EcoShell I

Fourth Edition
June 2014

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EcoShell I – Simple Low Cost Permanent Housing Introduction

The EcoShell is a simple, low cost concrete dome. It is ideal for low cost housing around the world as a replacement for the junk that is presently in place.

It can be built primarily by hand and requires minimum costs and equipment.

The EcoShells can be built of many sizes. Each size requires an Airform of that size. A small 10 ft. diameter by 8 feet high is ideal for a storage. But it can be lived in as well. It is small at 78 square feet (7 plus square meters).

Our favorite for low cost housing is 20 feet diameter (6 m) with a height of 10.5 feet (3.2 m). It has a floor area of 314 sq ft (29 sq m). The U.N. recommendation for a family of 8 is 28 sq m.

They can also be built 30 ft (9.14 m) for 707 sq ft (65 sq m) for a larger home or a classroom or small clinic. And we like the 40 ft (12 m) diameter for a medical clinic, school and more. Virtually any modest size will work.

The following is an example to build an EcoShell 20 ft in diameter of 314 sq ft (29 sq m). To build the EcoShell an Airform with tie downs is needed and an inflator fan. We call them a kit. In some places a generator will also be needed to run the fan. At least 100 EcoShells can be built with the single kit if it is properly taken care of. Currently (November 2013), a 20 ft kit is worth about $4300 Freight On Board (FOB) Italy, Texas.

If 100 Domes are built from 1 kit the forming costs drop to less than $50 per 20 foot diameter dome.

In addition to the kit you will need 2 rolls of Basalt Rope for the EcoShell and enough rebar for the floor. (The floor can be reinforced by steel rebar or Basalt rebar - budget). Consider rebar at 15 to 18 inches on center both ways in the floor. It can be 10mm or even 8 mm steel rebar (3/8 inch diameter) or 6 mm Basalt rebar.

In addition you will need the hand tools to mix the concrete and apply the concrete, the hooks to hold the rope to the floor and a few miscellaneous supplies. You will also need about 100 Stainless Steel Hooks for the reinforcing at about $104 per dome.

The floor will take about 4 cubic yards (3.5 cm) of concrete plus some extra for the perimeter depending on how deep it is wanted. In many places it is negligible. The shell will take 4 to 5 cubic yards (3.5 to 4.5 cm). The thickness is variable due to application and desires. (The calculations are for 2 plus inch thickness. Practice will make it possible to use 1.5 inch thickness). The floor should be a 6 bag mix and the shell an 8 bag mix.

Obviously you will need the kit for many domes. And you will need the supplies for each dome built. The concrete can be applied by hand or it can be applied by equipment. The equipment can be a simple as hand tools or a simple hand help spray gun or a shotcrete pump. All of this equipment is shown on our website.

EcoShell 1

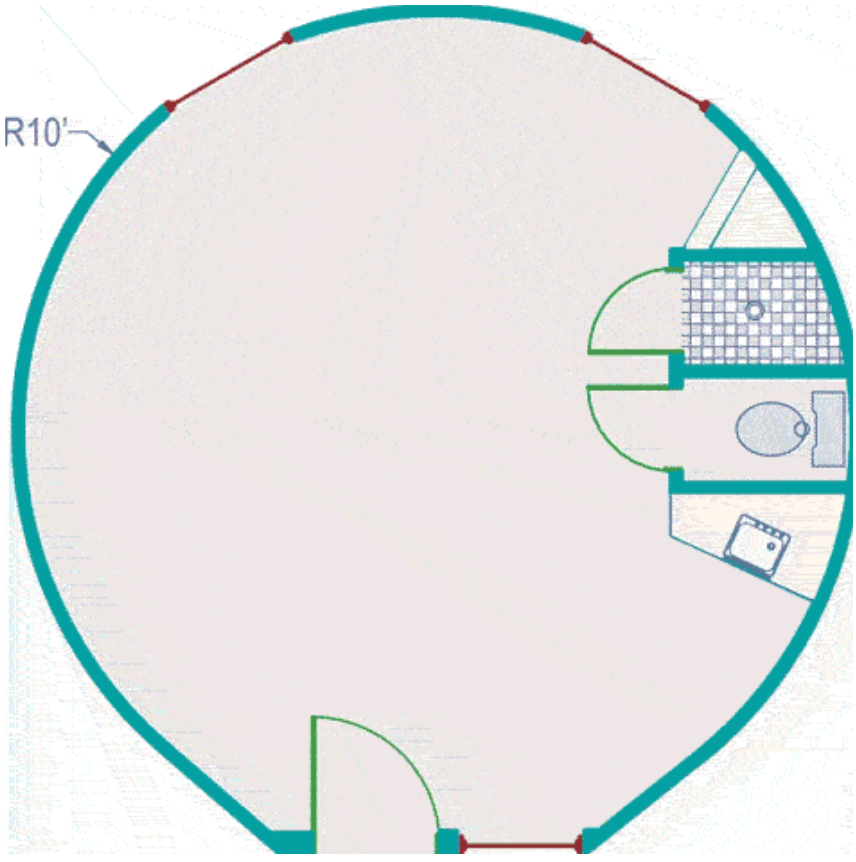
David B South
Edited by Freda Parker, Melinda South, Kelly Lewis

David B. South is president of Monolithic, Inc. and chairman of the Domes For The World Foundation (DFTW).

Monolithic, Inc. is a family of companies with a mutual goal: to improve the lives of people worldwide through the introduction and construction of Monolithic Domes and Monolithic EcoShells for personal and public use. DFTW is the newest member of that family.

Established in 2006, DFTW is registered as a nonprofit 501(c)(3) with federal tax status.

Domes For The World Mission Statement: DFTW will initiate and coordinate efforts to alleviate housing shortages in struggling cultures and impoverished lands. We will seek grants and donations to fund important projects worldwide. We will train local crews in our construction methods and technology.



The UniShell is an EcoShell I with a diameter of 20 feet and a living area of 314 square feet, suitable for family habitation in developing nations.

EcoShell 1

David B South

Many countries beyond the United States can benefit from the construction and use of EcoShells.

Monolithic created this step-by-step manual and illustrated it with cartoon-like drawings so that all workers -- regardless of what their native language may be -- can learn and use these instructions to complete an EcoShell I.

An EcoShell's construction process is a modern adaptation of the building of the Pantheon and thousands of other domes erected over the centuries. The ancients built them by piling mounds of earth or by creating large, false works of timber in the shape of a dome. They then covered these forms with brick, stone or a monolithic layer of concrete. Once the covering settled or set, they removed the forms.

Monolithic has substituted an inflatable Airform for the earth work or false work. To construct an EcoShell, concrete and rebar are placed on the outside of the Airform. (This differs from the construction of a Monolithic Dome; it calls for rebar and concrete on the inside of the Airform.)

EcoShells built for habitation in developing areas with desert-like or tropical climates are not insulated; nor do they usually need to be. But they may need roof coatings. Nevertheless, EcoShells make super-strong dwellings, impervious to fire, tornadoes, hurricanes, earthquakes, and termites. They can be built by native labor for a fraction of the cost of any comparable structure.

We estimated that a single Airform can be used to build more than a hundred buildings, thus making the cost of forming negligible. Because the EcoShell is a thin shell, its actual volume of concrete is very small -- far less than that used in conventional buildings (see table).

The EcoShell is perfect for any type of building that doesn't require insulation. (Note: In climates requiring insulation, the uninsulated EcoShell can be insulated very easily.

The EcoShell's construction method has also been used to build bridges over small rivers and streams. We here at Monolithic think that its applications are virtually unlimited and that, in the future, more ideas for this construction procedure will be generated and implemented.

Monolithic EcoShells Solve World Housing Problems

The United Nations has determined that an average family habitation in developing areas needs to be about 28 square meters or 302 square feet.

One EcoShell design, the UniShell, fits that bill perfectly. The UniShell has a diameter of 20 feet and a living area of approximately 314 square feet.

Its construction, including the floor and dome shell, requires less than eight yards of reinforced concrete -- or 64 sacks of cement for a cost of about $320. The price of the aggregate will vary from place to place, but assuming that it's about $10 per yard, that adds another $80. The 1,250 pounds of rebar will cost about $375. So the total cost of the materials for a UniShell home, that will last for generations, is about $800 (2002 prices)

(Cost does not include labor, windows, doors, exterior coating, interior finishing.)

In countries such as the Union of South Africa, India, Pakistan, Korea, Mexico, Ghana, Philippines, Honduras and others, the need for low-cost housing is staggering. Housing shortages range from 500,000 to 1,000,000 in each.

So the need for structures is obvious, and the solution is the UniShell. Unfortunately, there is a missing part to that equation: money.

For that reason, in 2006 we established Domes For The World (DFTW), a nonprofit organization determined to promote practical, affordable and safe housing in developing nations. To that end, DFTW actively seeks grants, contributions and funding.

Monolithic's Promise

We want to support you in your construction goals. Our website www.monolithic.org is a carefully maintained source of information that can answer many questions about the nature and construction of Monolithic Domes, Monolithic Crenospheres and Monolithic EcoShells.

But you are also welcome to contact us with your questions and concerns:

The Monolithic Dome Institute
Phone: (972) 483-7423
Email: mail@monolithic.com

EcoShell Versus Conventional Concrete Buildings

Type	Size	Floor Area	Interior Volume	Surface Area	Concrete Needed	Rebar Needed
Dome	20′d × 11′h	314 sq. ft.	2,408 cu. ft.	690 sq. ft.	8 cu. yd.	1,250 lbs.
Square	18′ × 18′ × 8′	324 sq. ft.	2,592 cu. ft.	900 sq. ft.	22.7 cu. yd.	4,900 lbs.
	Difference	-10 sq. ft.	-182 cu. ft.	-210 sq. ft.	-14.7 cu. yd.	-3,250 lbs.

Metric Conversion:

Type	Size	Floor Area	Interior Volume	Surface Area	Concrete Needed	Rebar Needed
Dome	6.1m × 3.35 m	29.17 m^2	68.19 m^3	64.1 m^2	6.12 m^3	566.99 kg
Square	5.49m × 5.49 m	30.1 m^2	73.4 m^3	83.61 m^2	17.36 m^3	2222.6 kg
	Difference	-.93 m^2	-5.15 m^3	-19.51 m^2	-11.24 m^3	-1,474.18 kg

Type	Size	Floor Area	Interior Volume	Surface Area	Concrete Needed	Rebar Needed
Dome	30′d × 13′h	707 sq. ft.	5,744 cu. ft.	1,238 sq. ft.	24.1 cu. yd.	2,500 lbs.
Square	24′ × 30′ × 8′	720 sq. ft.	5,760 cu. ft.	1,584 sq. ft.	42.7 cu. yd.	9,200 lbs.
	Difference	-10 sq. ft.	-16 cu. ft.	-346 sq. ft.	-18.6 cu. yd.	-6,700 lbs.

Metric Conversion:

Type	Size	Floor Area	Interior Volume	Surface Area	Concrete Needed	Rebar Needed
Dome	9.14 × 3.96 m	65.68 m^2	162.65 m^3	115.01 m^2	18.43 m^3	1,133.98 kg
Square	7.32 m × 9.14 m	66.89 m^2	163.11 m^3	147 m^2	32.65 m^3	4,173.05 kg
	Difference	-1.21 m^2	-.45 m^3	-32.14 m^2	-14.22 m^3	-3,039.07 kg

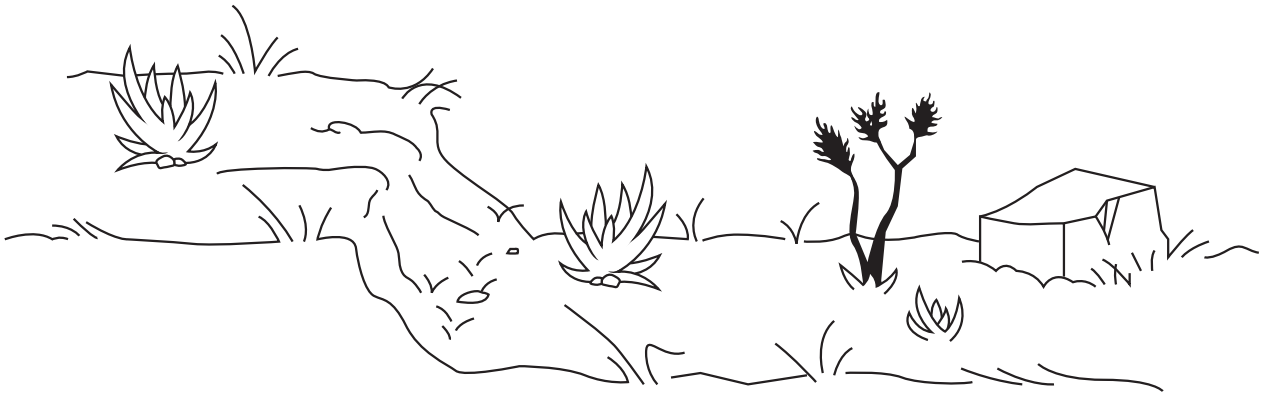
Type	Size	Floor Area	Interior Volume	Surface Area	Concrete Needed	Rebar Needed
Dome	40′d x 16′h	1,257 sq. ft.	12,197 cu. ft.	2,060 sq. ft.	30 cu. yd.	4,200 lbs.
Square	24′ × 52′ × 18′	1,248 sq. ft.	9,984 cu. ft.	2,464 sq. ft.	68.8 cu. yd.	13,300 lbs.
	Difference	-9 sq. ft.	-2,213 cu. ft.	-404 sq. ft.	-38.8 cu. yd.	-9,100 lbs.

