Build Your Own Concrete-Block-Wall-Swimming Pool
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Introduction

The most important step in the construction of a pool is a complete understanding of the preparation and assembly of the pool. Begin by reading these assembly instructions thoroughly to obtain a clear understanding of the techniques presented. Local building codes vary from one community to another. Prior to installation, these should be checked with the local building Inspector. It may be necessary to purchase or procure proper permits before construction begins. You may need to review the building requirements with the inspector and discuss the instructions and drawings pertinent to the pool you will be constructing.

Industry safety requirements dictate that all pools less than 40' long require at least one ladder or stairs and that a second ladder is required if the pool is over 40' long. Refer to N.S.P.I. standards later in this document, for further requirements.

ANSI and N.S.P.I. standards classify pools with less than 7-1/2 feet of water in the deep end are classified as type "O", non-diving. These type pools must not have diving, or jump boards, installed on them.

There is something about a swimming pool that appeals to most people, whether it be children, who will spend all their summer vacation swimming under a hot sun, or adults who prefer to lounge at pool side, watching their youngsters have a wonderful, summer’s afternoon. It isn’t hard to imagine the enjoyment that would come from having one’s own pool in the backyard. Round and oval above ground pools are, affordable, very popular, and satisfactory for many people. But maybe you would prefer a larger pool, with a shallow end for wading, a deep end for a diving board, or waterslide, but commercial installation price tags, have been holding you up. An alternative is, of course, to build your own, using local materials for the pool walls, specialized equipment from your local pool dealer or DEB Design, and
step-by-step construction plans, with which to put it all together. By building your own, you'll be able to have a beautiful, professional looking pool, for half to two thirds of what a professional installer would charge. This project could also be constructed in phases, as time and money permit. The pool specifications are:
18’5" wide by 36’8" long with an 8’ hopper style deep end
A 4’ by 8’ fiberglass pool entry step assembly
A hard, flat, and attractive pool bottom
A beautiful 20 millimeter thick custom liner
Aluminum liner track (not plastic) that accepts lumber or concrete decking
A main drain
A skimmer
A high capacity sand filter
An automatic chlorinator
Dual return water lines

Initially, you could be intimidated by this project. After becoming familiar with the steps, though, you won't be. This plan will guide you through, from start to finish as you construct what could be, one of your most enjoyable and rewarding projects, ever.
Material List

The following components will be available at your local building supply center:

- 34 pcs. 1/2" x 20' concrete reinforcement bar
- 306 pcs. of 8"x8"x16" standard cement block (Note: In areas of dense soil, substitute with rebar block)
- 204 pcs. of 8"x8"x16" cement block with rebar notches
- 12 pcs. 90# bags of Portland cement (for small on-site cement batches)
- 1 load (6 yds minimum) aggregate/sand mix for concrete (for small on-site cement batches)
- 12 yds. mason sand for the pool bottom
- 18 pcs. 90# bags of Portland cement (for the pool bottom)

Miscellaneous 1-1/2" PVC pipe and fittings

The following components are available at your local swimming pool dealer or can be obtained through DEB Design:

- 100 ft. 1/8"x 4’ foam liner backing
- 110 ft. aluminum cove molding
- 1 pc. main drain
- 1 pc. liner
- 1 pc. pool pump
- 1 pc. pool filter
- 2 pcs. return fittings
- 1 pc. automatic chlorinator
- 1 pc. safety rope assembly
- 2 pcs. safety rope anchor fittings
- 1 pc. skimmer assembly
- 1 pc. fiberglass pool step assembly
- 1 pc. light niche
- 1 pc. pool light
- 1 pc. multi port valve
- 250’ flexible PVC hose
**Pool Location**

Perhaps you already have an idea of where you would like to install your new pool, and what its elevation should be. And maybe you’re doing this project in steps, like I did, with the pool going in this year, and the deck, diving board, waterslide, changing rooms, etc, later, as funding allows. This pool plan will yield a pool that measures 18’ 5" wide by 36’8" long with an 8’ deep end. Your own pool could be built to whatever size, or design you prefer, using the same construction methods. My family and I have found, though, that this size works out quite well. One element that is essential is to plan for future expansion. Having a long-range plan will help reduce the possibility of oversights, if future building elements are added, such as changing rooms, equipment storage room, sauna, spa, etc.

**Layout the Pool**

Once you know where your pool will go, install temporary stakes at the four corners. Don’t worry if they aren’t exact, they are only for reference.

Next construct batter boards. (See Figure 1) As in building construction, these will be used to identify exactly where the pool walls will be built, after the initial excavation. To make these, use 8 pieces (salvaged lumber preferably) of 1"thick by 6" wide by 6’ long pine boards (or 2x4’s). Butt join two of the boards together. Screw a cleat across the edges of the boards to form a 90-degree angle as shown. Repeat with the other 3 sets. Set these assemblies aside.

Find or make 12 wooden stakes to which the batter boards will be attached. These should be at least 1-1/2" square and long enough to accommodate the slope of the grade. In my case, the ground was fairly level, so the stakes only needed to be about 2-1/2’ long. Pound the stakes firmly into the ground 4’ outside the corner stakes, as shown. (See
Figure 2) Repeat for the remaining 3 corners.

Pick the pool corner with the highest grade point, level, and attach 1 of the batter board assemblies 1 ft. above the ground using screws. A cordless drill works well for this task, as the batterboard assembly won’t be upset by the pounding of a hammer on the nails. Stretch a mason line from the batterboard assembly to another corner with a line level at the midpoint. Adjust the mason line until fairly level, (The assemblies don’t have to be perfectly level, yet) and mark the line height on 1 of the 3 stakes. Transfer the mark to the remaining 2 stakes, using a straightedge (board) and a 4-ft. level. Repeat this with the 2 remaining corners.

