

I dug a 30 foot deep cave-like vertical shaft in my living room and 150 feet of horizontal tunnels with a doorway in the hillside. I suppose an ant nest is more of a model for the tunnel than a termite nest.

I dug the vertical shaft first, plastering it with a layer of nylon-cement. Then, after doing a lot of measuring and calculations I started in the hillside with the horizontal tunnel and connected with the bottom of the vertical shaft. The tunnel has good ventilation and electricity for lights.

It gets pretty humid in rainy season, but cement and nylon are both compatible with water.

Right now, I am in the process of colorizing the tunnel with colored cement.

Shapes such as stairways, walkways, ponds and furniture can be carved into the earth and covered with a layer of nylon cement to preserve their shapes.



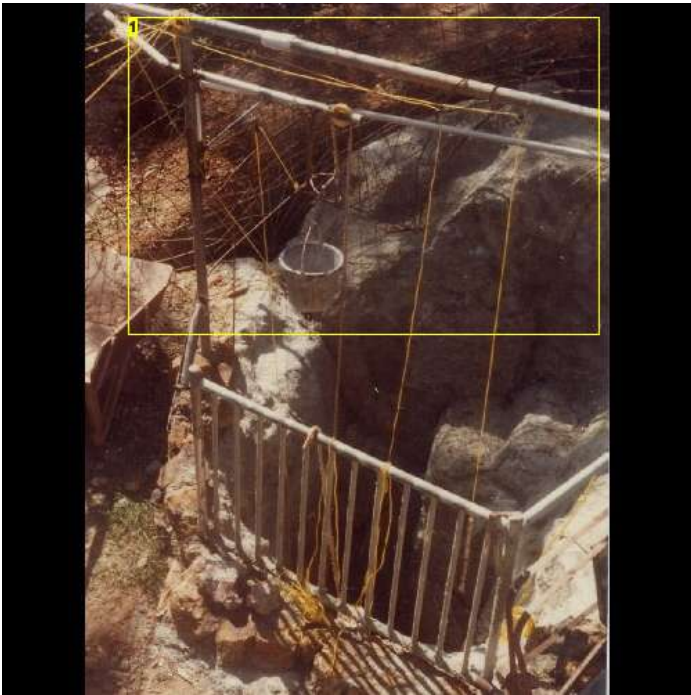


Image Notes

1. This is the Rube Goldberg invention I made for hoisting dirt out of the vertical shaft in my living room. By pulling ropes I could hoist buckets of dirt, dump them, and return the bucket for more dirt. I dug the shaft to look like a natural cave, with climbable walls.

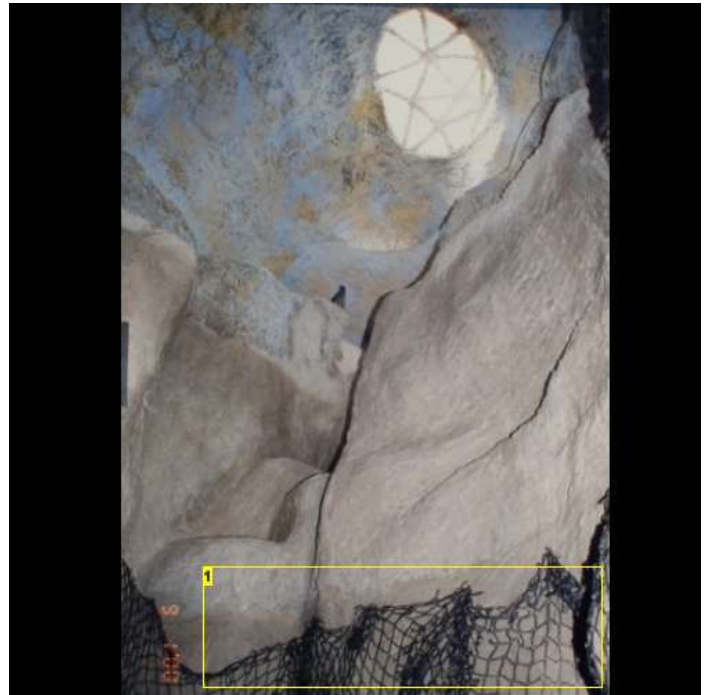


Image Notes

1. One needs big mesh fishnet for plastering underground. The cement has to pass through the holes to stick to the walls.