Metric Conversion:

Type	Size	Floor Area	Interior Volume	Surface Area	Concrete Needed	Rebar Needed
Dome	12.19 m × 4.88 m	116.78 m^2	345.38 m^3	191.38 m^2	22.94 m^3	1,905.09 kg
Square	7.32 m × 9.14 m	115.94 m^2	282.72 m^3	228.91 m^2	52.6 m^3	6,032.78 kg
	Difference	-.84 m^2	-62.67 m^3	-37.53 m^2	-29.66 m^3	-4,127 kg

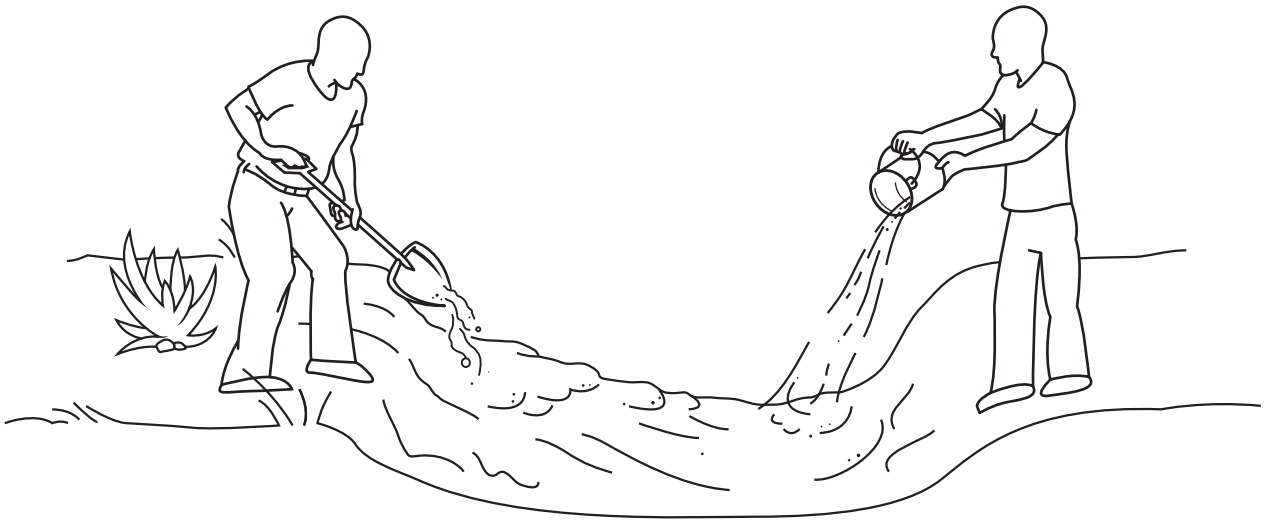
Conventional buildings require 200% to 300% more concrete, 300% to 400% more reinforcing bar and double the labor of comparably sized EcoShells. Ironically, EcoShells are far stronger and better able to withstand natural disasters.

Refer to:
Quick Guide — EcoShell Construction Steps
on page 32 of this book.



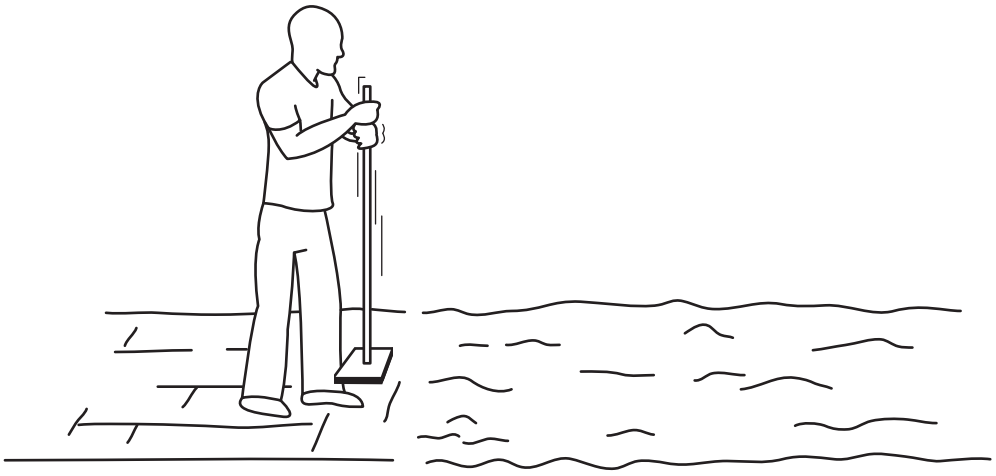
1.)

Clear all obstructions, debris and organic material, such as trees, bushes and grass, off the ground on which the EcoShell will be built.



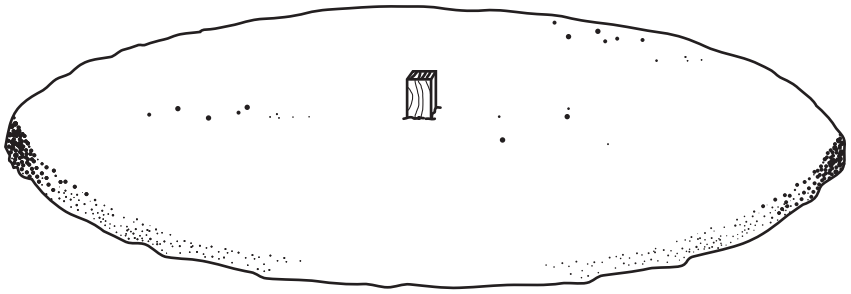
2.)

Then level the ground.



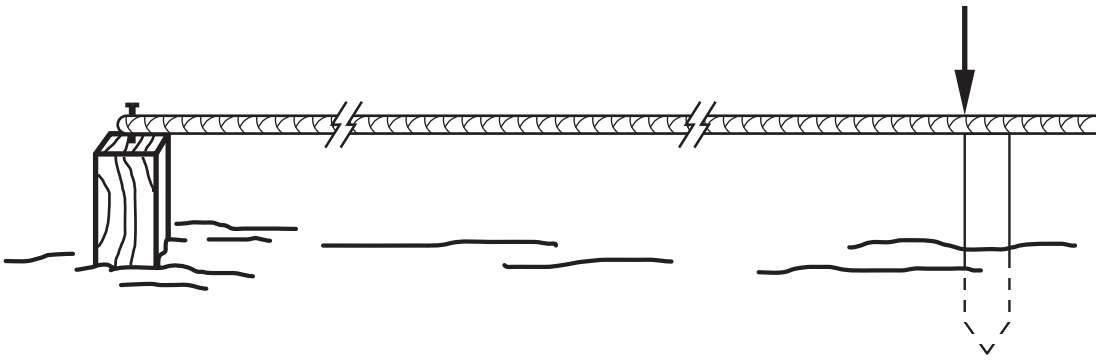
3.)

Tamp the ground with a hand tamp or mechanical equipment until it has an even, all-over firmness.



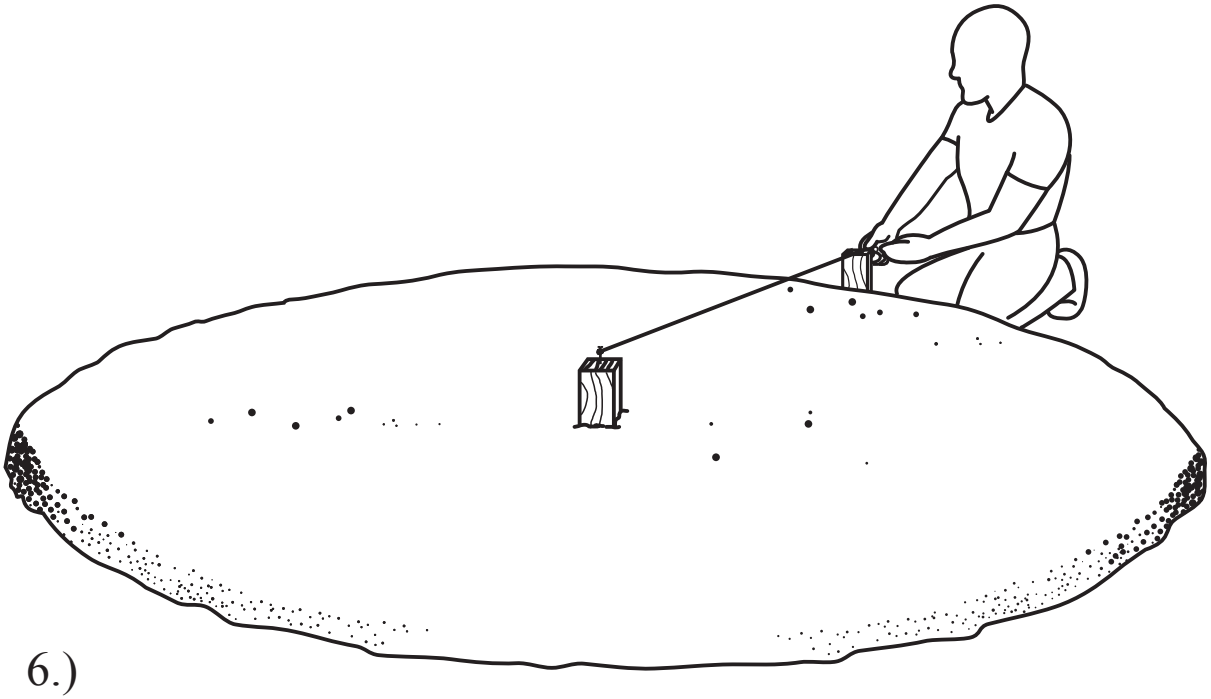
4.)

Set a stake into the center of the site that the EcoShell will occupy. This center stake will act as a guide for marking the perimeter.



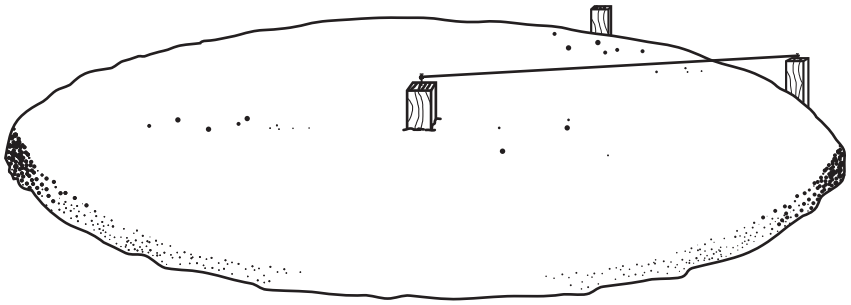
5.)

Set a nail into the middle of the center stake. Using a tape or pole, measure the distance from the center stake to points on the perimeter where the forming stakes will be placed.



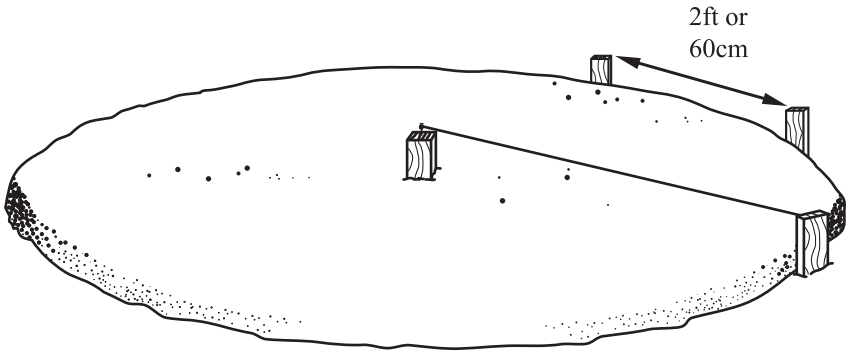
6.)

Drive the forming stakes into the ground. All forming stakes should be at the same distance from the center so that a circle is formed. Be sure to allow for the thickness of the forming stakes.



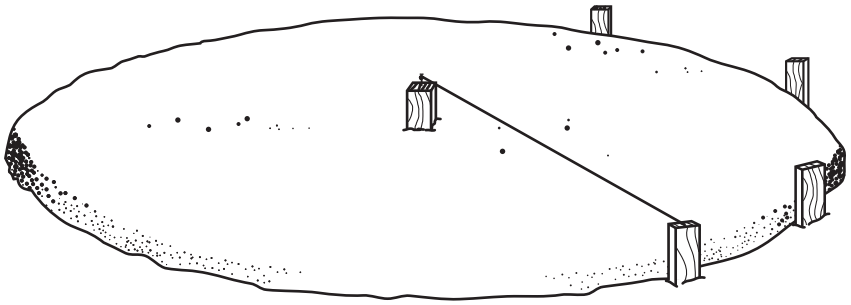
7.)

Space the forming stakes about 2 feet apart around the perimeter. That perimeter, created by the forming stakes, outlines the site for the foundation/floor slab edge of the EcoShell.



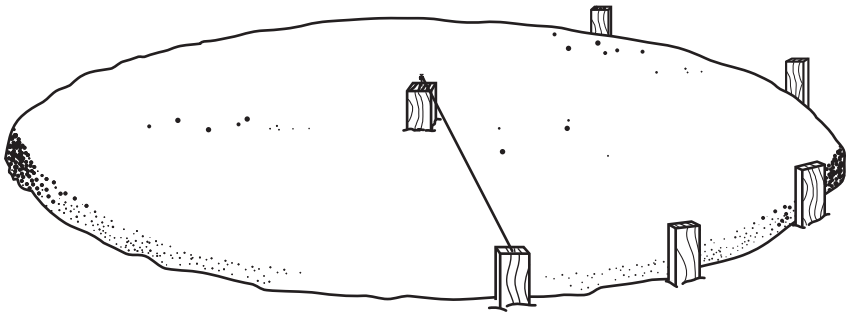
8.)

Drive the forming stakes deep enough so that they will hold under the concrete's pressure even after the footing trench is dug around the perimeter.



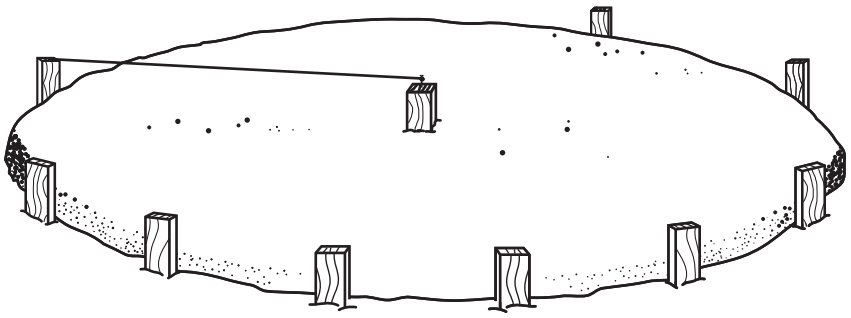
9.)

Remember that the forming stakes must all be at the same distance from the center stake plus the thickness of the forming boards. Center stake and forming stakes should all be at the same level.



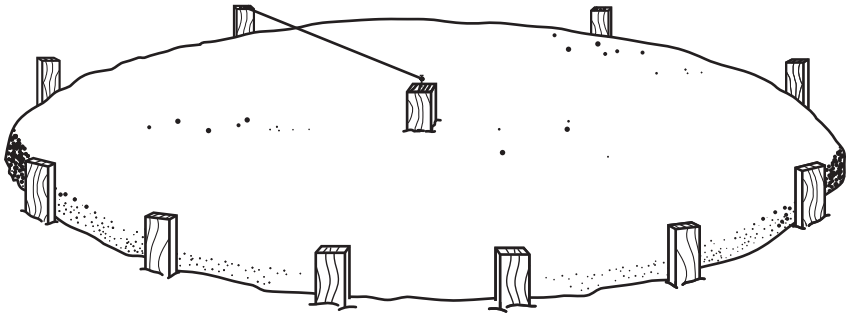
10.)