Attach the 3 remaining batterboard assemblies using the marks now inscribed on the stakes. We now have 4 batterboard assemblies installed with which to establish the footing corner positions.
Figure 2

Figure 3
Next identify which of the 4 pool sides you want to mark first. This will be determined by the proposed layout of your pool. In the pool shown, the long end needed to be parallel with the house. This was then a simple matter of measuring from the house, and marking on each of the 2 end batterboard assemblies, (Batterboards A and D) the same distance. (Note: the following procedure starts with the end wall, first) Make a shallow saw cut on each board mark, and attach a mason line tightly through the cuts on the first 2 batterboard assemblies. (See Figure 2)

* Now install another line between batterboards C and D, that is parallel to the first mason line. To do this, measure 36’ 8” from batterboards A and B, down to batterboards C and D, and mark. Kerf the batterboards and install a mason line between the cuts. (See Figure 2). Next install a mason line between batterboards A an D. Kerf batterboard A. (See Figure 3) and insert a mason line into it. Stretch, and temporarily attach it to batterboard D. Now check for
Figure 5

Note: Excavate to 24" minimum beyond outside of footing

36" Between Footings
18" Between Footings

Figure 6

First row of block

This dimension will be determined by the pool step assembly width

Footings

29 Block

14 Block
Start of the project.

Batter board installation.
Start of excavation.

Install footing forms.
Completed footing pour.

Re-bar cement block
squareness at the intersection of the first and third mason lines, with a large square. If you do not have one, make one according to Figure 4, or use a piece of plywood. Be as precise as possible. When satisfied with the placement of the line on batterboard D, mark, kerf, and fasten it in place.

Next, measure 18'5" from batterboards A and D, down to batterboards B and C, mark, kerf and install the 4th mason line between the cuts. (See Figure 3).

Perform a final check for squareness by measuring the diagonals of the rectangle, formed by the intersecting mason lines. The measurements should be exactly the same. If they are not, adjust the third and fourth lines (maintaining an 18’ 5" spacing between) towards batterboard D or C, and recheck. This took a number of tries for me, so readjust and recheck, until satisfied. If your batterboards have multiple kerfs from the adjustment process, be sure to identify the final position with a marker, so the lines can be correctly reinstalled after the initial excavation.

Excavate and install footing forms

The next phase will be an initial excavation to establish a flat grade at approximately 2" below the finished height, of the shallow end. Therefore, we need to establish a finished pool height reference point.

Start by driving a grade stake (2" by 4") firmly into the ground, close to one of the batterboards. This stake needs to project above the finished pool height. Mark your proposed finished pool deck height horizontally, on the grade stake. Transfer the mark to all 4 sides of the stake with a level. Remove the mason lines from the batterboards. Excavate all soil to a grade level 42" below the grade stake mark. The area should be excavated 2'wider on all 4 sides. A transit makes it easier to maintain a level cut, but when I did mine, I was working alone, so I had to estimate it. It turned out ok,
except I took a bit too much out of the deep end, which caused some minor problems later. I rented a bobcat to do this at a cost of about $80.00, but I had to move right along. In my case, this was practical, as I only had to cut 2’ deep, and the rental store was only 1/3 mile away. If you are excavating deeper than 2’, you’ll need a backhoe. I had quite a problem arranging for a backhoe later in the project, as it was late summer, and all the contractors were very busy. The best time would have been springtime, before everyone got booked up. Also, the job you need done, is small, which could make it harder to get help. One backhoe owner I talked to, first expressed interest, but when he found out what the project was, he realized that his trailer was broken. Anyway, the loose dirt should be moved away from the excavation area far enough to make it easier to work around the pool, as the project progresses. Now that you have done the initial excavation you can install footings. As with any sound building project, the footings are most critical to the project's success. A general rule of thumb is that the footings should be the same depth as the wall thickness, and twice the wall thickness, in width. Since we were using 8” block for our own wall, the footing dimensions needed to be 8” deep by 16” wide.

First you need to determine the elevation, or height of the top of the footings. (See Figure 7) This can be found by measuring down from the finished pool mark on the grade stake (45”) plus the coping height (App. 2-3/8”) Keep in mind that footings need to be installed onto undisturbed, compacted soil, so if you are building on a slope, the footings should start at, or below the lowest grade level. To insure that the footings were level, we borrowed a transit from a friend, to help determine the footing elevation, and make sure it was level. The footings will be flush with the inside of the pool wall. Use a plumb bob hung from the 4 corner mason line intersections, to identify the form board
position. Use a mason line stretched between all 4 corners as a reference for the form boards. Dig for the inside form boards first and then the outside. As I stated earlier, footings should be placed onto firm ground, so try not to dig any deeper than necessary. Once you have completed the form board trenches, pound wooden stakes down on the outside of the front of the first form board. Now using a transit, water level, or laser level, fasten the front form board to the stakes with screws, so it is 42-7/8" below the mark you established on the grade stake, earlier. Next, pound stakes for the outside form boards. Use a 2' level and reference the front form boards to establish the outside form board height. (Note: the inside form boards must be straight and plumb)

At this point, since we live in a cold climate, we placed reinforcing bar, or re-bar for short, into the footings. This is usually sold in 20' lengths, in 1/2" thickness, or larger. The bar bends easily and can be bent in half for easier transport with a trailer or truck. We placed 2 runs of re-bar into the form 4" from the bottom. (See Figure 5) If a run of more than 20' is required, overlap and fasten the re-bar ends together, using wire or hose clamps. To support the re-bar, I pounded 1" by 2" stakes into the ground on which the re-bar rested. We drove dry wall screws in on each side of the stakes and attached a piece of wire across the screws, to hold the re-bar in place. If you are planning to run the main drain and skimmer lines under the wall, be sure to provide an access for the lines under the footings. Once this is done you are ready to pour concrete, into the forms. Bring in a ready mix truck as you'll need just a bit over 3 yards of concrete. Now would also be a good time to form up a 4' by 8' concrete pad to support the pump, filter, and heater. This should be placed as close to the pool as possible, and be at a height close to the finished level of the pool deck.
Lay the 1st row of block onto the footings
Next, we'll need to position the first row of block, onto the footings. First, lay re-bar on top of the footings. Lay the first row of block (keyed) onto the footings over the re-bar according to Figure 7, aligning the inside edge of the block with the footings as shown in the following pictures.

