

BUILD GOOD EARTHBAG WALLS

B3: Earthbag Info Part 3



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With Natural Building Blog friends

PREPARE TO BUILD



Soil test
Plan
Footings
Base wall

Strong soils for strong walls

Quakes can warp earthbag buildings.

Soil should be 188 psi (1.3 MPa) or more.

300 psi (2.1 MPa) required by some US codes makes stronger walls.



Estimate soil strength

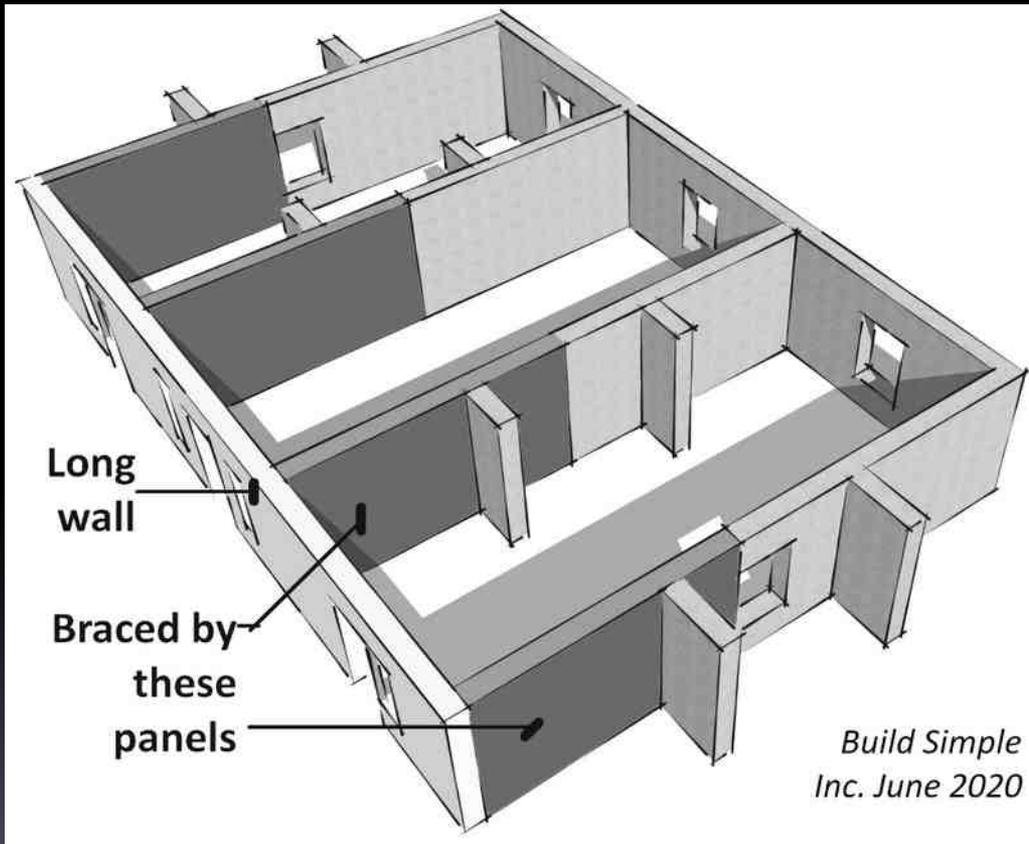


- **Make small samples**
- **Dry 24 hours in an oven**
- **Test under a small lever**

Sample psi x 1.8 for approximate compressive strength. More info: [How Strong is My Building Soil? at BuildSimple.org](http://BuildSimple.org)