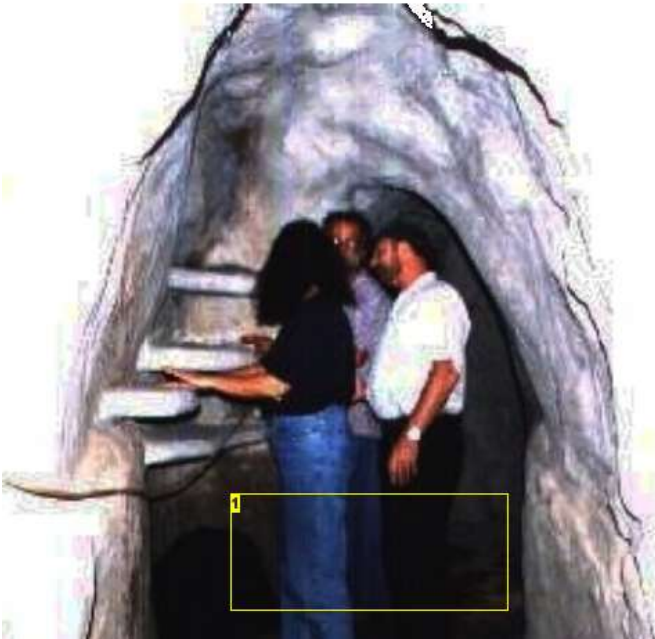


Image Notes

1. Visitors are playing percussion music on the Styrofoam filled shelves. They sound like conga drums.

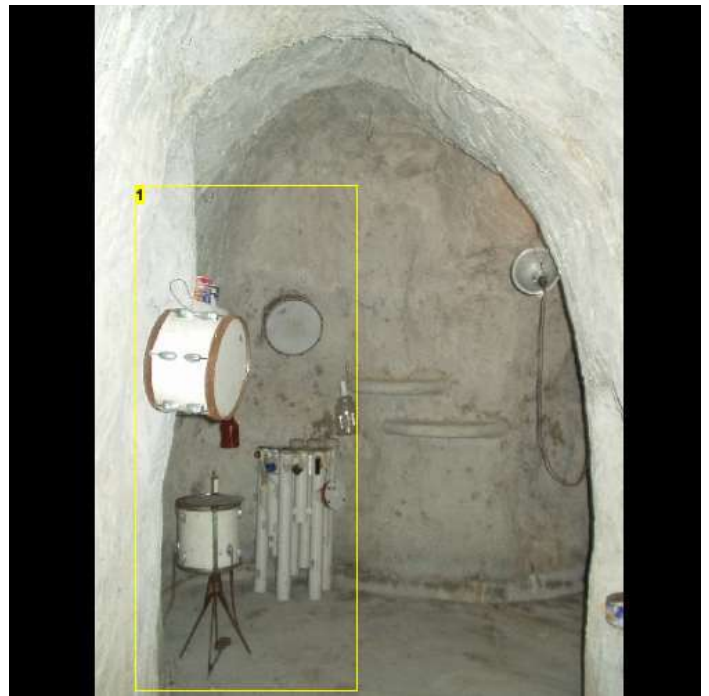


Image Notes

1. More percussion instruments in storage.

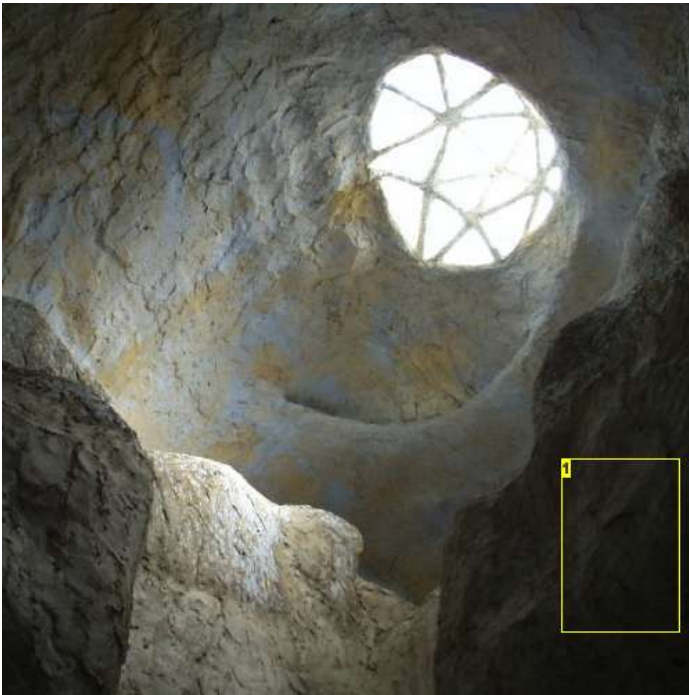


Image Notes

1. I can see the sky light at the end of the tunnel.

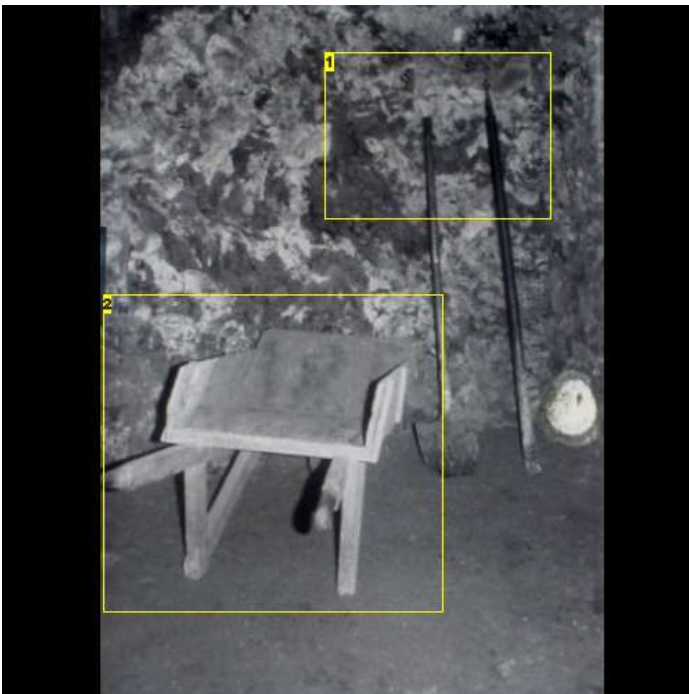


Image Notes

1. The "coa" on the right is a digging tool like a big chisel. The blade is from an automotive spring leaf. I dug the tunnel with the coa and used the shovel to load the wheelbarrow.
2. I made the wheelbarrow out of wood, using an old iron wheelbarrow wheel someone gave me.

step 6: Water

Water doesn't harm cement, so cement can be used in making fishponds, water tanks, washing machines and toilets, among other things.

A friend years ago told me that cement water tanks keep the water tasting fresher than other materials do. Personally, I get my drinking water in gallon jugs from a local spring because I don't like the chlorine and other additives in public water. Our public water goes out frequently, so it is a good idea to have some in reserve for all the other things we use water for.



Image Notes

1. These water tanks are made of Hi-rib, which is an expanded sheet metal with holes cut in it for plastering, and raised ribs in one direction for rigidity. It is great for making cylinders. I put some rebar "belly bands" around the tanks to help resist the outward pressure of the water.



Image Notes

1. Washing machine. Pump the handle up and down and the two plungers go up and down, agitating the wash.



Image Notes

1. Flush toilet. It's kind of like the old chain pull toilets with the high tanks. This tank has lower elevation, but still lots of water pressure.

step 7: Trellises

A rebar trellis is basically the same thing as the rebar that defines the form of a cement structure before plastering it. Here in the tropics, vines grow all too well, along with the rest of the weeds. They all provide shade for structures below them, and some vines provide fruit or edible leaves. What with global warming and possible food shortages ahead, shade and food are good things to think about.