Check level and distance for each stake. Instead of trying to drive the forming stakes all to the same depth, mark the set stakes and cut them at the level you need.



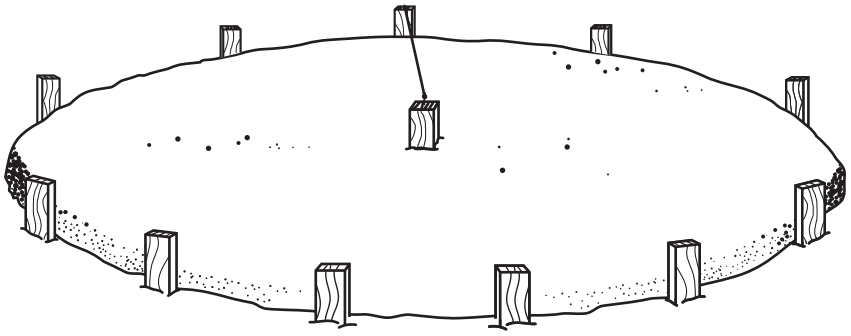
11.)

The forming stakes will contain the floor/footing. While they do not have to be perfect, it helps to have them all as level as possible.



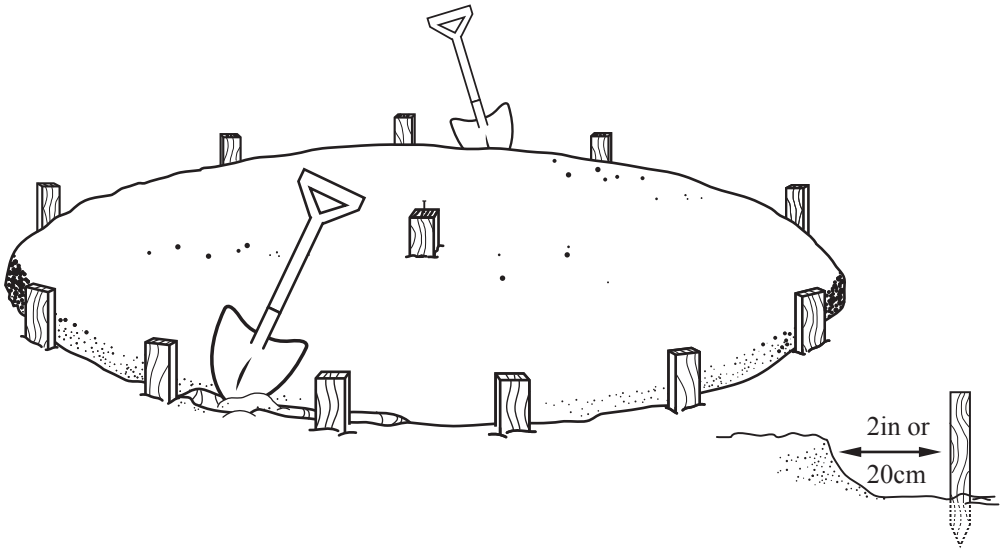
12.)

The floor will hold the Airform down as it is inflated. When inflated, the Airform for an EcoShell with a 20-foot (6m) diameter may have an uplift of 15,000 pounds (7,000 kgs).



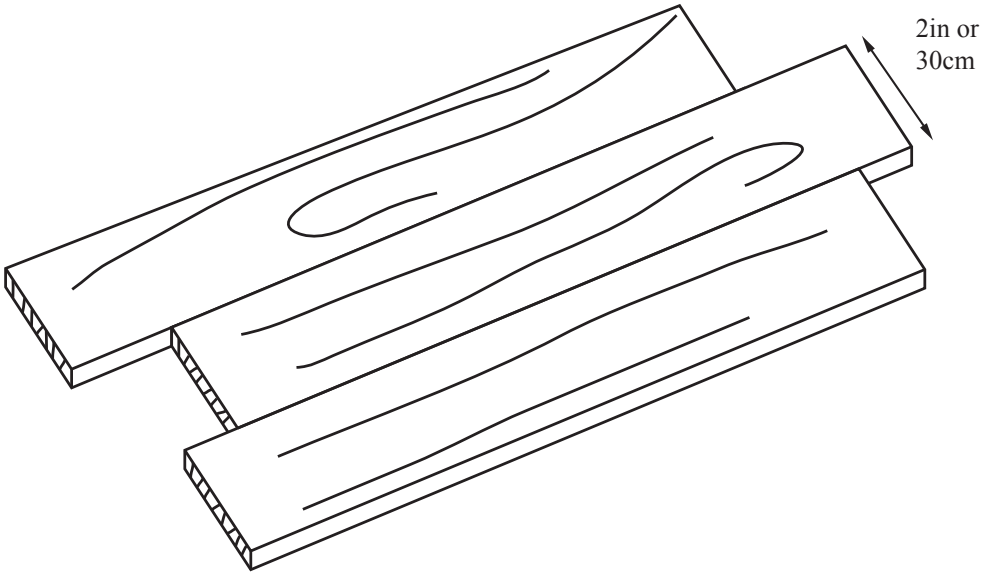
13.)

These instructions are for a small to moderate size EcoShell. Larger EcoShells may require deeper and wider footings. After the forming stakes are driven in and leveled, they should get a final diameter check.



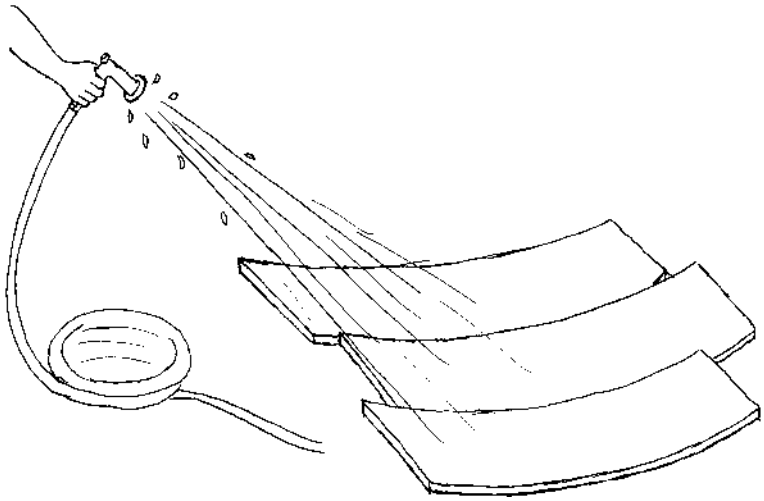
14.)

Dig a footing trench approximately 8” x 8” (20 cm x 20 cm) on the inside of the forming stakes.



15.)

Forming material is needed. Usually this is plywood cut into 12” (30 cm) widths. But many other products, such as heavy sheet metal, plastic panels, siding, etc., will also work.

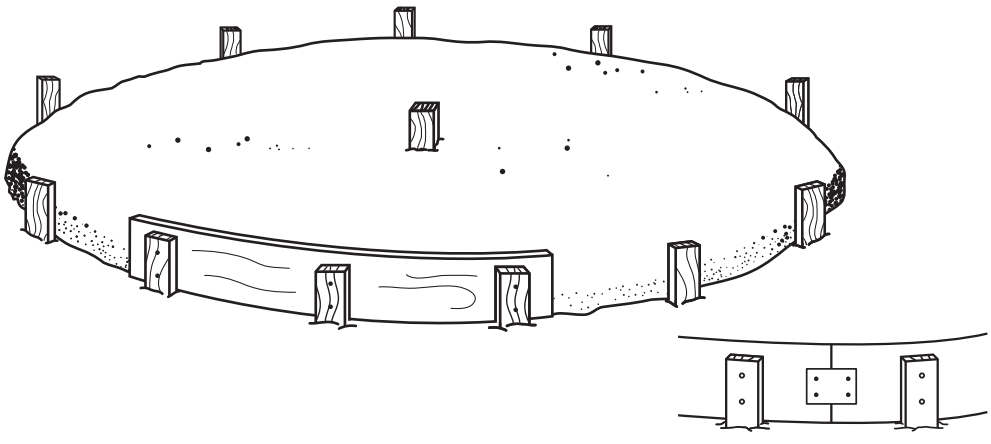


16.)

Wet the plywood. Wetting allows you to bend the plywood into the shape you need. If plywood is not available, multiple layers of a pliable material may be used.

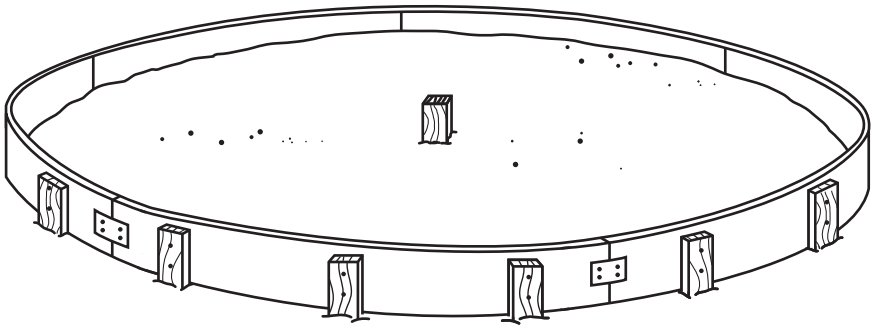
17.)

Manually bend the plywood. Before bending, the plywood may need to be soaked for a day or two. Usually, 1/2” (10 to 12 mm) plywood works best.



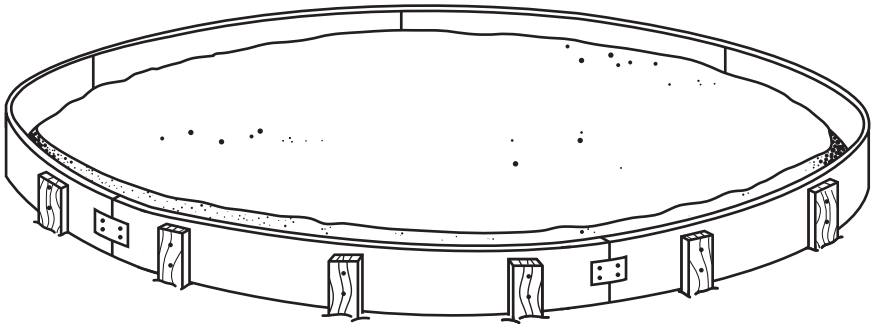
18.)

Place the formed boards inside the forming stakes and fasten them to the stakes, preferably with screws, but nails or stables can also be used. Fasten together the ends of the forming boards so that that they will not move when concrete is poured inside.



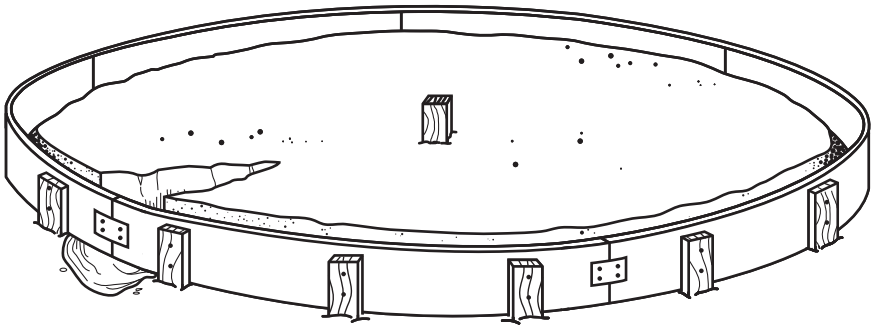
19.)

With plywood all the way around, the footing perimeter looks like this.



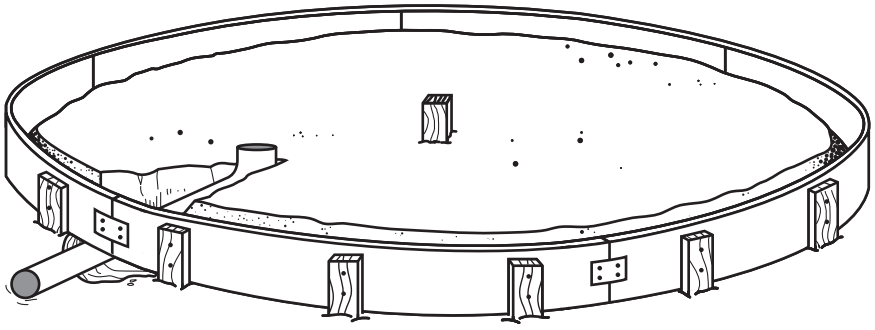
20.)

Check for proper trench diameter and be sure the floor is level. Keep in mind that changes/corrections are hard to make once reinforcing rebar is placed.



21.)

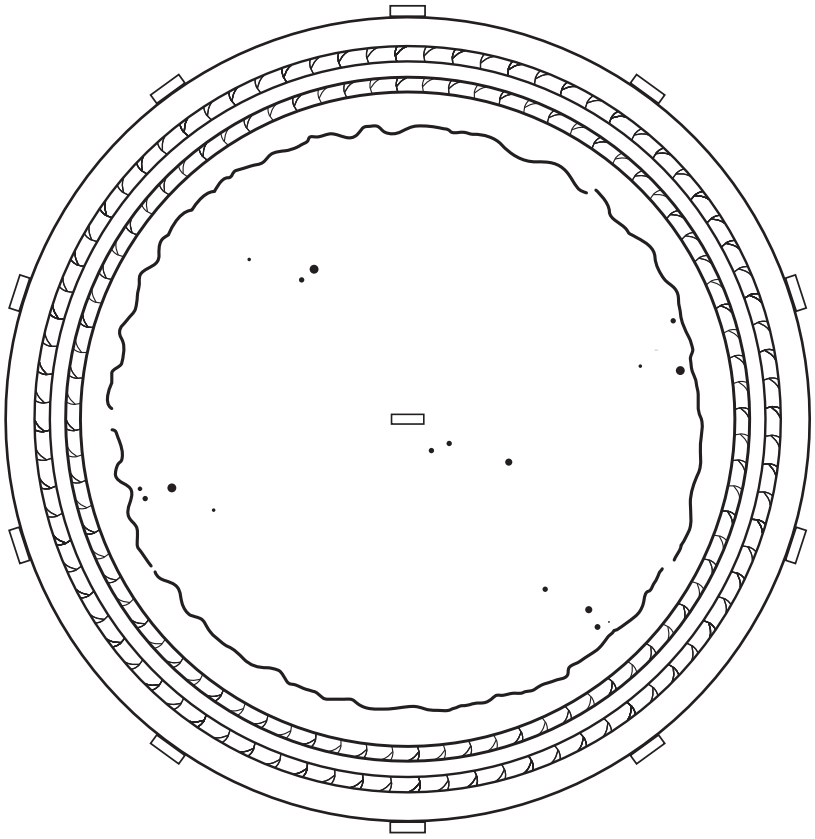
For plumbing, sewer or electrical installations, dig a trench under the plywood perimeter to the spot where the utility will be placed.