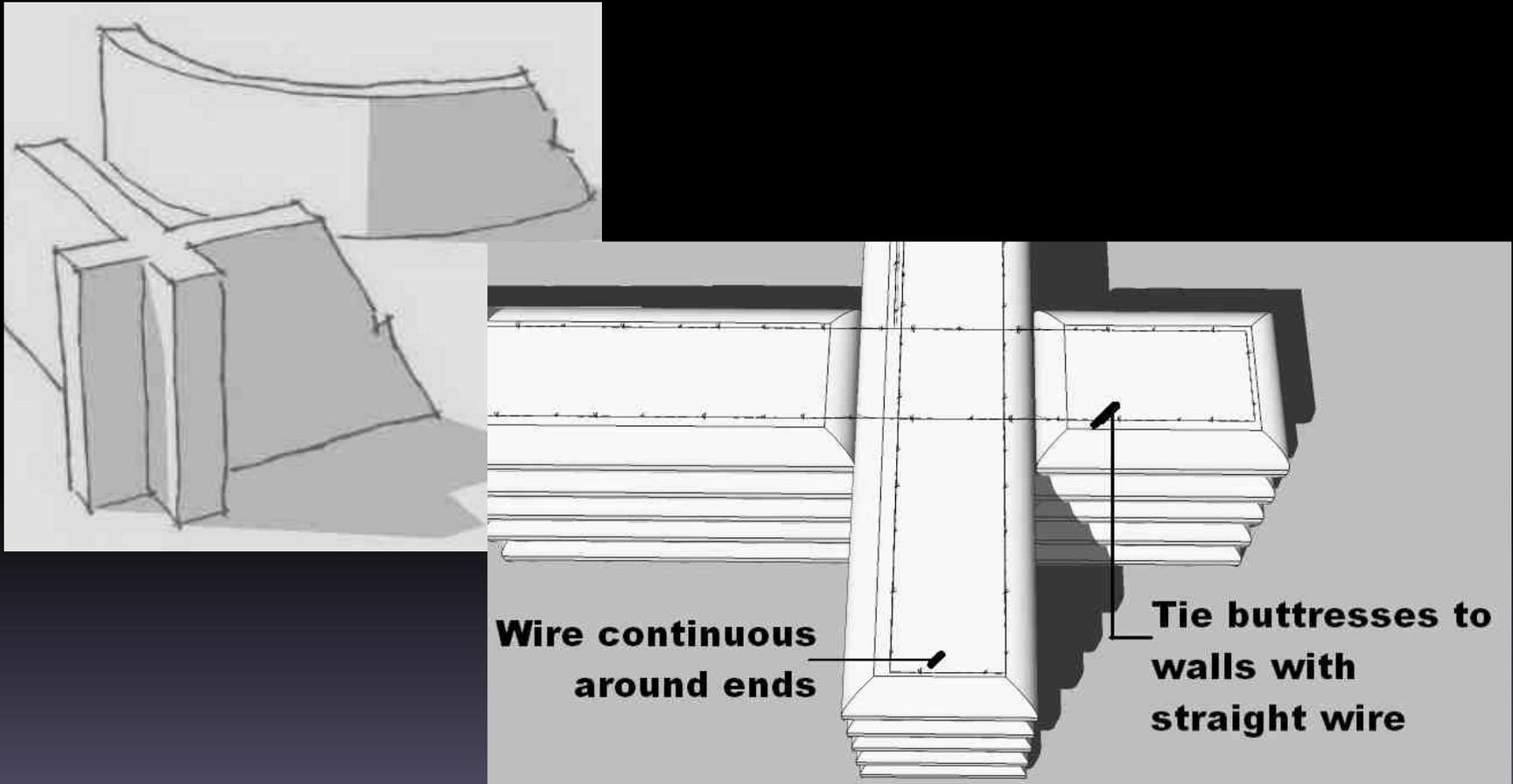


Plan walls to brace each other



- **Locate openings away from corners**
- **Add a buttress if walls are further than 12' (3.7 m) apart.**

