

Openings in Walls I: Reinforcement

INTRODUCTION

These general construction techniques are chosen to introduce low-tech and low-cost construction. Combined with good quality control, they can create buildings 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**

Engineers or expert earthbag builders may be able to make specific recommendations better suited to your site and building. This information is intended for small single story houses built of 38 cm (15") wide walls of 50# bags filled with an earth mix containing some clay.

Earthbag is very strong in compression (carrying loads) but can benefit with additional reinforcing bars in key locations, including the edges of all wall openings.

All earth-filled bags at doorway openings should have the opening end tamped well in addition to the top. Place neater ends of bags facing toward opening to simplify plastering. Locate openings or adjust bag size near opening to allow 30 cm (12") long bags at opening edges minimum.

Use wood, metal, or strawbale opening forms to allow adequate tamping without deforming edges of openings.

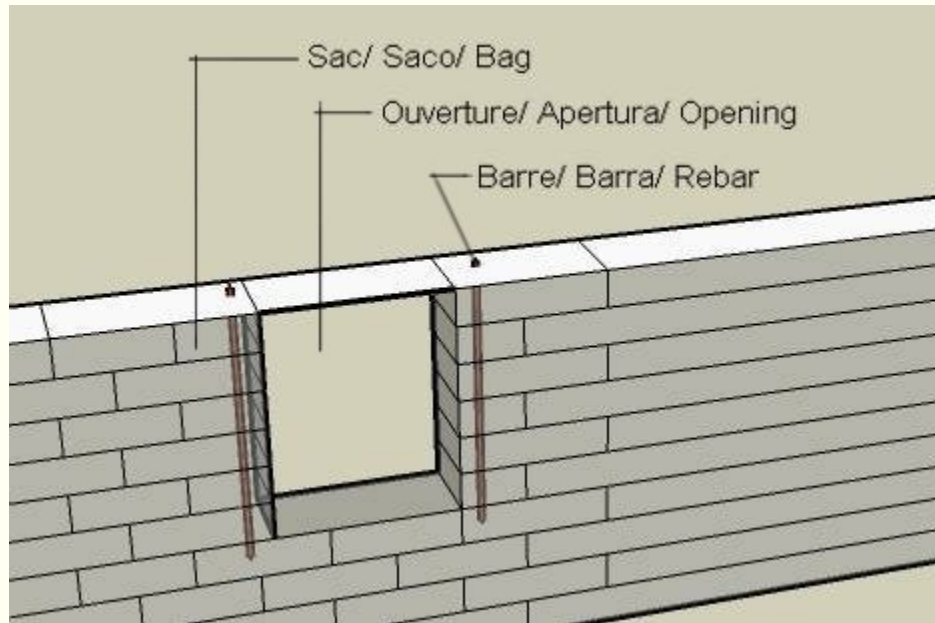
All rebar should be at least #4 (1/2") diameter.

Clay-rich cob building techniques can be used to add trim to building

elements including the edges of openings. Metal or plastic mesh can make earth decorations stronger.

REBAR REINFORCEMENT AT OPENINGS

Materials: Rebar



Sac/ Bag: Face bottoms of bags to openings.

Ouverture/ Opening: Keep edges of bags straight and plumb.

Linteau/ Lintel: Level of the bottom of the future lintel.

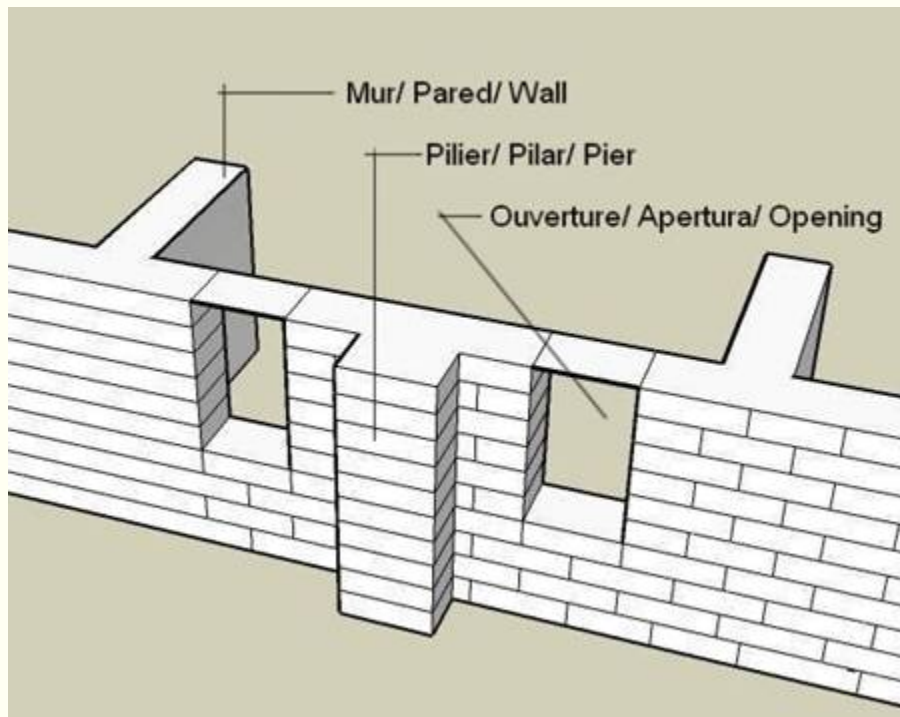
Barre/ Rebar: Drive a rebar 30 cm (12") longer than the height of the window opening through the bag wall. Drive it vertically through the center of the smallest bags along the opening edges.