22.)

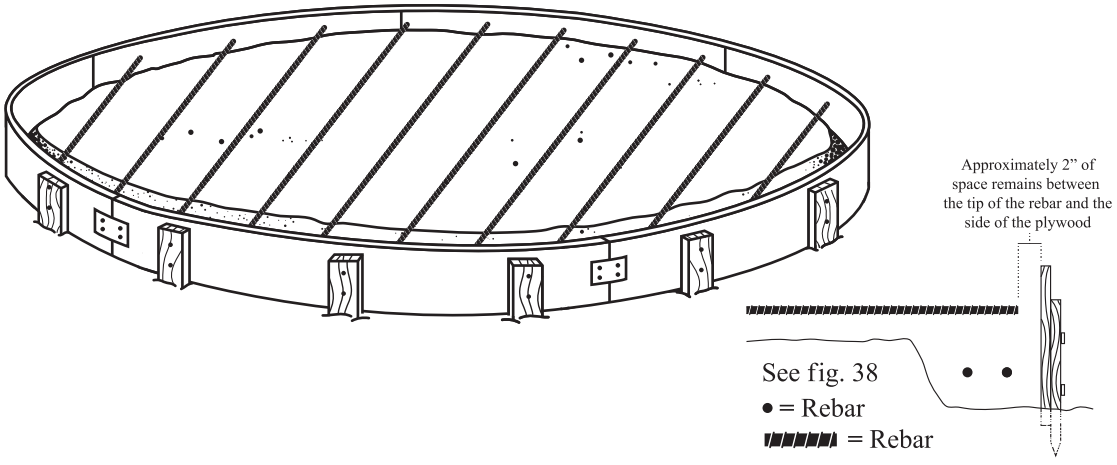
Slide pipe into the trench and up to its proper position.

23.)

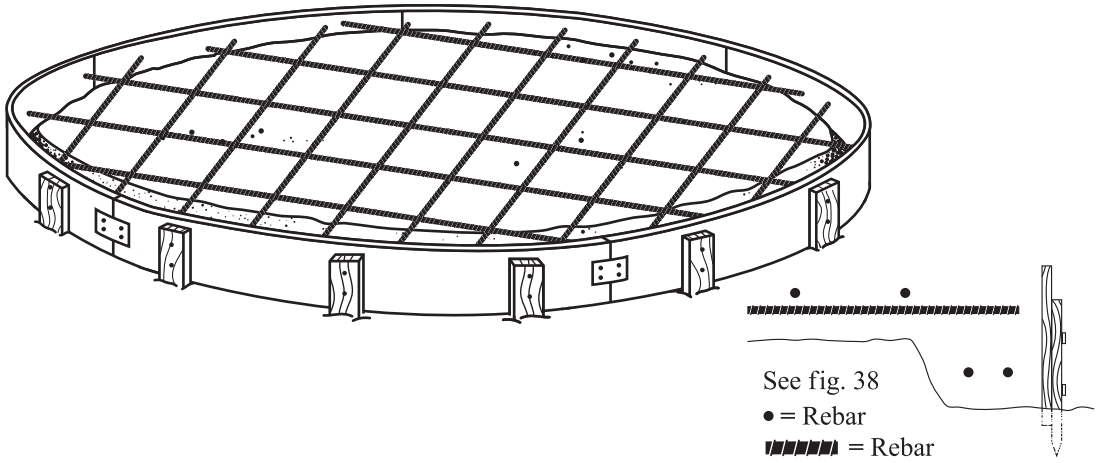


Place two continuous rebars 3/8” (10mm) in diameter into the trench.
Rebars may be spliced with a 12” (30 cm) overlap.

24.)



Use bricks to hold perimeter rebar (ring beam tendons) 3” off the dirt and at least 2” in from the formed edge. Then place the floor rebar.



25.)

Place floor rebar in the middle of the slab. A cross pattern of #3 (3/8" or 10 mm or 6mm Basalt) rebar 15" (35 cm) on center is adequate for most floors. Stop rebar about 2" (5cm) from edge.

Mix: 1 bag cement
6 buckets of rock
4 buckets of sand
2 buckets of water
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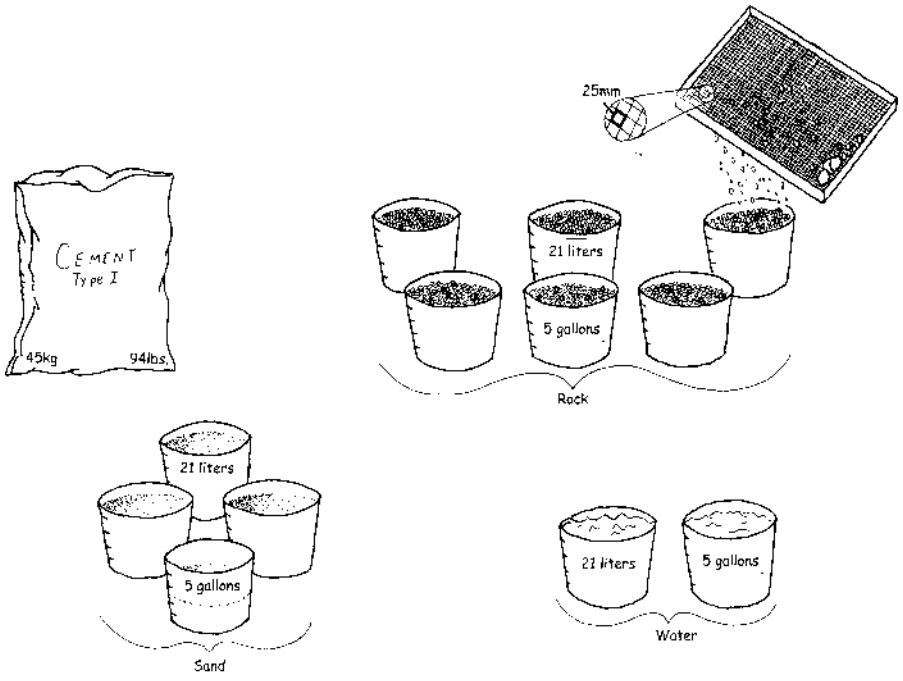
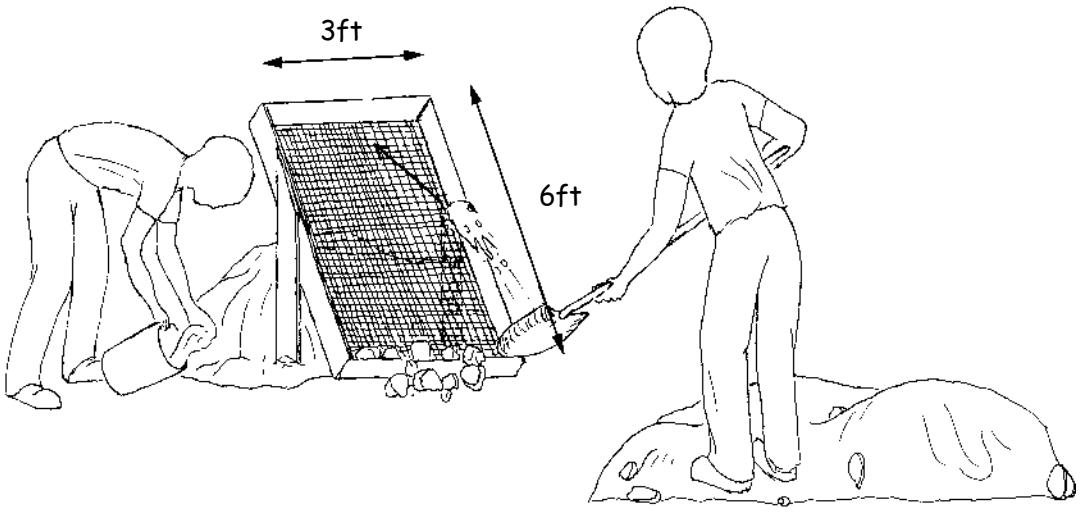
1 batch of shotcrete



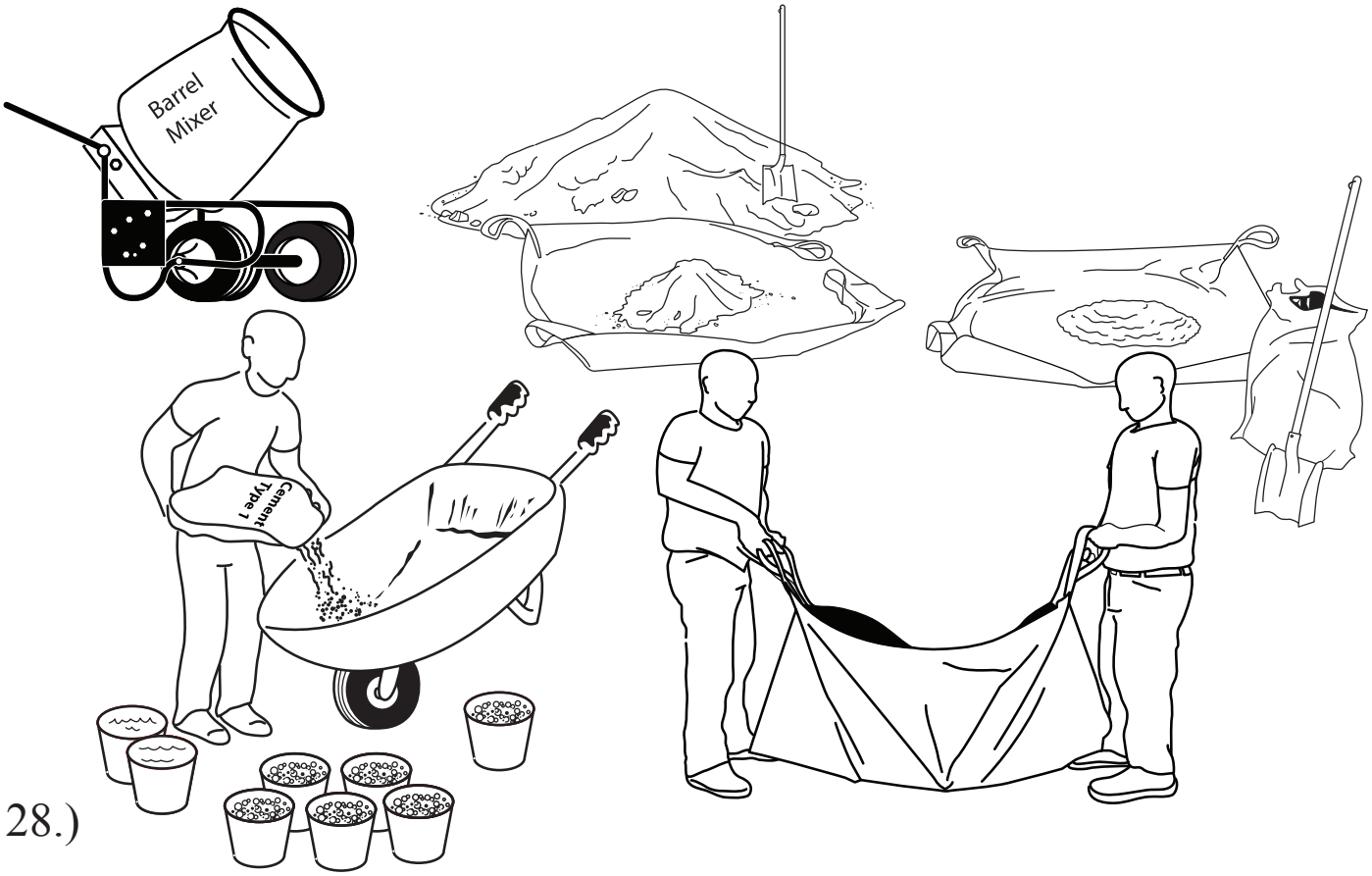
26.)

Materials for the footing mix: Cement Type I or II, several 5 gallon (21 liters) buckets, a sifting screen with 25 mm holes.



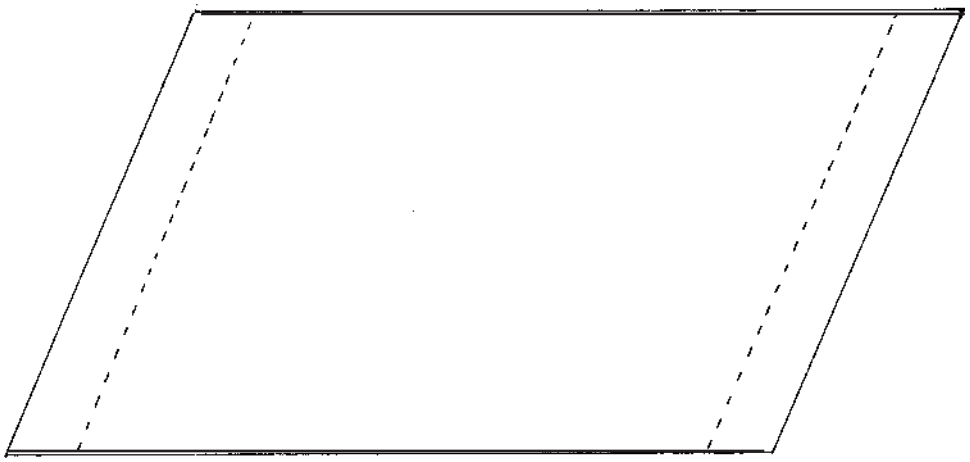
27.)

Sift the gravel by throwing the unsifted dirt at the top of the screen. As the gravel falls to the bottom, the proper mix size will fall through.



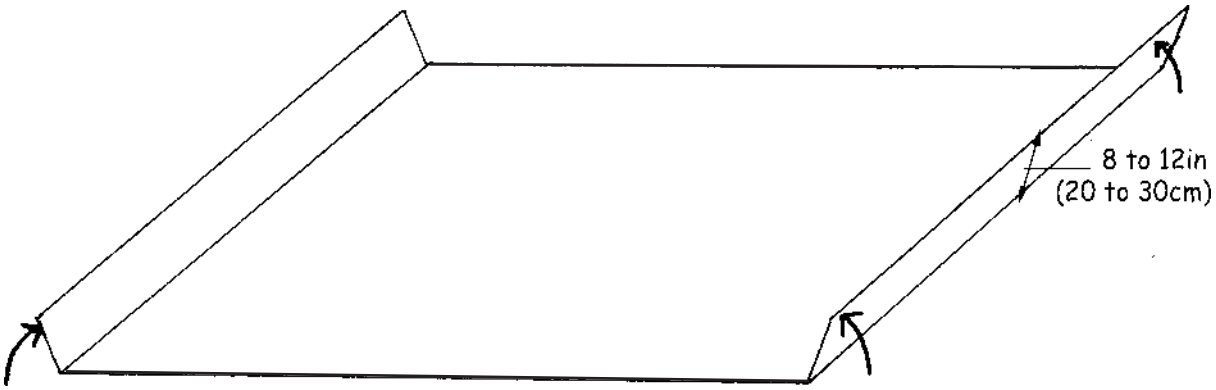
28.)