Curved walls and buttresses add strength



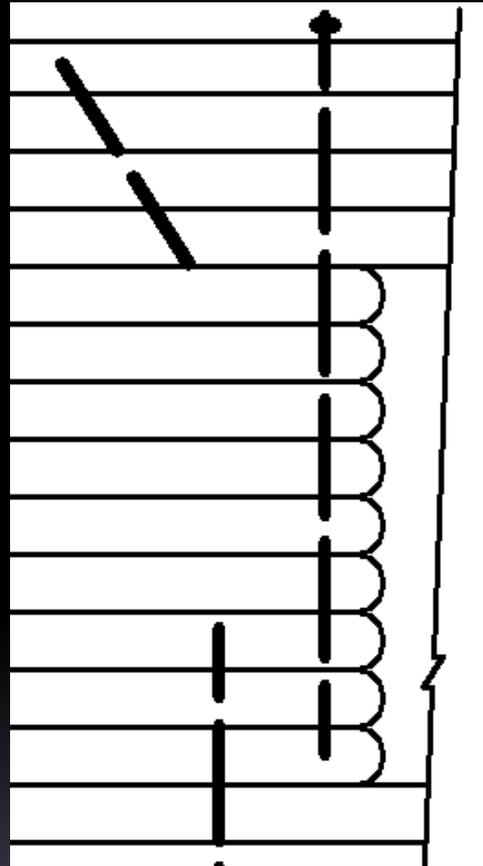
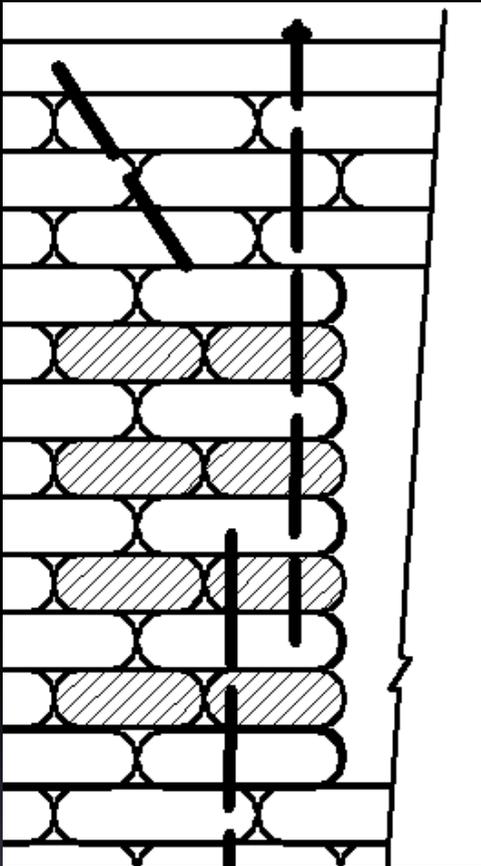
Plan bag lengths carefully



- **Overlap bags 6- 8” (16-20 cm)**
- **Never line ends up**



Choose tubes for strength



- Many bags don't connect to rebar
- Tube walls connect better to rebar
- If damaged, tubes resist twisting better than bags