Install vertical reinforcing bar into the footings
For soil conditions where maximum strength is required, the vertical pieces of rebar should be installed into the footings, when they are poured. On our project we found it much easier, to do the following:

1) Drill 1/2” holes into the footing, at every 3rd block. These holes should be 3 to 4” deep. We rented a rotary hammer drill from our local rental shop, to do this. It made the task go
quite quickly. Be sure to wear appropriate eye protection, when using this or other tools.
2) Count the number of holes you have drilled and cut an equal amount of rebar pieces, 12 to 16" in length.
3) Pound a piece of rebar into each hole using a sledgehammer.
4) When complete, recheck, and adjust if necessary, the base blocks.
Note: Do not install rods and blocks within 12" of the step opening. These will be installed later, with the step assembly.

**Partially fill the block cavities with concrete**
Next, go ahead and fill all the block cavities half full with concrete, to lock the first course in place. The easiest method for accomplishing this would be to call in a ready mix truck, however, most ready mix suppliers charge extra, if you do not order a minimum amount, usually 4 yards. We generally, have many small projects like this that could be mixed using a powered, portable mixer. All that's necessary is a pile of 3/4" aggregate, a pile of mason sand, and 90# bags of Portland cement. We had 6 yards of aggregate and 6 yards of mason sand hauled in and dumped in 2 separate piles, at an easily accessible location for electrical power, and water. We had a mixer of our own, but if you don't, you'll can borrow, or rent one from a local rental store. You'll also need a sturdy 4, or 5 cubic foot wheelbarrow. Once you have all these items you are ready to proceed. We have found the following procedure to work quite well. (One person operation)
1) Start up the mixer and shovel in 12 shovels full of aggregate
2) Shovel in 8 shovels full of mason sand
3) Shovel in 4 shovels full of Portland cement. The size of your mixer may not allow this amount of material, so just
keep the ratio at 3 parts stone, 2 parts sand, and 1 part Portland. (If the mix ratio is questionable add more Portland. 
4) Add clean water slowly with the garden hose until the mixture is wet, but stiff. 
5) Continue to mix and monitor the mixture's consistency. We found that it was very easy to add too much water, yielding a soupy mixture, which would have resulted in weaker concrete. If this happens, add a little more sand and Portland cement until the mixture is workable, but not runny. This will take a little bit of practice to judge, properly. 
6) Empty the mixer into the wheelbarrow. Immediately, spray just a little water into the mixer to rinse it, and then start loading the contents of the next batch. When you get to the point where you need it to mix a few minutes, (step #5) go ahead and transport the 1st batch and shovel it into the block cavities. (You only need to fill the blocks half way full) 
**Note: Be sure to pull the horizontal re-bar up off the footing, as you pour each cavity.** 
7) Now go back to the mixer and check and adjust if necessary, the new batch. Next, repeat step #6. Repeat this process, until all the blocks are half full, or so. When finished, be sure to thoroughly spray and clean the mixer, shovel, wheelbarrow, and striker board. Also be sure to clean off any concrete that remains on top of the cement block wall.
Dry laying the first row of block for the pool wall.

View of corner detail for the first row of block for the pool wall.
Leave an opening in the wall for the pool step assembly.

Dry laid completion of the first row of the pool wall.
Rebar installation and initial wall pour.

Completed installation of the first row of block.
Lay up the remainder of the wall block
Now go ahead and lay the next row of block on top of, and aligned with, the first row. Check all the blocks for plumbness, so that the wall doesn’t lean in or out. We had to use mortar on some of the rows due to irregularities in the footing. As with normal block wall construction, stagger the joints, so that no 2 joints are directly above one another. Repeat with additional courses until the wall is 5 courses high. Re-check each row for alignment using a mason line, particularly the top row. The coping will be mounted to it, and is the most visible element of the pool, so the top course should be straight. Leave openings in the wall for the skimmer, and light niche, as required.

![Diagram of a pool with labels for skimmer, light niche, and wall cavity for step assembly.]

Figure 8

Install the pool step assembly
Next install the pool steps. Read any instructions that accompanied the step assembly, before proceeding. Depending on the size and configuration of your steps, most of the following steps will apply. Determine the required
opening and finish dry laying the cement blocks to obtain a 6" gap on both sides, between the step assembly and the block. Cut the bottom of the step assembly (See photo on page 27), or the footing, so that the steps can fit flush with the front face of the footing. The rear of the steps will need to be supported. The steps I used came with fiberglass supports. Check the instructions that accompanied the assembly. Push the step assembly in until the face is flush with the pool wall, and the top is even with the coping. Once installed the coping/step union should resemble the photo on page 28. Temporarily lay a piece of coping on the wall on each side of the step assembly, to determine this height. Check the assembly for levelness, side to side, and front to back. Adjust until satisfied, and block or shim the steps to hold it in position. Pool step assemblies typically have flanges on the side, which will rest against the pool wall. The flanges on our step assembly were narrow, so we added plywood extensions. Three carriage bolts were installed into the extensions on each side to serve as anchors, when the step assembly is cast into the wall. Once the step assembly is in place and level from side to side and front to back, install form boards (3/4’ plywood) between the steps and walls. We held our forms in place using 1/4" threaded rod. Next fill the adjacent block cavities with cement. After the forms are removed, break off the remnant, threaded rod, and grind the projection flat to the pool wall with an angle grinder, or equivalent. Remove and set aside the liner face seal strips.
Check the straightness of the walls with a mason line.

View of wall opening for the step assembly.
View of corner detail of top block row. Notch the side of the block to provide rebar access.

View of completed installation of the top row of block.
View of rebar splice. (Tie together with wire)

Modify as necessary the flange of the step assembly so it can rest on the footing.
Install a flange extension to each side of the steps.

View of the proper step height with the coping laying on the pool wall.
View of the step assembly casting forms

Rear view of step casting forms. (Note that the concrete has been poured)
View of side of step after the concrete has been poured and the forms removed.