Mix the concrete in a wheelbarrow, barrel mixer, hand mixer or mixing box.



29.)

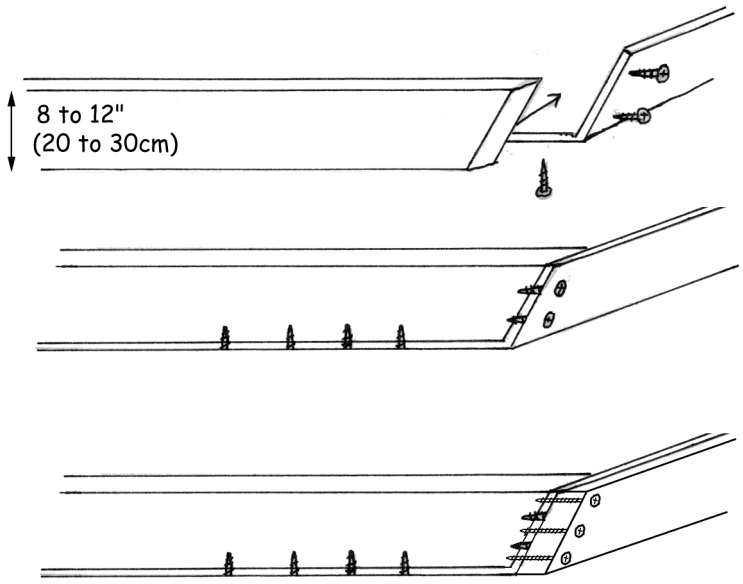
Mixing boxes are made with sheet metal floors enclosed in wood frames. The sheet metal can be anything, but 22-gauge galvanized steel is recommended.



30.)

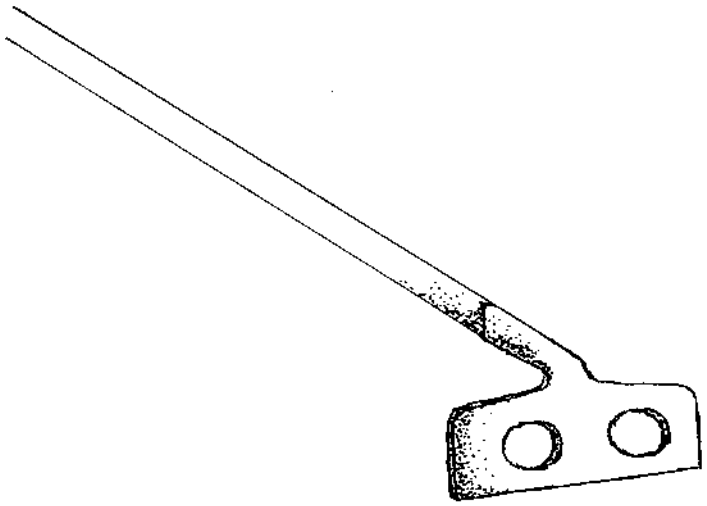
For 2 people, sheet metal measuring 36” x 72” (1m x 2m) is adequate. Factory bends can often be made at time of purchase. If not, the sheet metal can be field bent.

31.)

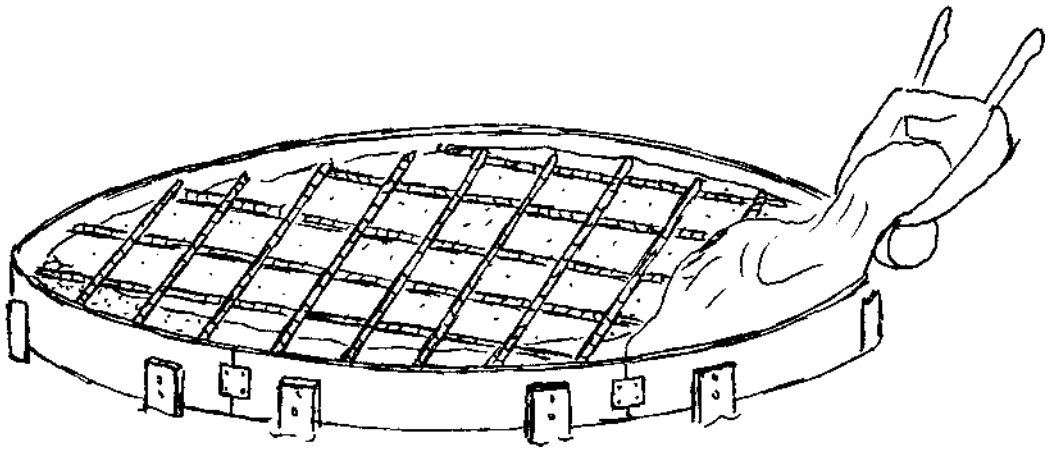


Fasten sheet metal to wood frames with screws or ring shank nails. To minimize leakage, place screws close together. First batch of concrete that's mixed will stop leakage.

32.)

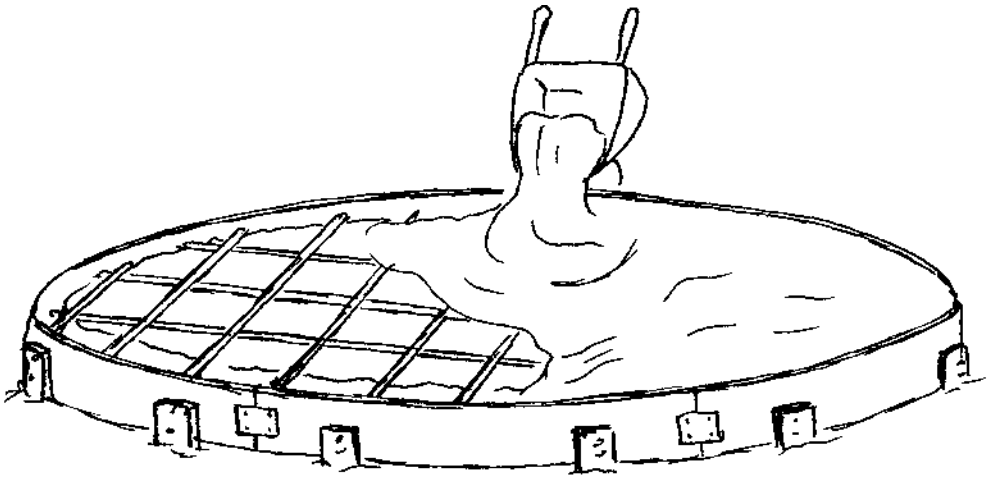


Mix concrete using a hoe. Any hoe will work, but the best hoes for mixing concrete are large and have double holes that provide twice the mixing action.



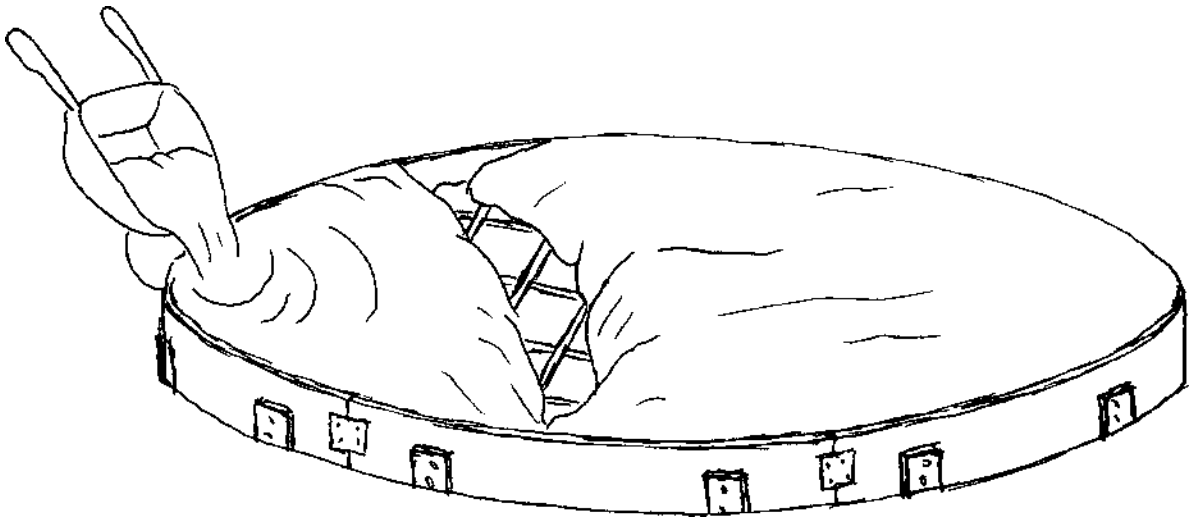
33.)

Mix concrete for the floor, by hand if you like. Concrete should be placed fast enough to prevent cold joints. Keep putting fresh concrete against older concrete all the way around.



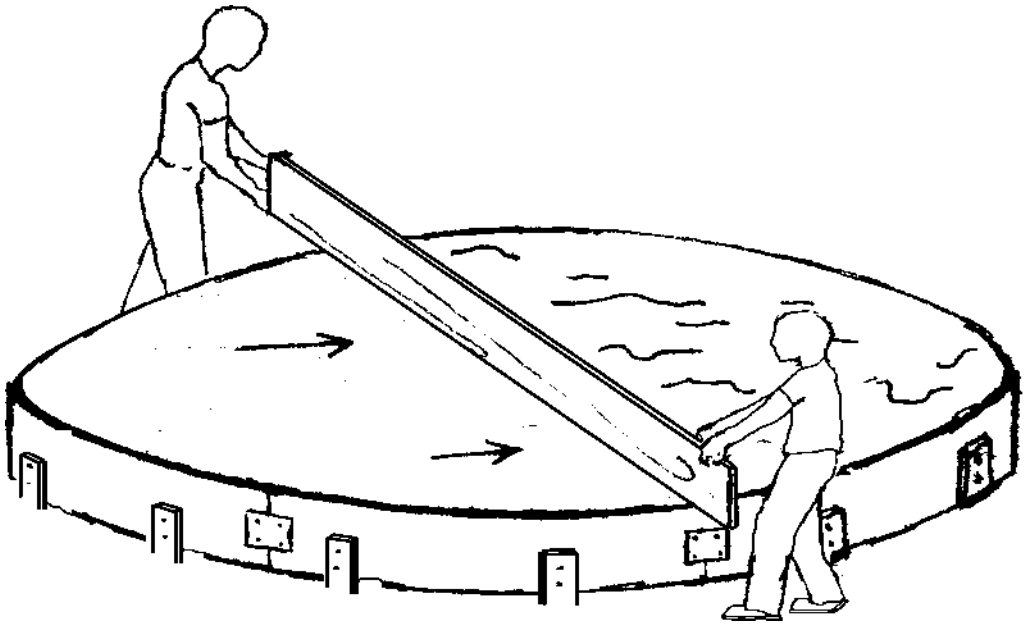
34.)

Use care in pouring the concrete so that rebar stays in the middle of the slab. Check to make sure that the placing of the concrete does not knock the forms out of alignment.



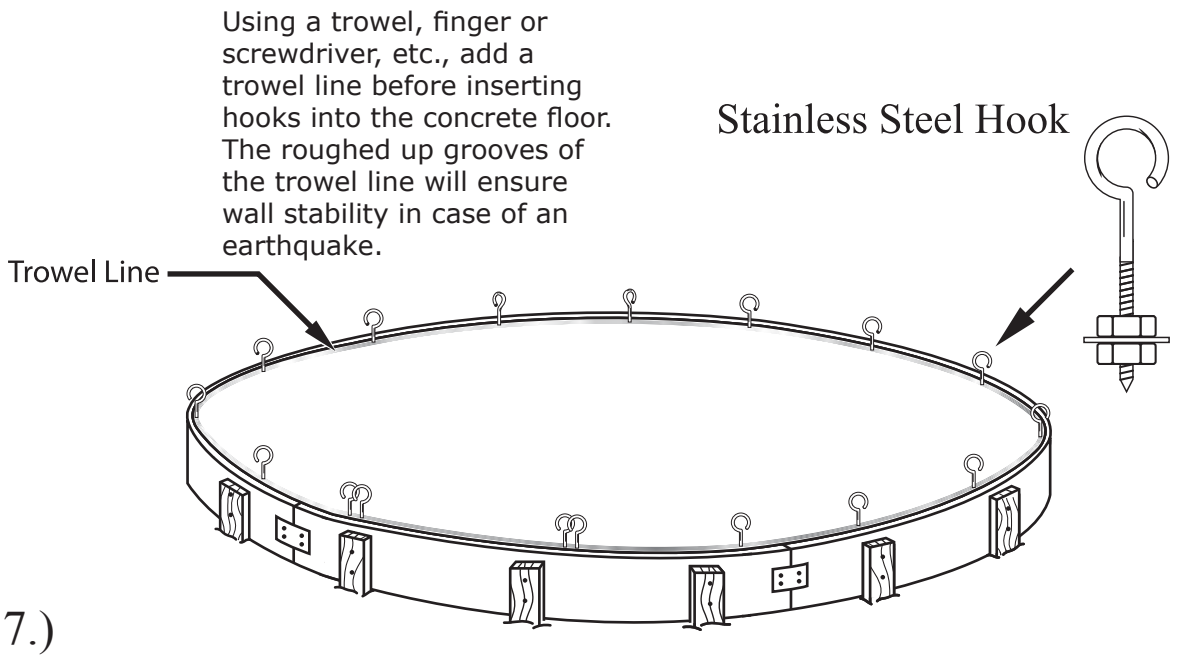
35.)

Place concrete. If placing of all of the concrete cannot be done in 15 minutes, start the concrete placing on one side and continue placing by moving across to opposite side.