Thicker walls and more wire for extra strength

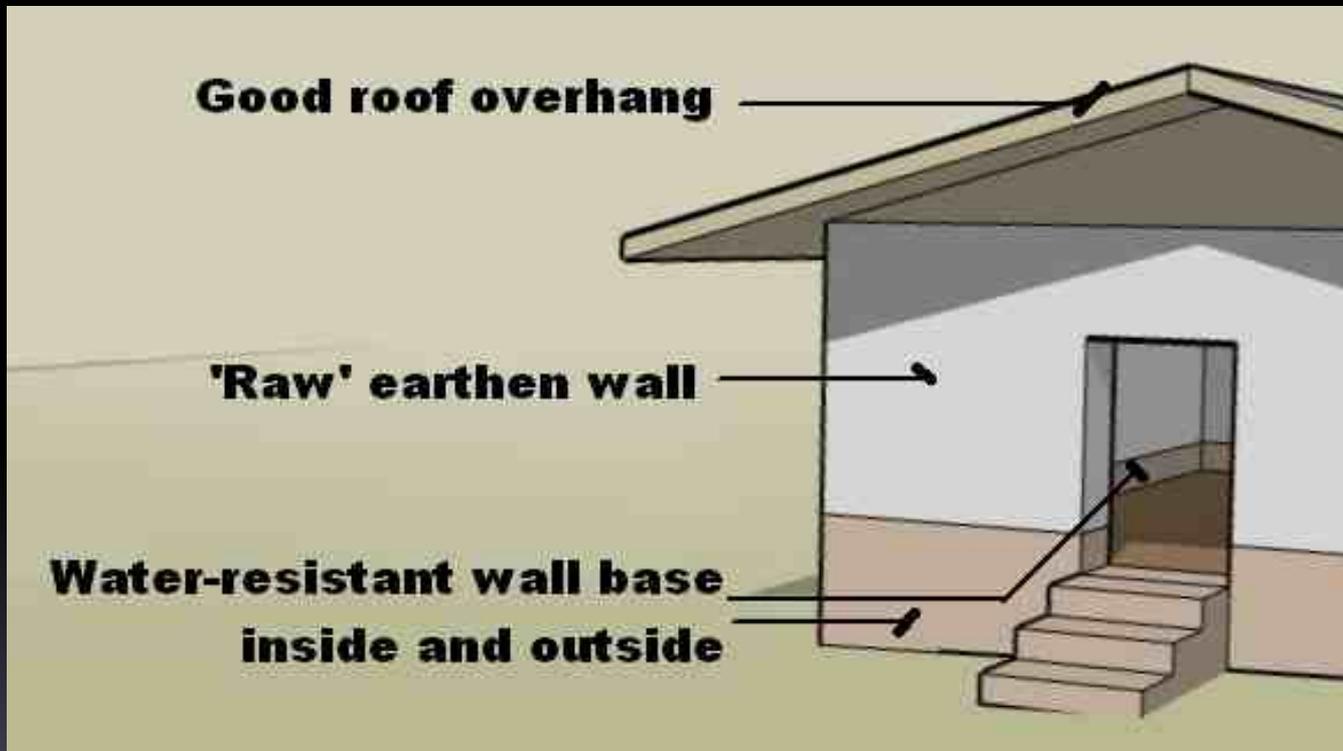


EARTHEN WALLS



Fill
Tamp
Lay wire

Start with water-resistant courses



**Needed
to survive
snow,
rain
splash,
inside
leaks**

Keep pipes under footings



**...away from
earth walls**

Moist soil fill cures strong



Fill bags the same

Use chute to
measure, or
count small
buckets



Fill the whole course the same

- The same person holds the chute for the whole course
- Angle and amount of shaking influence course thickness