Wide view of steps after completed pour of concrete and form removal.
Install the skimmer

The skimmer height should be such that the normal pool water level rests slightly above the middle of the skimmer throat. My own pool water level is normally 4 to 5" down from the top. Using the installation instructions supplied, lay the skimmer into position. Install form boards as shown starting on page 33. We fastened the face of the skimmer to the front form board using 2 of the screws that are used to fasten the faceplate to the skimmer. We held our forms in place using 1/4" threaded rod. Be sure to use thicker forms (3/4" plywood) and plenty of rod here to keep the forms from bowing and to insure the skimmer face is kept flush with the inside of the pool wall. Fill the block cores around the skimmer with concrete. After the forms are removed, break off the remnant threaded rod, and grind the projections flat to the pool wall with an angle grinder, or equivalent. Important: Before filling any cores with concrete, re-check the walls for straightness with a mason line.

Install the light niche

If you plan on installing a pool light, install the light niche, next. The niche height must be at least 18" below the normal water level of the pool. This will allow the light to be serviced without having to get into the pool, especially in the fall, when the light gets pulled out for the winter. Install a male threaded adapter into the threaded conduit hole and cement a 20' length of 160-PSI poly pipe, to the adapter. This pipe will need to be leak free and be plumbed into a weatherproof junction box that is positioned 8" above the coping of the pool, at a minimum distance of 8' away from the pool edge. Using any installation instructions supplied, along with this information, attach the light niche to the front form board using the supplied screws. We held our forms in place using 1/4" threaded rod. Fill the block cores that surround the niche with concrete. After the concrete has hardened and the forms are removed, break off the remnant
threaded rod, and grind the projection flat to the pool wall with an angle grinder, or equivalent.

Install the return fittings
These fittings provide a plumbing connection for the filtered water to be returned to the pool. I would recommend installing 2 of these on the pool sidewall, opposite the skimmer. I placed mine on the sidewall, 3’ from each end, at a height of 20” down from the top of the pool wall. This location will gently push surface debris, towards the skimmer. Drill, or chisel out openings for the water inlet fittings. Install a PVC female threaded adapter and a length of PVC pipe to the fittings, long enough to extend a few inches through the wall. Place the assemblies in position with the cover holes at 12:00, 3:00, 6:00, and 9:00. This will make it easier to locate the holes later, when the covers are installed, and the liner hides the holes. Once done, fill those cores with concrete.

Install the rope anchors
The safety rope is installed across the pool, at the start of the slope, to the deep end. The rope anchors are what the rope attaches to, and are installed into the pool wall at water level. Drill, or chisel out openings for the rope anchor fittings. Thread the anchor into a female threaded adapter. Solvent weld a short piece of PVC tubing into the adapter. Install some screws into the side of the tubing so that the concrete can securely latch onto the assembly. Many times children (and adults too) hang on the rope, so the anchors need to be solidly mounted. Pour concrete into the cores that contain the anchors, to permanently anchor them. Note: Be sure to double-check the placement before pouring. We installed all the previously mentioned items and then filled them with concrete. This saved a lot of mixer and wheelbarrow cleanup.
Install hose to the inlets and skimmer

Next we need to install the fittings and hose to our inlets and skimmer. First, solvent weld a 90 degree (deep socket) elbow to each of the outlet tubes. Then, solvent weld the flexible PVC hose to all the inlets. Solvent weld a piece of hose to the skimmer also. Run the opposite end of all the hose into the area where your pump and filter support pad will be built. These will be plumbed in later.

View of rear skimmer form.
Front view of skimmer form.

Fill the skimmer forms with concrete.
Front view of completed skimmer installation.

Rear view of completed skimmer installation.
Front view of light niche form.

Rear view of light niche form. (Note ground wire)
Front view of completed light niche installation.

Rear view of completed light niche installation.
View of water inlet assembly.

Front view of water inlet installation. (Note holes positioned at 12:00, 3:00, 6:00, and 9:00.)
Rear view of water inlet installation.

Front view of rope anchor installation.
View of skimmer hose routing.

View of hose attachment to skimmer.
View of hose attachment to the water inlet assembly.

View of supply hose routing towards the systems pad.
Install the corner diagonal forms
Next install the 45-degree forms at the corners. Hold these forms in place with stakes and bracing placed on the inside of the pool. 2" x 6" lumber works well for this.

Fill the block cavities and diagonal forms with concrete
Once the entire block wall has been laid, go ahead and fill all the block cavities and corner forms, with concrete. Note: For maximum wall strength install vertical lengths of rebar in the block cavities. These should stop just short of the top of the block wall). If you are planning to install a wood deck around your pool, fill the blocks completely, and strike level. If you will be pouring a concrete deck, fill the last row half way, only. This will leave block cavities for the poured deck to interlock with. Note that this task can be completed in phases, again working from one end of the wall, to the other. The size of your project will dictate the schedule of this task. Once complete, allow one full day of cure time. If you use ready mix, order 5 yards of pea gravel concrete. This has smaller aggregate, which will make the task easier. We built a wooden funnel to facilitate the wall pour. Even if you have to bucket concrete to some hard to reach places, the funnel will help. Any extra concrete can be used for pouring a bond beam, in the next step. (Be sure to scrap off any excess concrete from the top and front face of the wall that could interfere with the coping positioning)
View of corner form.

View of main drain access pipe. The main drain line will be installed through this line.
View of fabricated filling funnel.

Start of wall fill with pea gravel concrete.
The funnel can be filled with concrete and then slid to fill remote wall areas.

Filling the final section of the pool wall.
Pour a concrete bond beam

Install vertical, 12” long, lengths of re-bar, into the exposed footings. Use the same procedure previously used for the first row of block. Next call in a cement truck and pour cement onto the footings around the entire wall perimeter. Insure that concrete is placed behind the flange of the step assembly where it meets the footing. We used 7 yards and ran a bit short, so keep the truck chute moving.