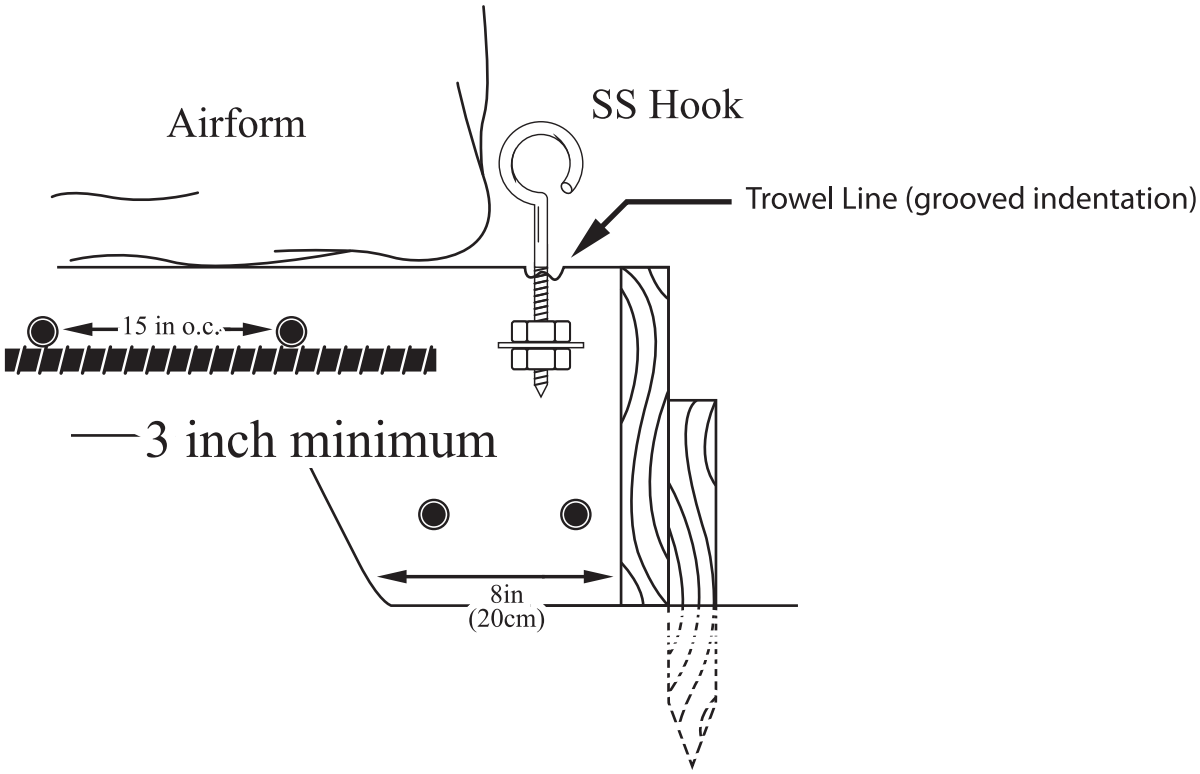
36.)

Level the concrete with a screed board as it's being poured. Excess can be moved ahead or removed. As concrete hardens, it can be troweled to a finer finish.



37.)

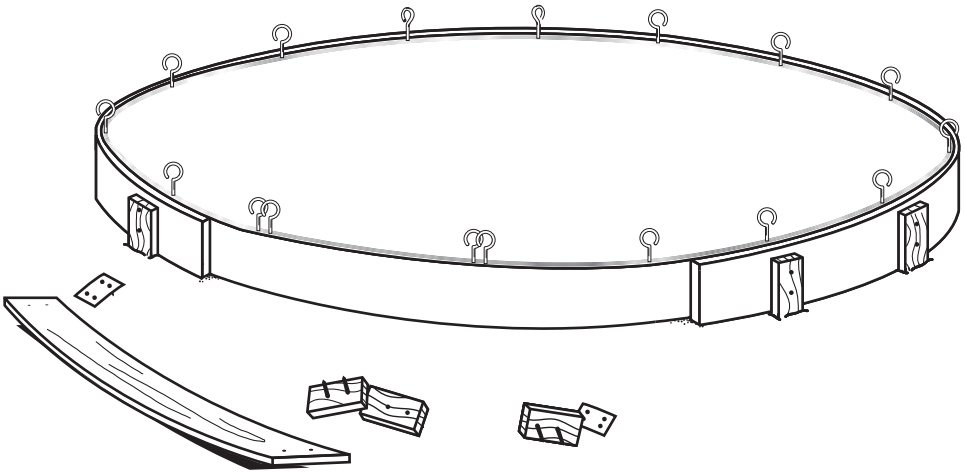
Before the concrete sets, place two hooks on each side of a doorway, but do not place any hooks within the doorway. Dig a small trench approximately 1" (25 mm) wide and 3/4" to 1/2" deep into the fresh concrete between the uprights, except for doorways. For larger structures, this trench should be 2" wide and 1" deep.



38.)

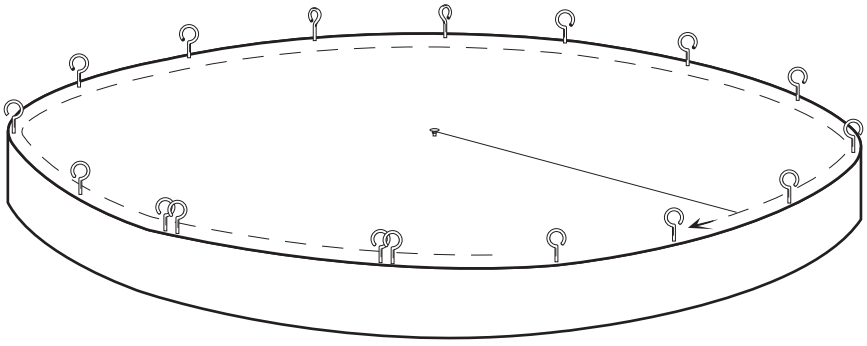
Placement shown is for an EcoShell with a 10' to 20' diameter. Larger structures may require different engineering. Always check for accuracy.

39.)



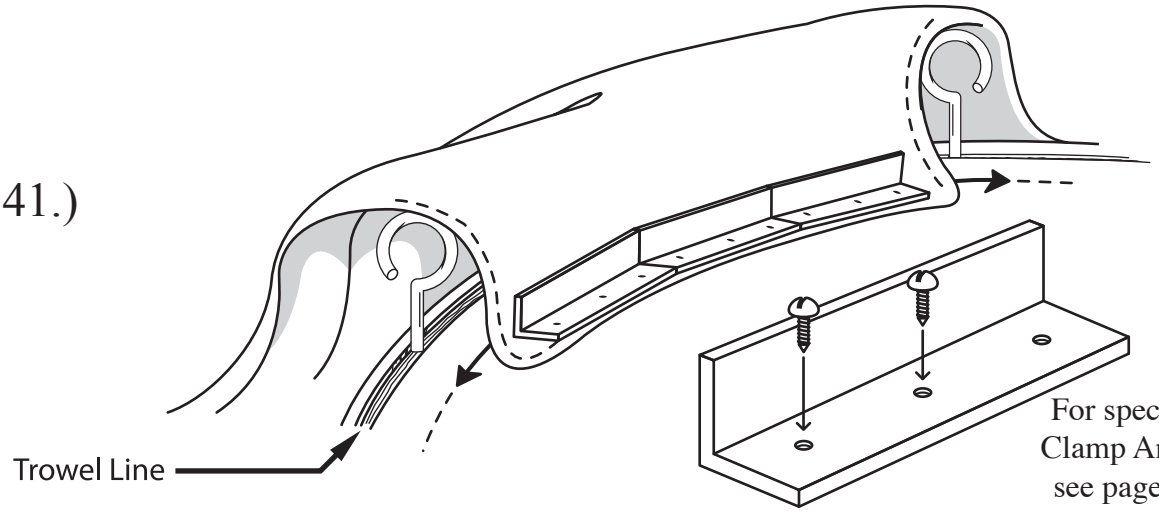
Remove the form boards once the concrete sets -- usually the next day. Provide a safe and clean job site by cleaning and stacking the form boards for future use.

40.)



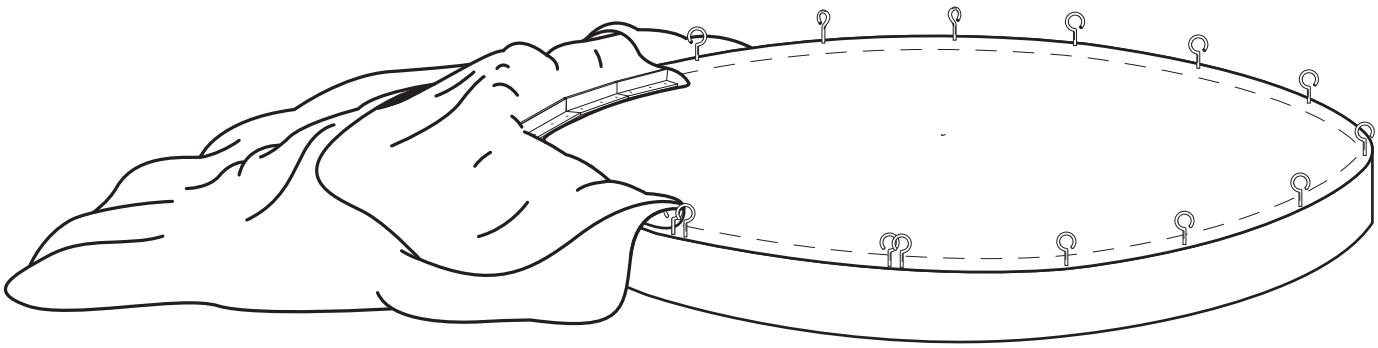
Mark a guideline 1” (25 mm) from the uprights. Guideline indicates where the edge of the EcoShell’s Airform will be.

41.)



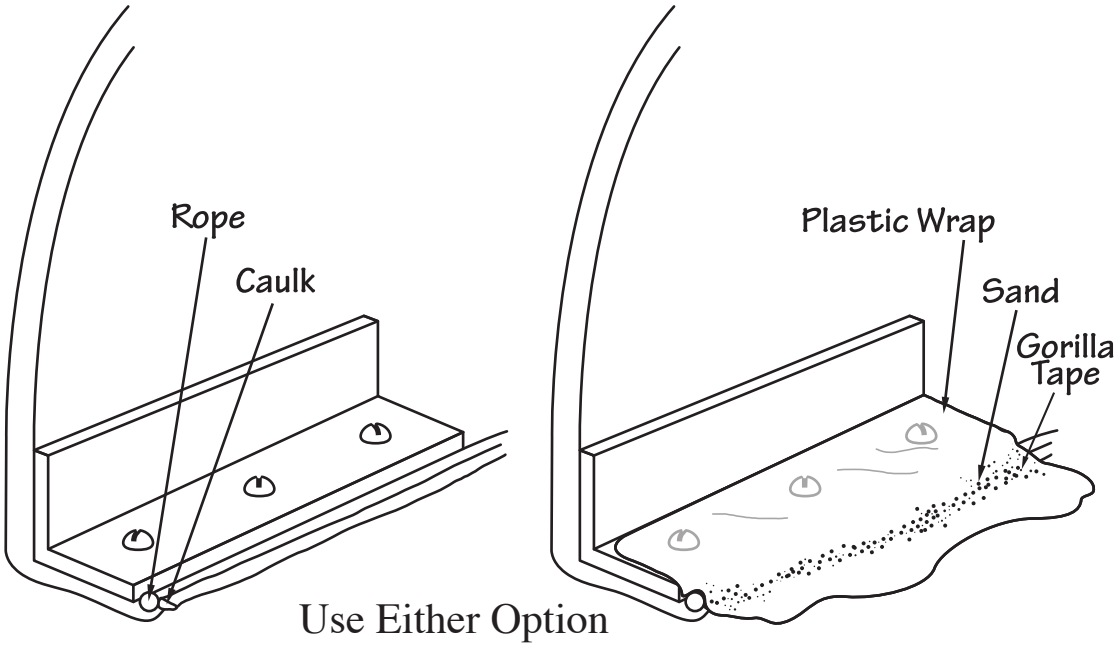
For specs on Clamp Angles see page 35.

Attach Airform using Clamp Angles as shown. Use 1, 2 or 3 concrete anchors as needed. Anchors can be screws (Tapcons) or a wedge foot anchor. It must be removable.



42.)

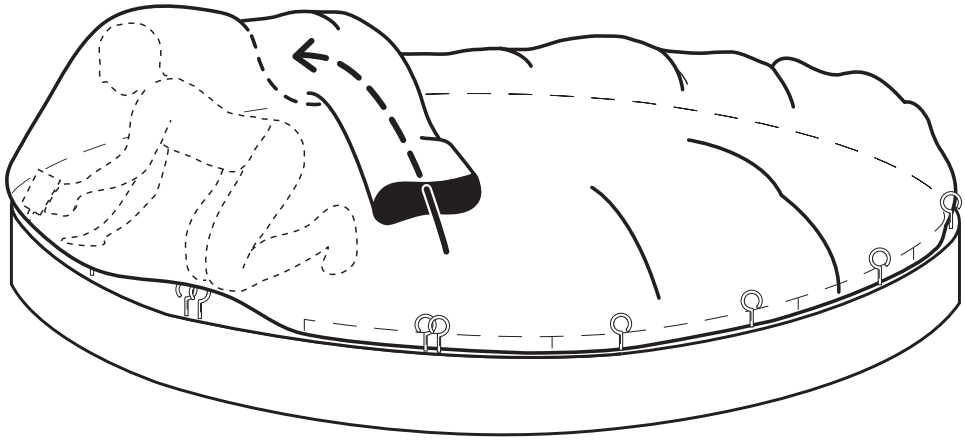
Continue placing Clamp Angles along the guideline. Carefully stretch the fabric along the guideline, distributing the fabric evenly all around. If not stretched evenly, there may not be enough to go all the way around.



Use Either Option

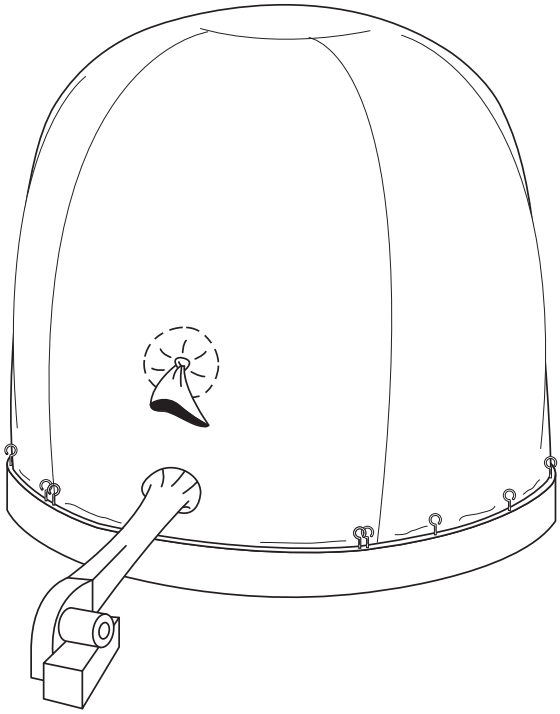
43.)

