

## SITE WORK I: Figuring Soil Needed, Grading for Drainage

These construction techniques are chosen because they are low-tech and low-cost. Combined with good quality control, they can create buildings and site structures strong enough to survive hurricanes and resist earthquake damage. Good quality construction includes:

- plumb and level walls
- adequate tamping
- strong bags
- correct soils
- appropriate building dimensions
- maintenance of exterior plaster layers and roofs

These are all necessary to create hazard-resistant buildings. More information on these topics is available at [www.earthbagstructures.com](http://www.earthbagstructures.com).

These details and notes are general and may not apply in all situations. Engineers or expert earthbag builders may be able to make specific recommendations better suited to your site and building.

Earthbag is especially inexpensive if soil can be found on the building site. If you plan your building, you can slope the yard to drain or build a cistern to save rainwater while you are digging enough soil for a small house . It is important to locate the building floor level correctly to allow enough soil to be dug out without leaving low areas that will not drain well.

A single minimal 2.4m x 3.3 m (8' x 11') shelter room can take 8 cubic meters (10 cubic yards) of good subsoil. If it is located on a gentle slope, the ground level may have to be lowered 0.8- 1 m (32 – 29 inches) at the uphill side of a 4m x 5m (13' x 16') area to provide enough soil for this tiny building.

A 3m x 6m (10'x 20') building can take 21 cubic meters (700 cubic feet) of

soil. These figures are without buttresses or benches.

In some parts of the world people begin house building with a sturdy cistern beneath the floor. This saves precious space in the cities, and can provide soil for earthbags. But this makes walls higher and requires stronger buildings. To keep earthbag walls strong to resist earthquakes without using a lot of cement, cisterns are best located a meter (3 feet) away from earthbag building walls.

### FIGURING SOIL NEEDED FOR EARTH BAG BUILDINGS:

Do soil tests to find out if you have to add sand or clay to your soil. If your soil is rocky, estimate how much of it is rock. You will need to dig up a larger area to get enough soil.

If you have to buy soil for building, some discarded material may be less expensive. Reject sand or 'crusher fines' are soils left over from making gravel and/ or washed sand sold for concrete work. Test a small amount to see if it will work well for building before you order a truckload.

These figures are for the standard 22 kilogram or 50 pound bags. Adjust for larger or smaller bags.

**Bag size:** 38 cm wide x 12.5 cm high x 60 cm long, holds almost 30 liters, compacts to 670 cm<sup>2</sup> of wall space when tamped.

15" wide x 5" high x 2' long, holds about a cubic foot, compacts to about 0.70 square foot of wall space when tamped.

<b>Wall height</b>	2.4 m	7'-10"	2.7 m	8'-10"	3.0 m	9'-10"
<b>Requires per linear</b>	meter	foot	meter	foot	meter	foot
<b>Amount of soil</b>	1 cubic cu. meter	11 cu. foot or 4/10 cu. yard	1.1 cu. meter	12 cu. foot or 0.44 cu. yard	1.25 cu. meter	13.5 cu. foot or 1/2 cu. yard

Soil is not needed for openings like windows and doors, but about 10% extra is a safe factor to cover mistakes or small changes. Better to have too much than not enough... But for heavy clay soils you should dig up at least 10% more, because clay compacts more than other soils.

If cement and/ or gravel are available you can dig out a cistern to save rainwater and use the soil to build the house. This is how much soil a cistern can provide. (Dimensions are to outside of cistern walls.) Less soil will be left over if earth-filled bags are used to build the walls, more if gravel or rubble from other locations is used to build with:

**3700 liter (1000 gal.) cistern** yields 4.2 - 8.4 cubic meters (2.6 m diameter, 1.5 m high) or 5.5 - 11 cubic yards (8'-6" diameter, 5' high)

**6000 liter (1600 gal.) cistern** yields 6.5 - 12.2 cubic meters (3.8 x 2.3 m, 1.5 m high) or 8.5 - 16 cubic yards ( 12'-6" x 7'-6", 5' high)

### GRADING FOR DRAINAGE

Before building, land may not seem to have a water problem. Rain soaks into the open ground.

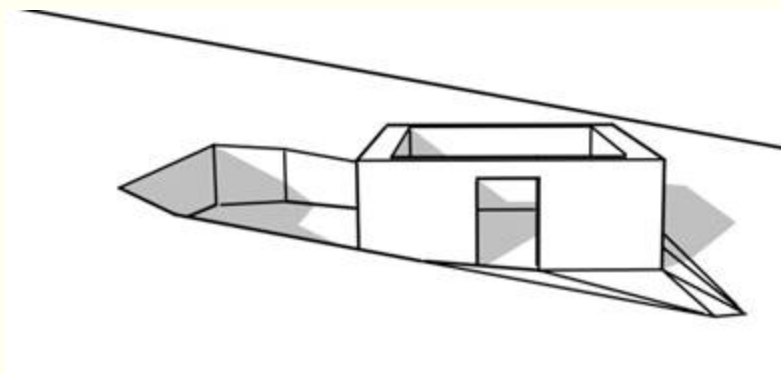
After building, rain runs off immediately from the roof, and quickly from the yard. If the earth was made firmer by machines or a lot of people walking, it won't soak up the rain as well. And there will be a lot less of it left uncovered to soak up the rain.

Saving rainwater in a large enough cistern can give you drinking water and help solve damage from runoff problems.

Very flat land can end up with soggy areas that breed mosquitoes. Very steep land can have streams that run into your house or wear away at your walls.

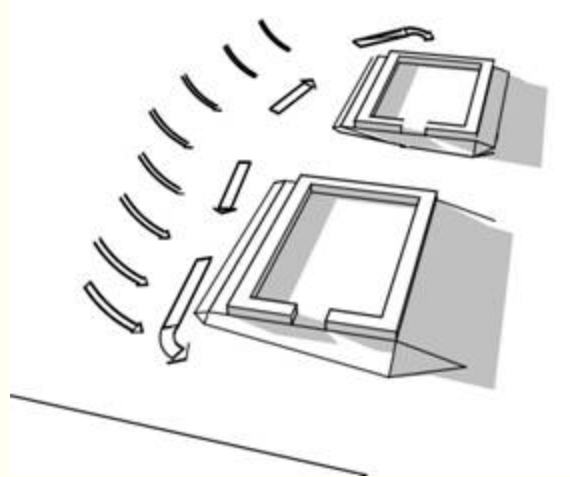
Buildings resist earthquakes best if the ground level floors do not step up or down.

They also resist earthquakes best if they do not have a lot of soil heaped



up against the building walls. To be safe in earthquakes it is better to dig some soil out of the higher side of the hill and use a separate wall if necessary.

A house on a slight mound is less likely to have water entering the home. The ground should slope down in all directions for at least 3 m (10'). This slope should be at least 1:50 (1 inch in 4') for rain to run off well. A swale (gently sloping drainage ditch) on the uphill side of the house should start 6 cm (2.5 inches) lower than the level outside the door if it is 3m (10') from the house. Leave enough room for the swale to fit around future buildings or additions.



To get enough soil to build with you will need to dig out more soil on the uphill side. When you choose where the house will go, the floor of the house will need to be a little higher than the ground level on the downhill side. If there is loose rock or rubble nearby, you can use that to fill inside the house to raise the floor level up.

Additional rock or rubble can be used for benches or retaining walls separate from the house.

Source : <http://www.earthbagstructures.com/details/sitework/sitework.htm>