Image Notes

1. Chayote. Kind of bland, but nice.

Image Notes

1. Col Blanca. Collard, I think. Leaves can be eaten raw, or steamed. Very good with a little oil and vinegar. Normally, it is not grown on trellises. It flops over on the ground and is harder to weed. On a trellis, it is easy to weed around it.



Image Notes

1. Zocato. Red when ripe. It is very sweet, like a melon.

step 8: Doors

Doors can also be made out of cement. They are about as strong as the walls. My doors weigh around 600 pounds and are built in place.



step 9: Think outside the box

Curves are a lot more fun to live around than straight lines are. When you have seen one box, you have pretty much seen them all. This flexible architecture technique is capable of free form flights of fantasy.



Image Notes

1. This is my upstairs bedroom.

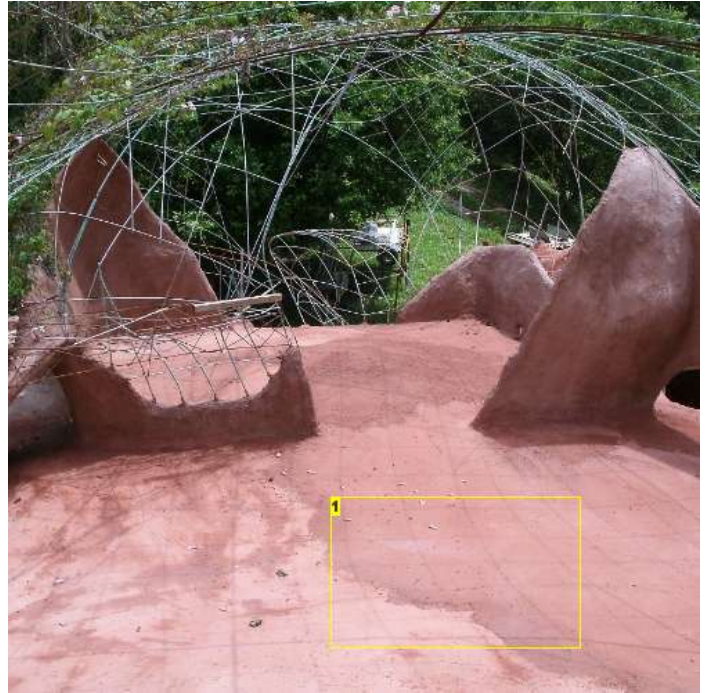


Image Notes

1. Roof of the guesthouse. Because of the rebar trellis, it would be a pretty safe place to let children play.

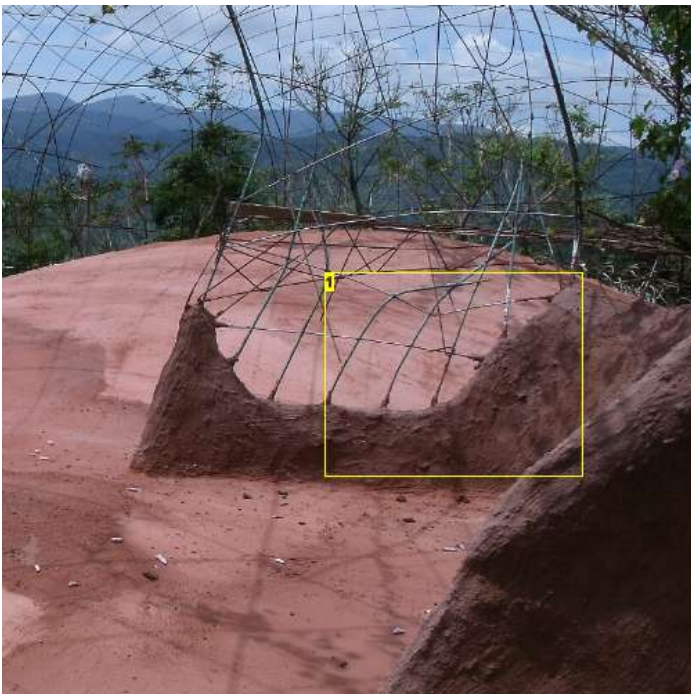


Image Notes

1. Rebar trellises can be turned into cement walls.



Image Notes

1. Outdoor shower grotto in the bathroom.



Image Notes

1. These are some Styrofoam scraps that I stuck to the wall of the shower grotto and splattered with colored cement.



Image Notes

1. These are "zipper stairs", so named because of their left-right-left-right pattern. They are easier and safer to climb, especially on steep slopes.

step 10: Interior shots

In boxy architecture, you have sharp corners to deal with. Normally, one has to slow down some to get around them. With nothing but curves, traffic tends to move faster.