After all Clamp Angles are in place, the joints must be sealed. Clean the joints and seal them with caulking or with plastic wrap and sand. See last page 35 for illustration of Clamp Angle.



44.)

As placement continues, workers placing the Clamp Angles will wind up inside of the Airform. Workers can crawl out through the provided sleeve. A sawhorse or other bracing device used to hold the fabric off the workers is helpful.



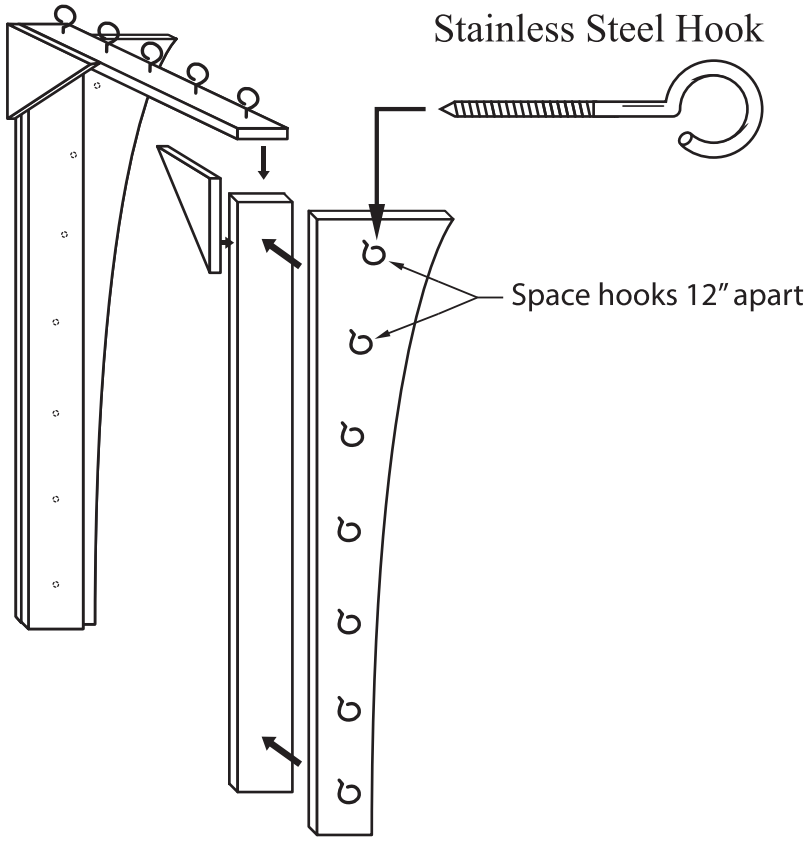
45.)

After all workers have exited, roll up and tie off the sleeve, making the Airform as airtight as possible. As placement of Clamp Angles progresses, ventilate under the Airform by starting the inflators. This is especially useful if a large fan is used only for this phase. The EcoShell Inflator must be used to properly inflate the EcoShell's Airform for construction.

Construct a Door Buck with curved sides that should follow the curve of the EcoShell.

You can then apply the Stainless Steel Hooks needed to thread the Basalt rope at a later stage.

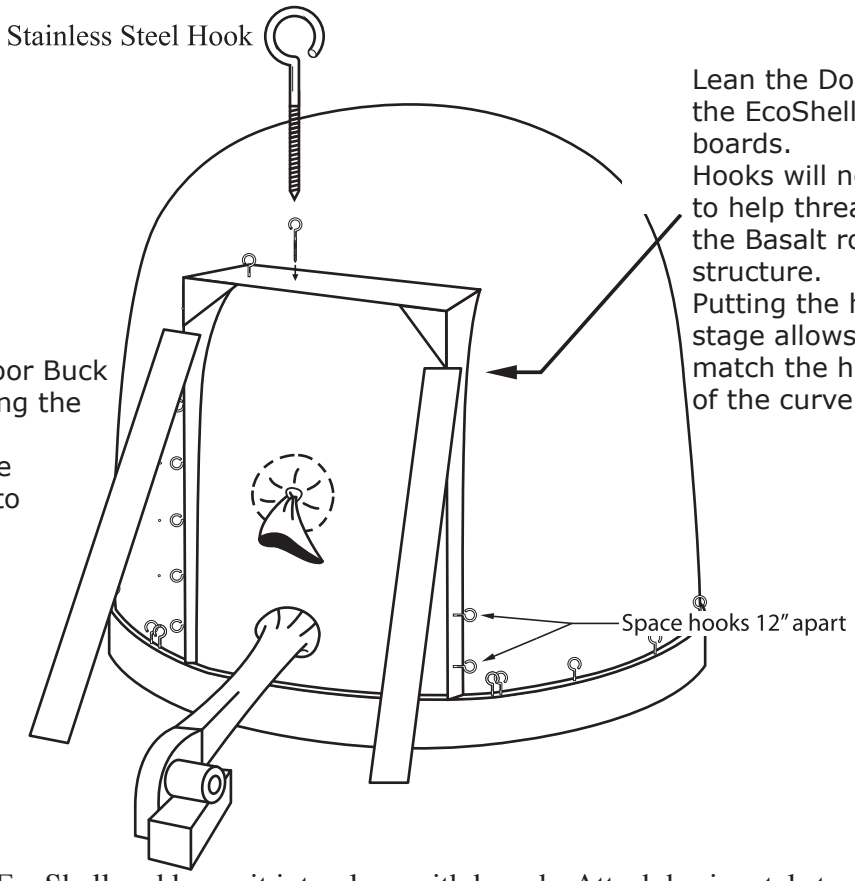
It is sometimes preferred to install the hooks after the Door Buck is securely in place. This allows the hooks to be easier aligned with the outer shape of the dome.



46.)

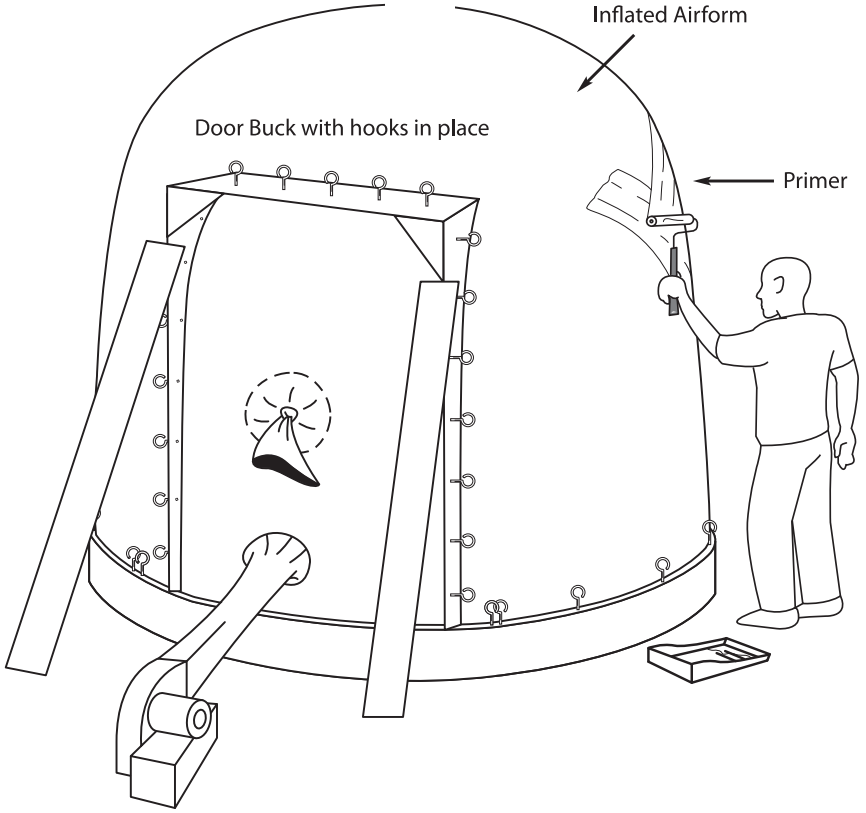
From plywood or boards, cut pieces that will make up the augmentations. Scribe them to fit the Airform. Then lean them against the Airform and secure them in place.

47.)



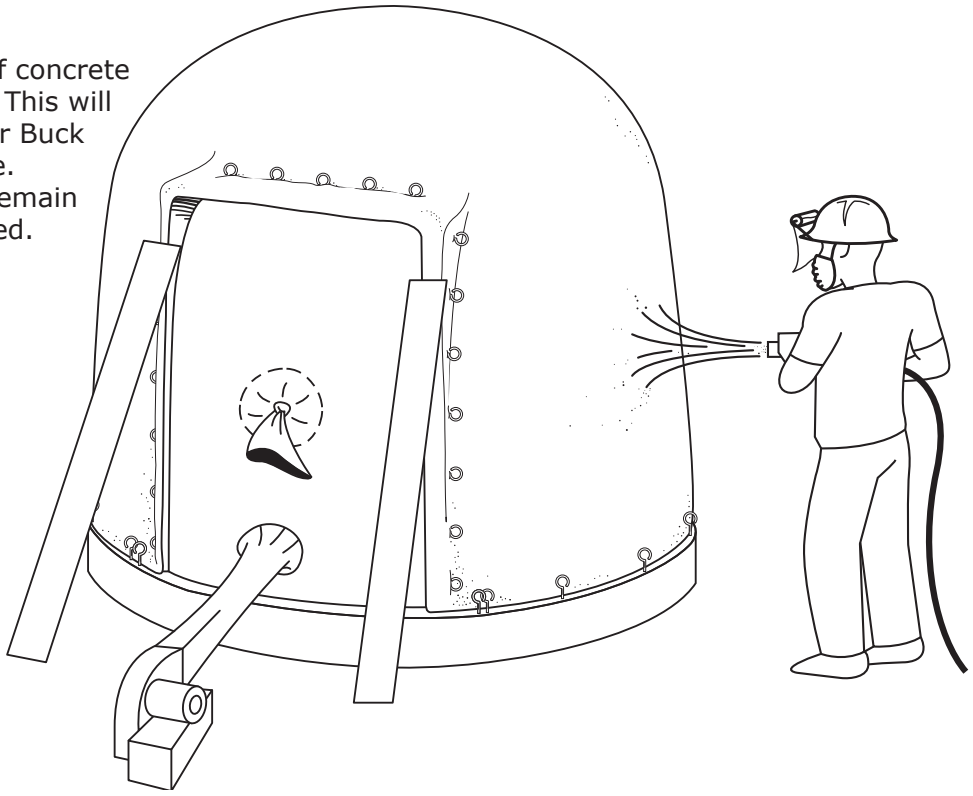
Position door buck to EcoShell and brace it into place with boards. Attach horizontals to verticals. Please use Basalt reinforcing. It will not be destroyed by rusting.

48.)



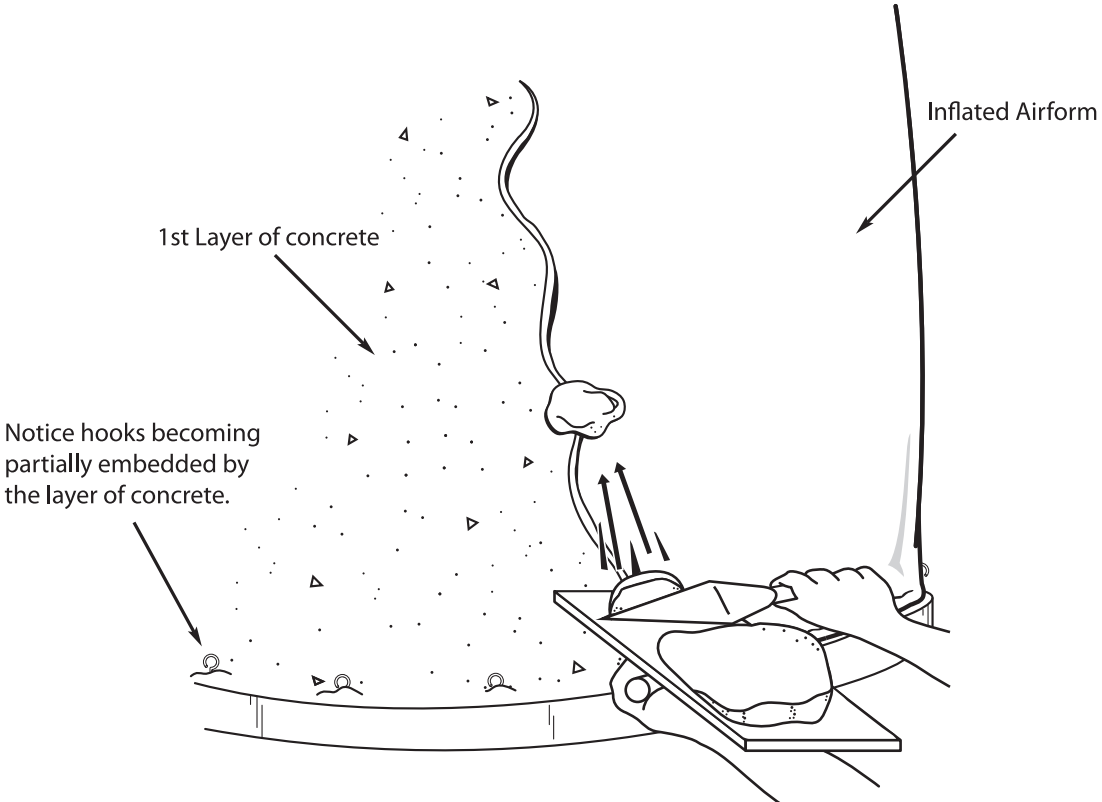
With the augmentation(s) braced against the Airform and the Stainless Steel Hooks in place around the Door Buck, this is a good stage to spray or roll on a light layer of primer over the Airform. The thin, tacky to the touch, layer of primer helps the concrete stick to the Airform.

Apply a layer of concrete to the exterior. This will secure the Door Buck to the structure. Hooks should remain partially exposed.



49.)