For a door use 2 rebars 1.2- 1.5 m (4'-5') long overlapped 45- 60 cm (18- 24").

For a poured concrete lintel leave rebar extending 10 cm (4") up into concrete. For a wood or corrugated metal lintel drive rebar through hole in lintel and bend tip over to pin lintel in place.

PIER REINFORCEMENT NEAR OPENINGS

Materials: Extra bags and barbed wire



Mur / Wall: A window or door within 50 cm (19") of an intersecting wall does not need rebar reinforcement.

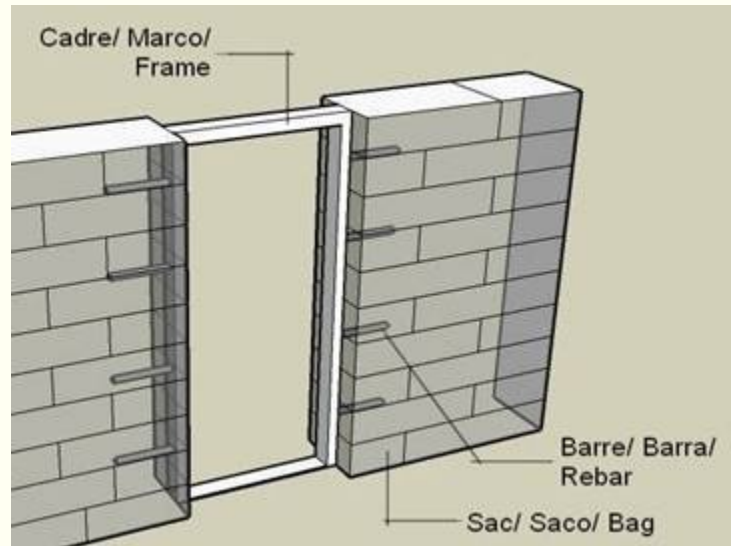
Pilier/ Pier: A window or door within 50 cm (19") of a pier does not need rebar reinforcement.

Ouverture/ Opening: Unreinforced openings must have 1 square meter of wall cross section between them.

In 38 cm (15") thick walls two openings can be located 50 cm (19") each side of a pier that is 50 cm (19") wide and juts out 38 cm (15") from the wall.

Piers, buttresses, or interior walls must have bags overlapped to connect well to walls. Extend barbed wire from walls into piers and buttress.

METAL FRAME REINFORCEMENT



Materials: Metal frame, rebar

Cadre/ Frame: Brace a sturdy frame and build bag walls up to it.

Barre/ Rebar: Weld 4- 30 cm (12") long pieces of rebar to each side of the frame to be located between courses.

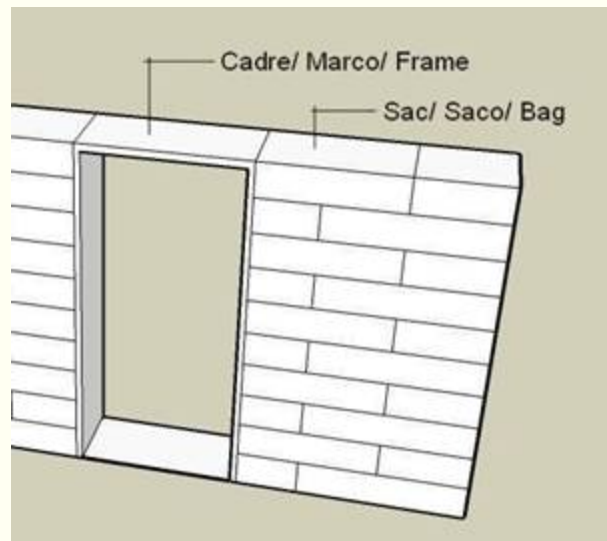
Sac/ Bag: Use horizontal braces or additional temporary framework to keep bag ends from bulging past edge of frame when tamped.

Drive vertical rebar pins through eye bolts to secure, or use long staples or bent nails hammered into bags to secure rebar extensions in center of bags.