**Important:** Prior to doing this, be sure to provide an access under the footing and bond beam, for the main drain hose. A piece of 2” rigid PVC works well for this. Extend the pipe under the footings out beyond the planned edge of the bond beam.

Mark the Liner Coordinates

Next we need to prepare for the deep end excavation. To do this we will establish marks on the top of the pool wall, so rope lines can be stretched across the pool, in line with the front and back of the deep end. Plumb lines will be attached to these ropes to mark the position and depth of the deep end, for the excavation. (See figures 9 and 10)

Measure down a sidewall from the step end of the pool and pencil marks on the top rail at 12’0”, 26’, and 31’11-1/2’. Repeat with the other sidewall.

* Using re-bar stakes fasten a mason line across the pool bottom to mark the start of the slope.
* Temporarily fasten a rope across the 24’ marks. (Rope line 1) * Temporarily fasten another rope across the 32’ marks. (Rope line 2)
* Mark 4’6” in from each pool wall side on both rope lines
* Prepare 4 mason lines 9’ long, and attach a weight to each one. (Machine bolt nuts will work) Attach these to the 4 marks on the rope lines, so that they measure 8’ 2”, when fully extended. During the final stage of excavation, these plumb lines will hang down and mark the 4 corners of the
View of end wall concrete bond beam.

View of side wall concrete bond beam.
View of end wall concrete bond beam.

View of step assembly concrete bond beam.
View of completed corner diagonal pour.

View of the completed pool wall.
6' by 10’ deep end.
* Remove the ropes from one sidewall and neatly set aside until needed.

**Excavate the Deep End**

Now it’s time to dig out the deep end of your pool. If your pool wall is less than 2’ high, an extended backhoe will do the job. If it’s higher you will probably need a highhoe, (a larger track mounted digger with more reach) If you have waited until now to call in a digger, you can work on the plumbing, until the contractor arrives. Also, if the plumbing is completed, (excluding the main drain) the deep end fill can be used to partially backfill against the pool walls, while the equipment is available. Once the digger arrives:

Take some time to make sure the hoe operator understands the bottom profile you are after. (See figures 9 and 10) Once he does, let him determine how to set up. Keep the digger there until he has removed as much of the dirt as possible. Final shaping can be done with a shovel and rake. Rake the sides down towards the bottom, and have the hoe remove the dirt. Check the bottom coordinates by reinstalling the rope lines and allowing the plumb lines to drape down into the pool. Don’t be afraid to cut to deep. It’s better to take too much dirt rather than too little. Once the digger is gone, it’s easy to shovel dirt back in, if necessary.

**Install Liner Profile Markers**

The pool bottom will be made of a sand and Portland mixture. This will be dumped into the pool, and built up to match the liner contours. We need to set small stakes, and attach mason lines to mark the actual liner profile. These string lines should be as accurate as possible, to insure a neat looking and proper liner fit, so take your time. (See figure 11)

Measure, mark, and snap a chalk line on the pool wall,
40" down from the top, around the entire inside perimeter of

Excavating the deep end.

Raking down and forming the deep end.
Install mason lines to mark the liner profile.

Center and install the main drain at the deep end of the pool.
the pool. Measure down from the pool end 12'0" on both sidewalls, and mark. Pound a small diameter (1/2" by 12") rod into the ground, against the pool walls, adjacent to the marks. (Stakes 1 and 2) Leave 3" or so, of the stakes showing.

Reattach the rope and plumb lines used during the excavation phase, and recheck the 4'6" inset dimension from the pool wall, where the plumb lines are attached. Pound stakes 3 through 6 into the bottom of the deep end, directly underneath the four plumb lines. Again, leave 3" or so, of the stakes showing.

Disconnect the plumb lines from rope lines 1 and 2. Measure down from the remnant marks, 8’ and mark the height, on stakes 3 through 6.

Measure 40" down from the top rail, on the deep end diagonals, and mark at the center of the diagonal. Install stakes at the base of the diagonals.

Now attach mason lines tautly at the marks from:
1) Stakes 1 to 2

![Figure 9](image-url)
2) Stakes 3 to 4  
3) Stakes 5 to 6  
4) Stakes 1 to 3 to 5 and up to the stake at the base of the diagonal  
5) Stakes 2 to 4 to 6 and up to the stake at the base of the diagonal
Install the Main Drain

Now that the mason lines are in place, we know at what height to place the main drain. Dig a trench to accommodate the flexible PVC pipe that attaches to the main drain. (See figure 11) I found it less disruptive to trench the slope, rather than the steep sides. Establish the center of the deep end by temporarily stretching mason lines across the deep end diagonals. Feed the PVC pipe through the access pipe, down the trench, and solvent weld it to the main drain. Center and level the main drain just under the mason strings, and secure in place with, stakes and stainless clamps. (Note the position of the cover holes for cover attachment after the liner is installed) Remove the temporary diagonal mason lines. Fill the trench back in and pack the dirt firmly down. Cover the face only of the main drain with duck tape. This will keep dirt, and cement out during the next construction phases. Now using the mason lines as a guide, add or remove dirt to establish a 1" to 2" clearance beneath the lines, across all pool floor surfaces. Pack down any dirt that needs to be added. If too much clearance is allowed, we
may run short of the Portland/sand mixture that we use, for the bottom.

**Install the liner coping**

Next cut and install the aluminum coping. This is installed on the top rail, and contains a slot to accept, and retain the bead of the liner. The coping type you use will depend on what style deck you wish to install later. (See Figure 12) The coping installation procedure will be the same, for whichever style is used. Take your time when measuring, marking, and cutting the pieces. The coping is very visible, so it’s desirable to have nice clean mitered joints. I used a powered miter saw, with a metal cutoff blade for cutting. This provided clean cuts, but had to be done very slowly.