Since floors are often domed, or at least sloping in this kind of architecture, it is useful to sometimes hang things, including furniture from overhead. This helps keep the floor easier to clean, for one thing.

I try to keep water run-off in mind always, to avoid puddling. All of my floors and patios slope some so they can be cleaned off with a hose. As far as house keeping goes, I tend to admire the lion pens at the zoo. Just get out the hose.



Image Notes

1. Automobile car seat with silicone rubber feet to protect the floor.
2. Safety grill around the vertical shaft in the living room. Rebar wrapped with strips of cement-saturated fishnet.



Image Notes

1. Big cave-like windows. Good ventilation, and a great view.



Image Notes

1. I keep a plastic tarp on the bed during the day, in case it rains with wind, since the big cave-like windows in the bedroom are always open. If it rains too hard at night, I just cover the bed and go sleep downstairs in the hammock.

step 11: Random shots

These are just some random shots. "Ginger", my snake started out as a little retaining wall alongside the walkway to the front door. Retaining walls keep dirt from washing down on the walkways. Her body, except for the raised head, is just carved dirt, with a layer of nylon-cement on it.



Image Notes

1. This is "Ginger" my 23 ft. python that greets visitors at the front door.

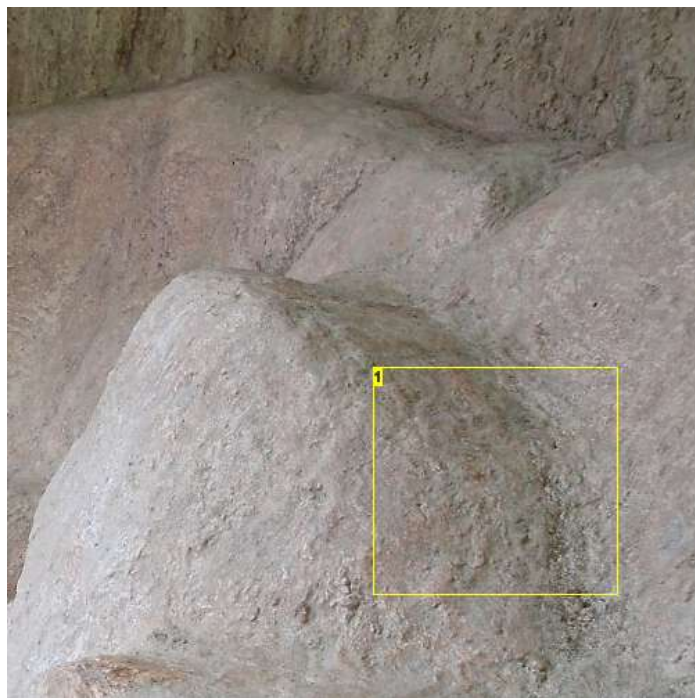


Image Notes

1. This is carved earth with a 1/4 inch thick layer of nylon-cement over it. Nylon cement is useful for making retaining walls, walkways, stairs and lots of other ground-carved things.