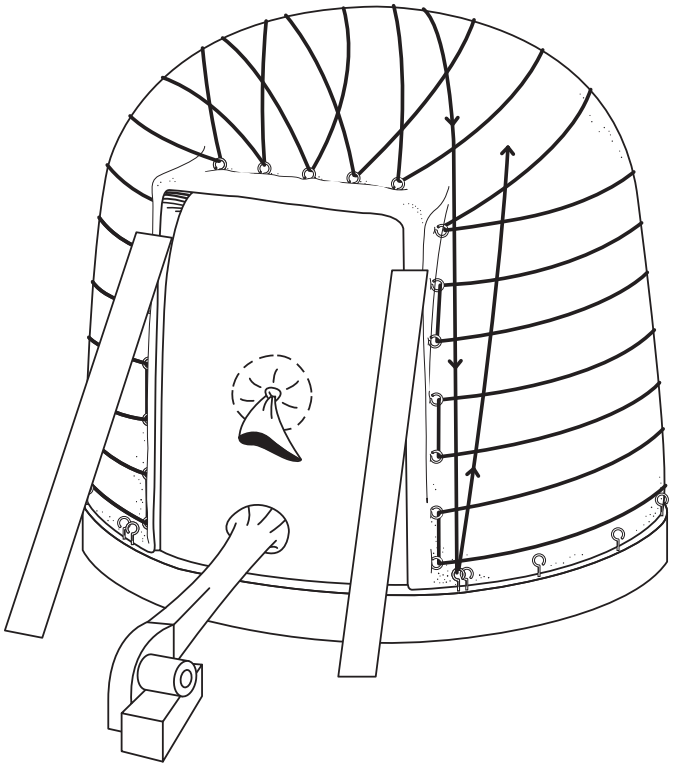
After the primer is added, apply a thin first layer of 1/2" concrete. Once first layer is set, spray on a second 1/2" layer. The 1" thick concrete should completely and evenly cover the Airform while uniting the augmentation(s) to the EcoShell. Here, the first layer of concrete is being added using a Shotcrete pump.



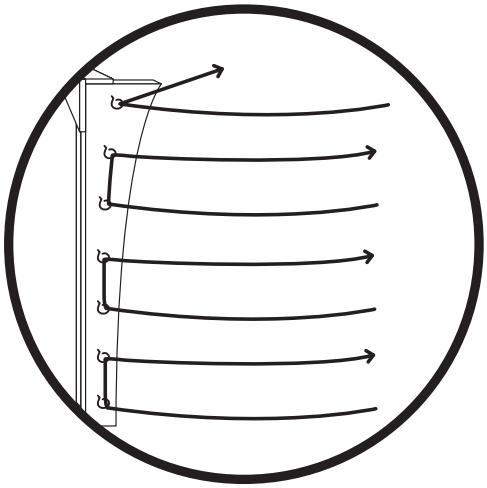
50.)

In addition to a Shotcrete pump, the first and subsequent layers of concrete can be hand applied by troweling or flipping it on, using a small mason trowel. Be sure to place only what will stick.
We now recommend application of 1/2" to 3/4" of concrete before a adding a reinforcing layer.
The first layer of concrete needs time to set (24 hours) before wrapping the Basalt rope around the EcoShell.

51.)

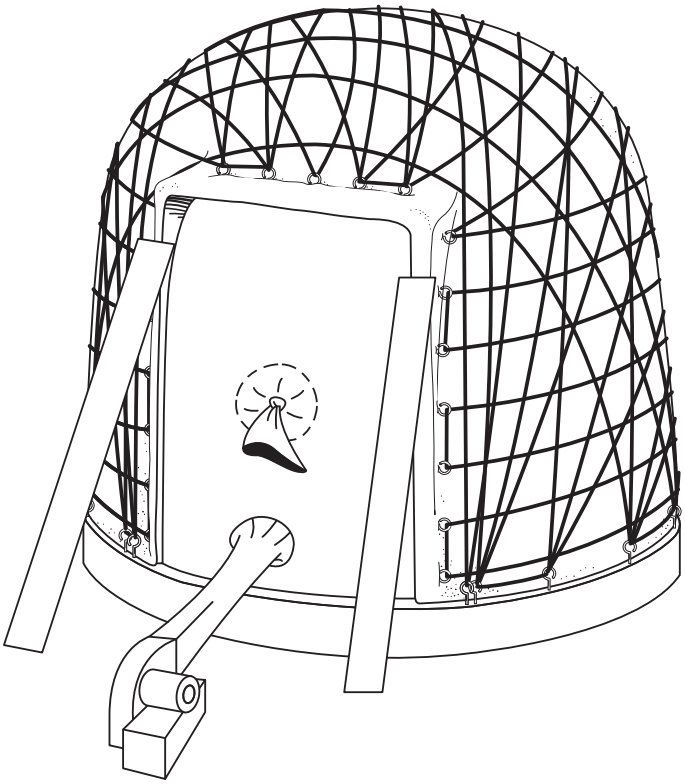


Begin by threading the Basalt rope thru the Stainless Steel Hooks horizontally and then vertically.



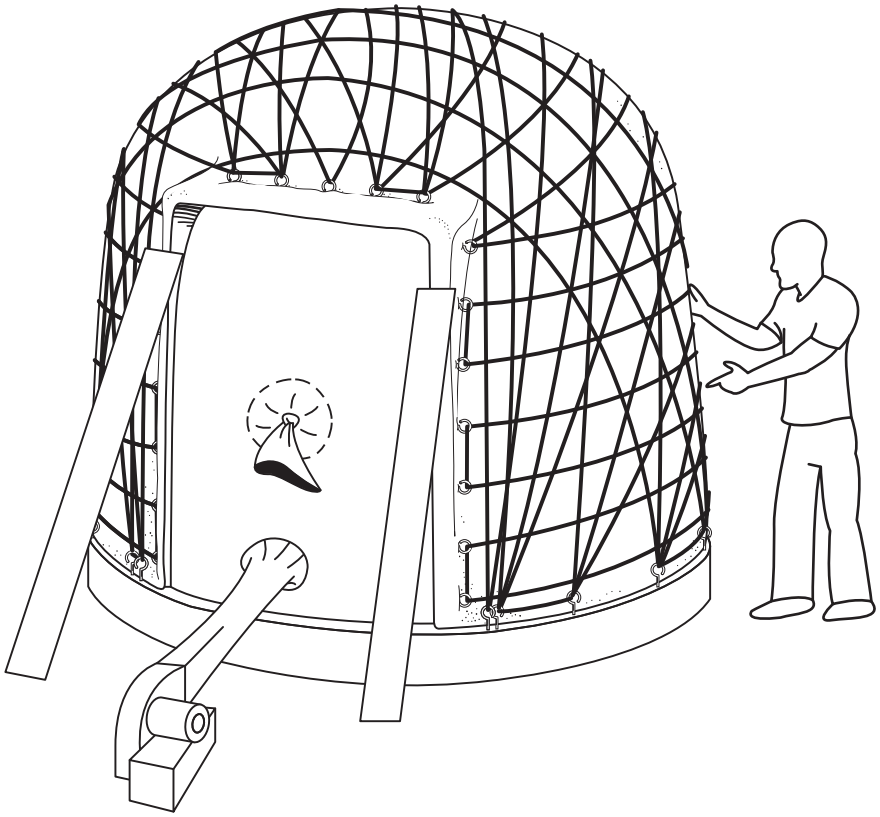
Wrap Basalt rope around EcoShell at 12 inches maximum spacing (30cm). Please use Basalt reinforcing. It will not be destroyed by rusting.

52.)



Continue wrapping the Airform with the Basalt rope. After a crossing pattern is achieved by passing the rope both horizontally and vertically thru the hooks, begin zig-zagging the Basalt rope thru the hooks and at an angle around the Airform.

53.)



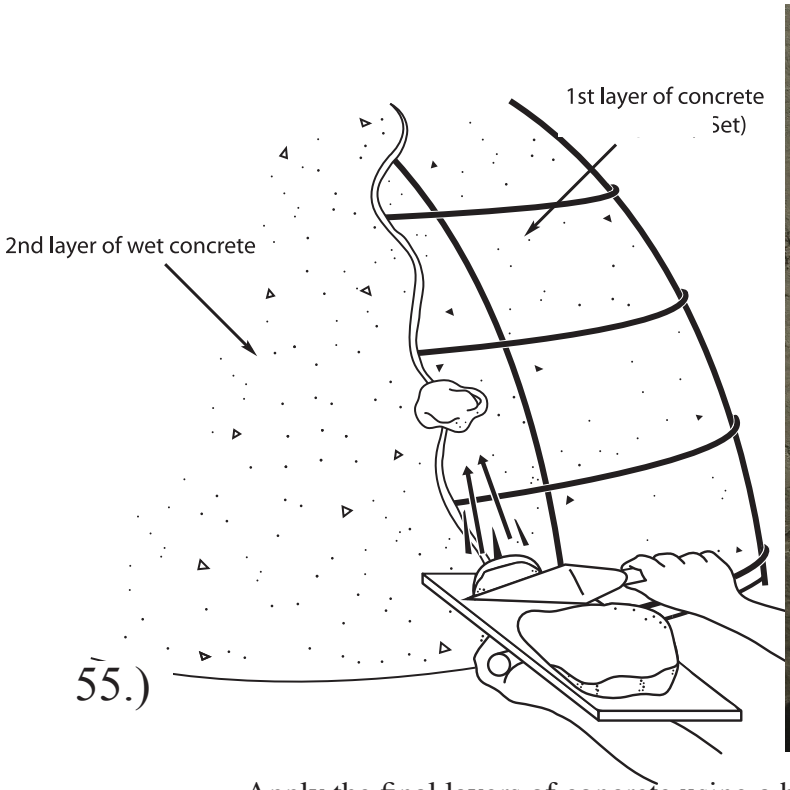
Make a final inspection. Basalt rope should lay flat over the the first layer of cured concrete after being wrapped in a crossing pattern and then a crisscrossed pattern.

Wrapping Basalt Rope

54.)

Thread Basalt rope thru
Stainless Steel Hooks.

Images of Basalt rope being wrapped around the first layer of concrete after the first layer of concrete has cured. The Basalt rope is threaded thru a series of hooks partially inbedded within the first layer of concrete.



55.)

Apply the final layers of concrete using a hand trowel or shotcrete pump.
Note: A layer of concrete should be hard to the touch before applying a new layer of concrete over it. Be sure first layer is hard before applying second and second is hard before applying third.

56.)

Remove the Airform after the exterior concrete has cured -- usually about 24 hours after the final concrete coat has been applied. But in cold weather, curing may take a few days.

57.)

EcoShell is now structurally complete. Its exterior should be coated with an elastomeric coating to help with solar reflectance and to protect against possible leaks from hairline cracks.

Quick Guide — EcoShell Construction Steps:

1.) Remove debris and level out the ground. (Page 3)
2.) Tamp the ground with a hand tamp (or similar) to flatten and firm the ground.(Page 4)
3.) Center a nail to the top of your center stake and use a string to mark the desired circumference. (Pages 4-5)
4.) Set forming stakes completely around the site's perimeter about 2' apart. (Pages 6-13)
5.) Dig an 8" x 8" trench that completely follows the inside of the forming material about 20cm wide.(Page 14)
6.) Define the floor by using forming materials such as 1/2" plywood to bend and attach to the forming stakes. Secure the forming material with screws and metal braces.(Pages 9-12)
8.) Dig a trench to add a pipe line for utility purposes. (Page 13)
9.) Lay 2 rebar rings into the trench. Use bricks to keep the rebar from touching the ground. Continue to add the floor rebar. (Pages 14-15)
10.) Prepare the concrete mix and pour over floor rebar. (Pages 15-20)
11.) Level the concrete with a screed board while pouring. (Page 20)
12.) Drag a trowel line around about 1 1/2" in from the outer edge of floor to set hooks. (Pages 21-22)
13.) Remove forming materials exposing the cured concrete floor. (Page 22)
14.) Mark a guideline for to define Airform placement (Page 23)
15.) Use clamp angle to secure Airform to floor. (Pages 23-25)
16.) Inflate Airform using an inflator. (Page 25)
17.) Construct a door buck and secure it to outside of EcoShell. (Page 26)
18.) Add stainless steel hooks to door buck and use curve of dome as a guide. (Page 26)
19.) Coat dome with a light, tacky to the touch, paint primer. (Page 27)
20.) Add a 1" layer of concrete to EcoShell's exterior by applying two separate 1/2" layers. All hooks should still be accessible. (Page 27)
21.) Workers also have the option of applying concrete using a hand trowel. (Page 28)
22.) Thread Basalt rope thru the hooks in a strategic pattern around the EcoShell. (Pages 28-30)
23.) Apply final layers of concrete, completely covering the Basalt rope. (Page 31)
24.) Once concrete is set, remove door buck and install a doorway entrance. (Page 32)
25.) Enjoy your new EcoShell housing dome that offers layers of protection against the elements.

Fabric Mixer

The Monolithic Fabric Mixer is simplicity itself -- fast and easy to use.

Here's how it's used: A cubic foot or less of concrete ingredients are put into the center of this fabric. The fabric is then agitated from side to side by two people. The completed concrete can then be transported to its point of use.

Here's the mix design we suggest for use with the Monolithic Fabric Mixer when building a concrete EcoShell: one container of cement, four containers of sand and water as needed. Start with one liter of cement, four liters of sand and one liter of water. Adjust the water to the conditions. Adjust the sand, if needed, by adding some 3/8" minus pea rock.

Basalt Reinforcing

Over the years we have become aware of another reinforcing made of Basalt. Basalt is another name for volcanic. It is a fiber pulled from the Basalt basically as fiberglass fiber is pulled from a mixture of rock. The Basalt fibers are then put into a rebar like pattern by using an epoxy to form the rebar. Basalt has some really good features. First and foremost it doesn't rust. Because it doesn't rust, it doesn't need nearly as much concrete covering it up to protect it from rusting.

The Basalt rebar is a little more than twice as strong as steel rebar and weighs about one fifth as much. Again, this has some huge ramifications in building EcoShell I buildings. If the rebar is Basalt we don't have to worry about leakage of rainwater getting into the reinforcing, rusting it and exploding the concrete.

We have been buying Basalt in coils woven as a rope. In the EcoShells we are now using a six millimeter Basalt rope. My preference is the rope as it coils tighter and ships easier. My recommendation is to put the 6 mm rope about 12 inches on center in both directions.

If you use the Basalt rebar and if you have quality control on building the structures you can use a total thickness of one-and-a-half to two inches.

It is always smart to coat the outside of the EcoShell buildings. The best coating we have found to date is silicone but other waterproof coatings can be used. The huge advantage by using Basalt rebar, is if over time the coating should start to leak water into the rebar, the building will just be bothered by unsightly spots where the leak occurs. But it will not have any structural problems.

It is fascinating and fun to contemplate the millions of houses we can build using the combination of concrete and Basalt.

Clamp Angles

1/8th inch thick angle iron is used make Clamp Angles that are used to hold the Airform to the concrete slab.