Install the 4 corners pieces first. Lay the pieces in place and mark the screw locations on the coping flange with a marker. Please note that the marks should be made adjacent to the block webs. Remove the pieces and drill 5/16" holes through the aluminum coping at the marks. Place the coping back in place, mark the hole locations on the block. Next use a rotary hammer-drill with a 3/16" masonry bit to drill holes into the block, 1-1/2" deep, at the coping hole locations. Lay a bead of caulk on top of the wall where the coping will lay and fasten the coping in place with masonry screws. Install cove caps over the cove seams, before any decking is built, or poured. Seal any coping openings (such as the ends) with caulk. This will prevent water from running down the inside of the pool wall when the concrete deck is poured.
Install the coping.

Install the liner backing.
Wood deck coping details

Coping Types

Figure 12
Install the liner backing

This next step should be done just prior to the liner installation. Check the pool wall for sharp protrusions, and remove them with a grinder. Next, designate a start point, such as by the steps. (Note: The liner backing is not applied to the step assembly face) Spray adhesive onto the start section of the pool wall, at the top of the wall, according to the instructions. Roll the foam backing onto the wall, as flat, and level, as possible, to the end of the adhesive application. Temporarily hold the foam in place with duck tape fastened to the foam and coping. Repeat these steps until the entire wall has been covered. Once done, also glue the bottom of the backing to the base of the wall. Cutout the foam backing from the light niche, skimmer, rope anchors and inlet openings.

Install the Support Systems

The pool support systems include the pump, filter, heater (optional) and chlorinator. These components serve to circulate, filter, heat, and automatically chlorinate the pool water. (See figure 13) Typically, a pump draws water from the skimmer and main drain and pushes it through a filter, a heater (optional), a chlorinator, and then back to the pool through the returns.

* Use 1-1/2" PVC piping and fittings.
* Install a flow control valve to the main drain and skimmer lines. This valve is necessary to allow a pool vacuum to be hooked to the skimmer, and to draw the water level down, for winterizing, or liner replacement.

Install the Pool Bottom, Install the Liner, and Fill the Pool

We’re getting lots closer to that first plunge, now. The next steps will be to install the pool bottom, install the liner, and fill the pool. This all needs to be done in one day, so now’s the time to beg, borrow, steal or solicit all the help you can get. It will be especially helpful, but not absolutely
necessary, to include some friends that have some experience with troweling concrete. The pool bottom will be made from a wet mason sand and Portland cement mixture, troweled flat onto the pool floor. The amount of time that this troweling process takes will depend on how much experienced help you have, and how particular you are about the flatness of the pool floor. I had the help of experienced trowelers when my floor was installed, so this was an easy task for me. If you won’t have experienced trowelers, I suggest practicing with wet mason sand to get the feel for it. This will be a large area to cover, though, so schedule this for a day with very favorable weather, and lots of help. We’ll also need the use of a bobcat, or tractor with a front-end loader. It will be used to mix the sand and Portland cement, and to transport, and dump the mixture into the pool.

Figure 13
View of completed support systems pad.

View of hose routing at pad.
View of main drain, skimmer, automatic chlorinator, flow control valve, and return line installation.

Filter valve detail.
View of heater hook-up.

View of completed plumbing of support system.
I rented one from a local rental store and ran it myself, since I know how to operate them. If this isn’t an option, an alternative would be to use a cement mixer, but we’ll be mixing 12 yards of material and the entire floor needs to be mixed and applied within a 2 to 4 hour window. Even if you have to hire an operator, it will be money well spent. You’ll need to have 12 yards of mason sand hauled in and dumped somewhere close to the pool in a non-grassy area. We’ll also need 18-90# bags of Portland cement handy. What about water? We’ll need a hose long enough to reach the pile of sand, with a spray nozzle. We also need to plan for filling the pool. I had a fire department tanker haul city water from a hydrant close by, and fill the pool, for a very reasonable fee. This pool will hold about 24,000 gallons of water, and the faster it’s filled the better. The reason for this is to get as much weight onto the floor mixture, as quickly as possible, to compact it, before it dries. In most cases though, a garden hose with good water pressure will have to do the job. So, we have:

- Good weather
- 12 yards of mason sand
- 18 bags of Portland cement (90 # bags)
- A bobcat or tractor and experienced operator
- Lot’s of help and round edge trowels
- Water
- Lots of food and refreshments for the help
- The liner
- The main drain cover and screws, the light niche cover, the skimmer faceplate, and the step liner seal strips
- A 24’ extension ladder
- One 1" by 2’ by 4’ piece of Styrofoam
- One 3/4" by 2’ by 4’ piece of plywood, or board, with a piece of the same size 1" Styrofoam attached and 14’ long strings tied to the center of the 2’ edges
- Duck tape, 2 brooms, 2 shop vacs with 1" hoses 6’
long, adapted to the end of the inlets, extension cords

Let’s go to work.

* Open the 18 bags of Portland cement and empty them onto the 12-yard pile of mason sand

* Have the tractor operator start mixing the sand and Portland (which we will call grout, from now on) together, using the bucket. Advise the operator not to cut too deep as to mix in topsoil, stones, or grass.

* After the grout is thoroughly mixed dry, start adding water with the garden hose. This amount of grout will require lots of water, so this may take a while.

* Continue mixing the grout with the tractor as water is added. Continue to add water until the grout is very damp, but not soupy.

* Start dumping the grout into the pool at the shallow end first, using the bobcat.

* Shovel the grout level with the chalk line on the walls (40" down from the pool wall top), and the mason lines that stretch between the stakes.

* After leveling start troweling the surface of the grout, to a smooth flat finish. The grout should be troweled right up to the mason lines, which match the liner profile.

* Continue dumping grout onto the pool floor, working from the shallow end to the deep end. I suggest you have a few trowelers work from the shallow end, and a few on the steep walls. Pack the grout well with the end of a 2" by 4" where it meets the pool wall. The deep end floor should be the last section to be troweled. If it is a hot, fast drying day, the grout may start drying out, after troweling. If this occurs, Shower the area with a very fine mist from the garden hose, taking care not to disturb the troweled finish.
View of pool base material mixing.

Distribution of the pool base material.
Dumping pool base material into the deep end.

Final troweling of the shallow end.
Final troweling of the deep end.