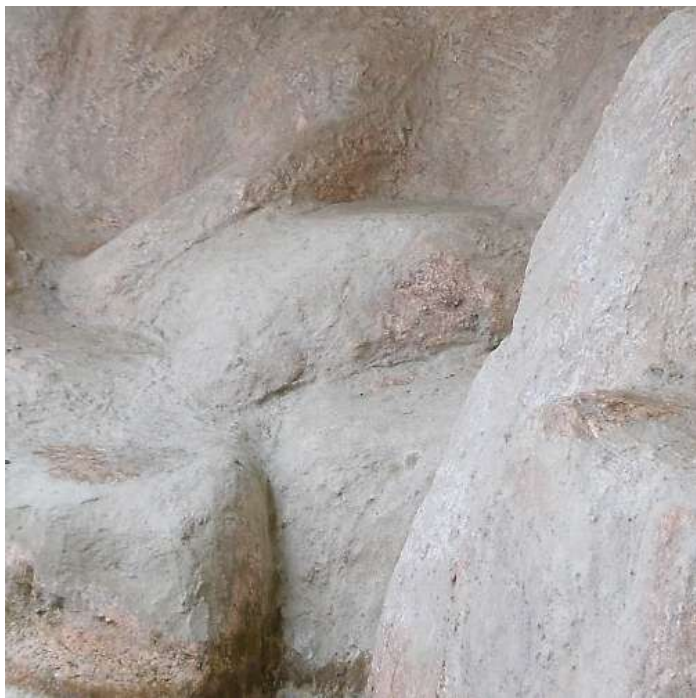




Image Notes

1. This hollow "rock" covers the septic tank.
2. This is the door to the septic tank.



Image Notes

1. These are some Styrofoam scraps that I stuck to the wall of the shower grotto and splattered with colored cement.

Image Notes

1. This is an architectural model I made for an Earth Day exhibit years ago. It also provided the photos for the entry photo of this instructable.



Image Notes

1. Hollow "trash rocks". I sew big sacks of fishnet, fill them with my un-recyclable trash and plaster them with cement. You can build with them, or use them as benches, tables, and sculpture bases.



Image Notes

1. This area is for partying, but right now it is being used for storing stuff.



Image Notes

1. Outdoor shower grotto in the bathroom.

step 12: Some more thoughts

We have not done a great job as custodians of nature on this planet. Our attitude has been more exploitative than cooperative and symbiotic. We encapsulate nuclear waste to protect ourselves from it. Perhaps, we should encapsulate ourselves, to protect nature from us.

Cities have already arisen. They spread out sideways, for the most part. They occupy a lot of territory that would otherwise be wilderness. They have covered a lot of otherwise good agricultural land, too. Maybe they could be condensed some.

I live on a mountaintop, surrounded by nature. The valleys tend to be the places where most of the cities were built, on top of the best alluvial soil. I imagine the topsoil is thinner at the top of the mountains. There would probably be less topsoil sacrificed by building cities on top of mountains than in the valleys.

Perhaps, we could use the tensile strength of steel to hang lighter, foam-like architecture off the sides of ridges, instead of using deep foundations to support skyscrapers from below. Structures might hang on ridges like saddle bags hang on a mule.

We have built our cities, and it is difficult to erase them now. We can use them as scaffolding, however, to build the next-generation of cities over top of them. My house uses what I call nylon-cement construction techniques. Ferro-cement uses rebar and wire mesh to support plastering with cement.

I substituted the wire mesh with free, discarded nylon fishnet from the tuna fishing industry. With nylon-cement construction techniques I can make free-form, dome-like architecture, toilets, washing machines, and lots of other useful things. The material is relatively inexpensive, and long-lasting. It makes a little material go a long way.

I grew up in times excited by Buckminster Fuller and the idea of domes. Science fiction space cities were dome-shape. Transparent domes kept out alien atmospheres. Anyway, domes are cool, and they have some interesting architectural properties.

Complex curvature gives strength. It is not easy to crush an egg shell, considering the amount of material involved. Breaking a flat cracker is relatively easy. Our existing box architecture is all made of flat crackers. I suspect that domes would hold up better in earthquakes and hurricane winds than flat architecture would. Domes also give one the maximum amount of volume with the minimum of material, compared to other shapes with the same wall thickness.

The stress forces in domes are all compression forces, whereas flat floors and ceilings have tensile forces involved, especially on their under sides. Domes can support a lot of weight without any internal supports. Box architecture tends to need support walls and columns.

Let's cut to the chase. A city could grow as a series of concentric domes. Theoretically, no dome needs to be supported by the domes underneath it. One dome can serve as scaffolding for building the next dome over it, or it could support a layer of light architecture between it and the next dome. The fill layer could be a foam-like structure resembling a termite nest. One could forget the domes and just build with the fill layer, but working the strength of domes into the design periodically doesn't seem like a bad idea.