Plumb as you tamp



**Roll course by hand
or foot, then
straighten while
tamping**



Keep people away from barbed wire work



OPENINGS AND MORE



Anchors
Bucks
Lintels

Anchor electric boxes



Hammer pins into bags



Metal anchors



Bucks keep bags level and plumb



Tamping warps unsupported wall ends

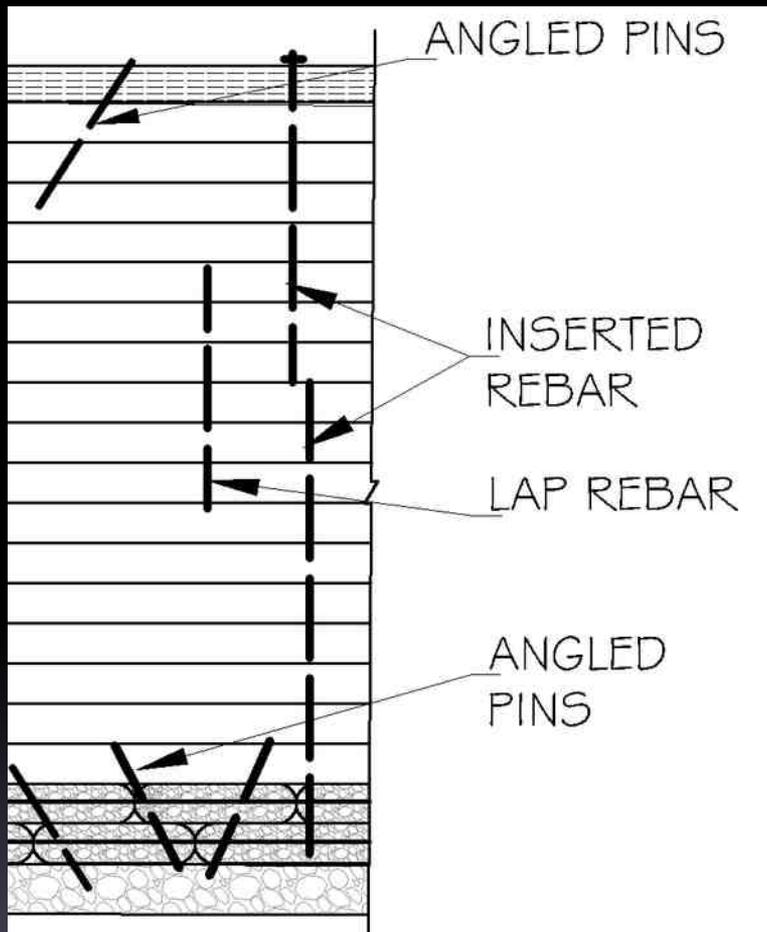


Make bucks strong enough

Resist tamping forces- move the pole up as the walls rise



Space inserted rebar out



- Insert lower rebar at half story height
- 3 courses higher insert lap rebar 15- 18" (380- 460 mm) away
- At top insert upper rebar directly above the lower one

Extend lintels into walls



**16" (40 cm)
minimum
each side**

Arches don't need lintels



**Make arch forms
strong,
thicker than the wall,
smooth outside**

Pipes for vent or access

Add extra just in case



TOP IT OFF



**Rebar Pins
Bond Beam
Plaster
Roof**

Pin reinforced bond beam into walls



- **24” (600 mm) pins every 24” (600 mm)**
- **Insert at alternating angles**

Attach rebar to bond beam



To embed 10" (250 mm) of rebar in a concrete bond beam, bend the top $>90^\circ$ before inserting



For a wood bond beam, weld a bolt on top

Bond beam must be strong



- **10" (250 mm) minimum on a 15" (380 mm) wall**
- **Reinforcing steel continuous at corners**

Rafter ties in bond beam



Plaster walls to save bags



Bags keep earth inside walls if stressed by quakes or vehicle damage.

Plaster within 2 weeks in tropics or within 4 weeks where sun is weaker.

Lime plaster on earth

Wall top must be under an overhang



Stucco is ok on earthen walls

Where it never freezes

Stucco on external surfaces only where it freezes.

Use earth or lime plaster inside to let the walls breathe in a very damp climate.



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This file covers some techniques for building with earthbag in non-hazardous and low risk areas.

Projects built around the world are featured at both the Earthbag Building and Calearth websites. See the other parts of the Earthbag Info series available online to learn more.

Strong buildings of natural materials require care and advice. Before building, purchase a book or video, take a course, and/ or seek advice from experienced builders and architects or engineers.

Before building in areas with seismic risk, check www.BuildSimple.org/resources for the latest structural information and the latest version of documents B100- 103 for best details for resilient CE Earthbag.

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Thanks for hard work and sharing photos:

Slides:

1- Small World School, Nepal

8, 12, 27 (left), - Residence J. Vallejo, Columbia

10, 19(l.), 25, 26(l.),- O. Geiger,

17- J. Turner/ Homegrown Hideaways, US

20- F. Pacheco, Ecooca, Brazil

22(l.), 28, 34- M. Long/ Haiti Christian Dev. Project, Haiti

22 (right), 37- M. Gunn & R. Lewis/ Children of Hope, Haiti

26(r.), 40- K. Hart

27(r.)- Rasin Foundation Clinic, Leogane, Haiti

30(r.)- D. Watson & A. Gerhart, Residence, San Miguel de Allende

30(l.)- Shine on Sierra Leone, Sierra Leone

32, 36- E. Bellamy, University of Cincinnati, US

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