Removing the mason lines and stakes.
As the floor sections are completed and the mason lines no longer needed, remove the lines, and pull the stakes. Smooth the grout where the stakes were removed.

* As the deep end nears completion, lower the 2’ by 4’ plywood/foam piece with strings onto the deep end. Lay this pad, foam down onto a troweled area of the floor and lower the extension ladder down onto it. The strings should be duck taped up to the coping. These strings will later be used to extract the pad. Lay the ladder against the end wall with the other piece of foam sandwiched and taped, between it, and the end wall coping. While holding the ladder have all the trowelers exit the pool, except for one.

  * Remove the ladder and have the remaining troweler finish the bottom, working from on top of the foam and wood pad.

  * After all troweling is done, remove the duck tape from the main drain and vacuum it out.

  * Reinsert the ladder and extract the last troweler.

  * Pull up the pad using the strings.

  * With lots of help, pick up the liner and carry it towards the pool taking care not to let the bottom drag on the ground. Position an equal amount of personnel on each side of the liner, and carry it over the pool, taking care not to disturb the troweled floor.

  * Using the liner seams as a guide, lower the liner down into place, and start pushing the liner bead into the coping slot, to secure the liner. Continue to attach the liner around the entire perimeter of the pool.

  * Detach a 6" section of the liner half way down both sides of the pool. This can be done by pushing flat against the liner with the fingers, and by pushing each hand towards each other.

  * Attach the 1" by 6’ long hoses to the broom handles using duck tape. Insert these broom handles down between
Unfolding the liner.

Metering out the liner along the pool sides.
Final positioning and initial liner attachment to the coping.

Completion of liner attachment and vacuum installation.
Start of pool filling.

Completion of pool filling.
the pool wall and liner, so it rests about an inch above the pool floor. Fasten it in place at the coping, using duck tape. Couple the shop vac to these hoses.

* Hold the liner back towards the steps in the gap, where there is no coping to hold it. The idea here, is to prevent any major vacuum leaks from occurring during the next step.

* Plug in and start both of the vacuums. Watch the liner as the vacuums start to pull out the wrinkles. Use the push broom to assist, if necessary, by pushing with the bristle side. Do not over do it though, as this could damage the liner.

* Now, once you are satisfied with the liner fit, and appearance, lower the pad back into the deep end close to the main drain. Carefully lower the ladder down onto the pad.

* Send someone down equipped with the main drain cover, screws, screw driver, and utility knife. This installer will need to work off the pad again, so pull the ladder back out. The installer needs to locate the main drain opening and screw holes for the faceplate. This is a matter of feel, but is not difficult, just somewhat stressful, as you’re going to start putting holes in the liner. The opening can be slowly cut out, until the faceplate fits properly. Once done, the screw holes can be located, by rotating the plate and poking, until a screw hole is found.

* Once the plate is installed, carefully lower the ladder, and extract the installer.

* Now start filling the pool with water.

  If a fire truck tanker is used:
  -Dump the first, few loads slowly, with a fire hose to avoid disturbing the grout. Don’t let any water spill down along the outside of the pool walls, as the water could find it’s way to the grout, and disturb it.

  If a garden hose is used:
- It’s going to take a while to fill the pool to the point where we will start fastening the liner to the steps, light niche, inlets, and skimmer

* When the pool water level is about an inch deep on the shallow end lay a piece of 1" Styrofoam on the floor in front of the pool step and attach the bottom seal strip of the steps.

Finish up by attaching both side strips. Trim the liner from the step opening, exit the pool, and remove the Styrofoam.

* As the water level approaches the light niche, install the faceplate.
  * Install the inlet faceplates.
  * Install the skimmer faceplate.
  * Fill the pool to a level just above the halfway point of the skimmer opening.
  * Fill the clorinator with tablets
  * Fill the sand filter with sand according to the installation instructions
    * Prime the pump and start it up
    * Recheck for leaks
  * It may be tempting for the kids to jump in at this point, but make sure that the pool base has 2 days to harden, before anyone goes in.
  * Take a break!!!

**Finishing Up**

The pool is now complete, and ready for use. The deck still needs to be installed, however this can be done as time, and money permits. The pictures that follow show a concrete deck installation, along with a diving board, water slide, and ladder. These components and the light niche must all be grounded to the pool coping. The coping is then grounded to the service box. #8 copper wire was used for all grounding. A GFI protected circuit must power any electrical components. **Important: Be sure to consult a licensed electrician for any electrical work.**
Start of concrete deck forming.

View of brass sockets for entry rail.
View of ground wire attachment to the coping.

View of a fabricated entry-rail-socket-fixture.
View of the ladder installation (Note ground wire).

View of the diving board fixture installation.
Slide and skimmer cover installation.

View of the plumbing detail for slide.
View of ground wire attachment to slide ladder.

View of the ground wire attachment to slide leg.
A roof top view of the completed pool project.

A pool side view of the completed pool project.
Install the Deck

* Prior to pouring the concrete, the coping was coated with liquid dish soap to keep the concrete from sticking to it.
* After the concrete pour was finished, some of it had to be cleaned from the pool bottom.
* The skimmer required an extension to bring its height flush with the deck.
* The water slide is fed with 3/4” poly pipe that is buried in the concrete. It is connected to a supply valve that is plumbed into the pump-to-filter pipe to allow for flow control.
* Holes were drilled in the water slide supports and ladder, so re-bar could be installed horizontally.
Frequently Asked Questions and Answers

Question:
How much did it cost you to build the basic pool as shown?

Answer:
Approximately $8000.00 excluding the deck, diving board, water slide, entry step handrails, and heater. This will vary, depending upon your local building material prices, but could be favorably impacted, if you have access to a "bobcat" and/or backhoe. I had to pay for these services which are included in the price mentioned above. This also includes the cost of the pool component kit listed below.

Question:
How long did it take you to build the pool?

Answer:
We started the pool at the beginning of July, and finished it in the end of August. I think one should plan on a 2 months of weekends, and weeknights to complete it at an enjoyable pace.