We have termites where I live. They cover their trails up the trunks of trees with a paper-thin layer of material they produce, and build a globular nest of this material up in the tree. If you cut open one of the nests, you find tunnels going everywhere. It is like an ant nest with tunnels and rooms.

Expand the termite nest to human scale and you get something like the architecture I have been developing, mostly with domes and arches. For the most part, I have felt pretty safe while doing my construction work, even high up in the air. Very seldom have I needed a ladder to do the work.

My cement house uses a domed grid of rebar to support fishnet. The fishnet has a fine enough mesh to hold cement plastered onto it. After plastering both sides, the resulting wall is about 1 ½ inch thick.

The same grid-like rebar structure that supports the fishnet and cement can be used to make vine trellises to cover it. The trellises shade the house and provide me with fruit and edible leaves. They could be converted into more cement house in the future by removing the vegetation and plastering the trellis with fishnet and cement. In that way, an apartment house, or termite nest city might grow over time little-by little, according to need.

I live in a tropical climate. In a colder climate, the vine idea might not be practical, but it is still the same sort of trellis that is involved in construction of domed cement structures.

With masses of people living together, one needs good ventilation, water drainage, waste disposal, and other things. All of those are fairly easy to design into things given the flexibility of this non-boxy architecture.

Besides designing functionally, this construction technique can also be used aesthetically, like sculpture. Cities could be more like Disneyland and less like Costco, if we stopped building so many boxes. They could be a lot more fun to explore and live in. The more time we spend inside the mall the less time we spend trampling the wildflowers outside the mall.

It is hard for me to imagine something like a termite nest being owned other than cooperatively. If it is the only game in town, who do you trust to be the landlord?

Public transportation might be worked into the structure, something like a subway system. Winches or ski lifts might take the place of truck roads for getting people and things up the mountains. Gravity slides and pipelines could take things down the mountain. We have sure scarred up a lot of the landscape with roads. I wonder when that will stop?

Population control by legislation is not a popular idea in democratic societies at the moment. Maybe we will stabilize at so many billions someday, maybe not. The reproductive rate and death rate are the two factors that need to be balanced. Any stress on the environment changes it. How much stress is too much stress? Minimizing the stress seems to have some importance to environmental health. We have to think about protecting nature from ourselves.

I wouldn't want to live in any of today's cities, but there are city people who learn to live with and even love cities. If we are going to continue with cities, let's think about ways we might improve them. The termite nest city is a whole new ball game.

step 13: Links

These are links to some of my other instructables. They all have potential uses in a Termite Nest City.

<http://www.instructables.com/id/A-HANGING-NURSERY>
<http://www.instructables.com/id/A-REBAR-TRELLIS-for-Home-and-Garden>
<http://www.instructables.com/id/HANGING-GRAPE-BOX-PLANTERS>
<http://www.instructables.com/id/Hand-powered-WASHING-MACHINE>
<http://www.instructables.com/id/ROAD-REPAIR-with-NYLON-CEMENT>
<http://www.instructables.com/id/ZIPPER-STAIRS-a-new-type-of-stairway-using-Nylon>
<http://www.instructables.com/id/HANGING-alternative-storage-techniques>
<http://www.instructables.com/id/TRASH-ROCKS-Eliminate-Unrecyclable-Trash>
<http://www.instructables.com/id/Put-a-Rounded-Roof-on-a-Square-House>

<http://www.instructables.com/id/TERMITE-NEST-CITIES-the-Next-Generation/>

Related Instructables



Put a Rounded Roof on a Square House
by Thinkenstein



A REBAR TRELLIS - for Home and Garden by Thinkenstein



ZIPPER STAIRS - a new type of stairway using Nylon-Cement
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Expressing Architectural Qualities of a Photo by using tools in Photoshop by alexatw8



Painting with Colored Cement
by Thinkenstein



Urban Exploration by Tetranitrate



Casting an Historic Architectural Detail by Mark M.



"Augusto" Workshop-Marco Davidson, Melbourne Australia. (slideshow) by Melbourne Marc