WOOD FRAME REINFORCEMENT

Materials: Wood frame, nailer plates

Cadre/ Frame: Build a sturdy wood frame as thick as the bag wall. Add temporary horizontal bracing until tamping is completed. Locate bracing so workers can pass through doorway

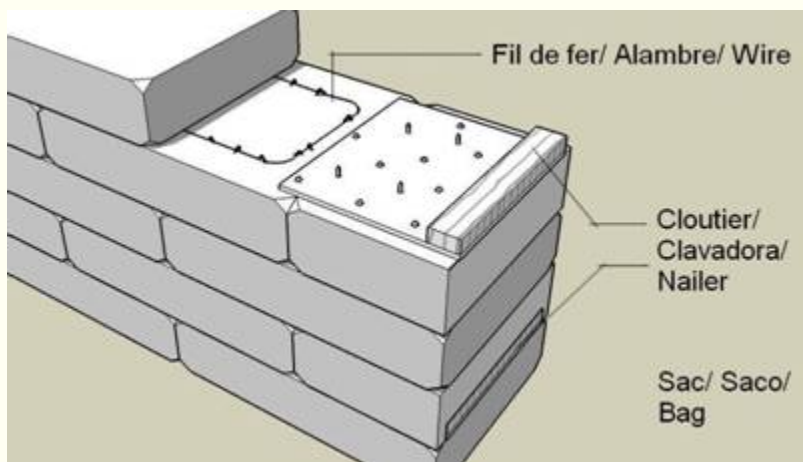


during construction.

Sac/ Bag: Lay bags up to the frame. Embed nailer plates (see below) in bags at edge of opening.

Use 4 nailer plates (see below) or anchor bolts per doorway side, 2 per window side for small windows, or 3 per side for windows taller than 60 cm (24").

NAILER PLATES TO ATTACH FRAMES AND STUD WALLS



Materials: Plywood, Nails, 5x10 cm (2x4 inch)

Sac/ Bag: Keep bags near openings or wall ends tamped firmly.

Fil de fer/ Wire: Continue barbed wire between bag courses to doorway or nailer plate.

Plaque/ Plate: Screw a 30 cm (12") long piece of 5x10 cm wood (2x4 inch) to one side of a 30 cm (12") wide piece of plywood or sturdy metal plate. Size the plywood or metal 10 cm (4") longer than shortest bags at opening.

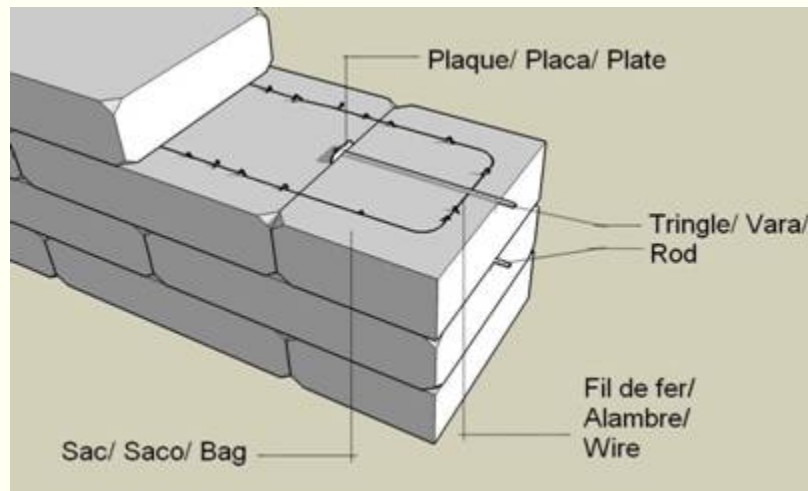
Clou/ Nail: Tack the nailer well to bags below with 7.5 cm (3") long galvanized nails. Leave some nails sticking up at least 2.5 cm (1") above the nailer plate.

Cloutier/ Nailer: Place nailers with 5x10 (2x4) lumber edge exposed.

Screw door or wall frames to 5x10 (2x4) end of nailer plate.

Nailer plates will be covered by rough and finish coats of plaster.

ANCHOR BOLTS TO ATTACH FRAMES AND STUD WALLS



Materials: Galvanized or painted metal plates, threaded rods

Metal connectors will not be subject to damage by insects or fungus in hot or humid climates.

Plaque/ Plate: Place a galvanized or painted metal strap or a plate 6" long with 2 holes between the 2 bags nearest to the opening.

Tringle/ Rod: Insert a galvanized or painted bolt or threaded rod through each end of the metal plate. Use a washer and nut to fasten rods to door, window, or wall frame.

Fil de fer/ Wire: Lay barbed wire every course to the end of the bag row.

Sac/ Bag: Set small end bags between rods.

Note: Locate opening so small end bags will not be smaller than 30 cm (12").

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