Question:
Can you provide an overview of how the pool from your plans is built?

Answer:
The pool walls are made with concrete block. The pool floor is made using a wet Portland cement and sand mixture that is trowled onto the ground. The liner is installed into the coping and all wrinkles removed using shop vacs. The pool is then filled with water. The weight of the water compacts the base, which hardens in a couple days. The coping is made from aluminum and is available for pools with either a concrete or wood deck surround. The construction techniques specified in this plan can be used for any size pool. All that changes are the wall dimensions, and the bottom profile. That's a quick overview of the construction. The advantage of this type of installation is primarily economic, since all of the construction can be done by
average do-it-yourselfers. This plan is an exact replica of a commercial in-ground version, except instead of using expensive galvanized steel walls, concrete block is used instead. The result is a beautiful, professional looking pool that can typically be built for 1/3 to 1/2 of what a commercial installation would cost.

Can you supply pool components necessary to build the pool specified in your plan?

**Answer:**

Yes, DEB Design can provide a kit that contains the following components:

1. liner
2. pool pump
3. pool filter
4. automatic chlorinator
5. 108’ aluminum cove molding
6. main drain
7. safety rope assembly
8. set of safety rope anchor fittings
9. skimmer assembly
10. roll foam liner backing
11. check valve
12. flow control valve
13. return fittings

Total cost: $3000.00 Excluding Applicable Tax And Freight Costs (1999 Prices—Please go here for current pricing)

http://www.deb-design.com/products2.htm

Warranty: As specified by the manufacturer (available upon request)

Shipping: Contingent upon location
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Pool Care

FILTER OPERATION

1. Under normal usage, the multi-port valve handle remains in the "Filter" position.

2. Once or twice a week, shut off the pump, place the multi-port handle on "BACKWASH" and turn the pump back on.

3. Backwash for 1 minute, or until the water in the sight glass is clear.

4. Shut off the pump and place the multi-port handle on "RINSE" and rinse for approximately 10 seconds.

5. Shut the pump off, turn the handle back to the "FILTER" position, and restart the pump.

CLEANING THE PUMP BASKET

1. Shut off the pump.

2. Shut off both the LOWER SUCTION VALVE and SUMMER VALVE.

3. Place the multi-port handle on "Closed".

4. Remove the pump cover (Turn counter-clock wise), remove the basket, clean and replace.

5. Replace the cover and move the filter handle back to the FILTER" position. Open both valves and restart the pump.
CLEANING THE SUMMER BASKET

1. Shut off the skimmer valve.

2. Remove the basket from the skimmer and remove any leaves and/or debris.

3. Replace the basket and open the skimmer valve. NOTE: If the basket does not come out the top, remove it from the front of the skimmer.

VACUUMING THE POOL

1. Place the vacuum head on the end of the pole.

2. Place one end of the vac. hose on the vac. head.

3. Place the vac. into the water and prime the hose. (To do this, place the hose in front of a pool inlet and hold until air bubbles stop coming out of the vac. head).

4. Shut off the skimmer valve, place the vac. adapter inside the skimmer over the basket, place the vac. adapter elbow into the open end of the hose, open the weir door on front of the skimmer, put the hose and elbow through the front of the skimmer, and attach to vac. adapter.

5. Open the skimmer valve to create a suction on top of skimmer.

6. Shut off the lower wall valve to generate a greater degree of suction at the top.

7. Move the vac head slowly in a back and forth motion over the bottom of pool until clean (Do not raise the vac. head out
of the water or prime will be lost.)  
8. When completed, reverse the procedure, then backwash the filter and clean the baskets. Store the hose in a garage, shed or other shaded area.  
NOTE: If vacuuming to "WASTE", make sure that the water level is above the skimmer level. If the level falls below it, shut off the skimmer valve and refill the pool to its normal level and re-open the skimmer valve.

CHEMICALS

The test strips, or kits measure CHLORINE, pH and ALKILNITY. Follow the directions provided for best results.

CHLORINE: The chlorine level should read between 1 and 3 parts per million. (This is a maintenance level, not a killing level) If the chlorine is low, turn up the automatic chlorinator if the pool is so equipped. It takes a while for the chlorine level to rise as tablets are slow dissolving. Broadcasting granular chlorine will raise the level quicker because it dissolves faster. The maintenance dosage is 1/4 to 1/2 oz. per 1000 gallons. (Watch the wind direction when broadcasting granular chlorine). If the chlorine level is too high, shut off the chlorinator until the desired level is reached. Re-open the chlorinator valve to maintain the proper level.

PH: The pH level should be maintained between 7.2 and 7.6. When the pH is above 7.8, scaling occurs. To correct this, add muriatic acid directly in front of a return line. Do not add more than one quart at a time! As the pH level drops, reduce the dosage and re-test periodically, to prevent the level from dropping below 7.2. Adding acid as instructed allows for immediate use of the pool. Use extreme caution when using muriatic acid. After it's use, replace the cover.
and dip the bottle into the pool to wash off any spillage. When the pH is low, the pool water is highly corrosive and can cause damage to the plumbing and pump. To correct this, add pH UP as needed, following the label directions carefully. Test the water periodically and adjust until the pH is at the proper level.

ALKALINITY: Total alkalinity is the combined and uncombined alkaline material in the pool water. This is directly related to the maintenance of the pH level. Muriatic acid is used to lower the alkalinity level, but note that it will also lower the pH at the same time. If the pH is OK, add small amounts of acid and test the pH frequently to prevent lowering below the 7.2 minimum level.

SHOCKING THE POOL

Every two weeks SHOCK your pool!!!!!!!!!!!!!!!!!!!!!!! To do this, follow the procedure below:

1. Broadcast 1 pound of QB BRITE (non-chlorine shock) per 10,000 Gals. of pool water to rid the pool of organic waste.
2. Add 3 oz. of PREMIUM 60 Algaecide per 10,000 Gals. of water.
3. Add 1 oz. ULTRA BLUE (Particle Coagulant) per 6,000 Gals. of water.