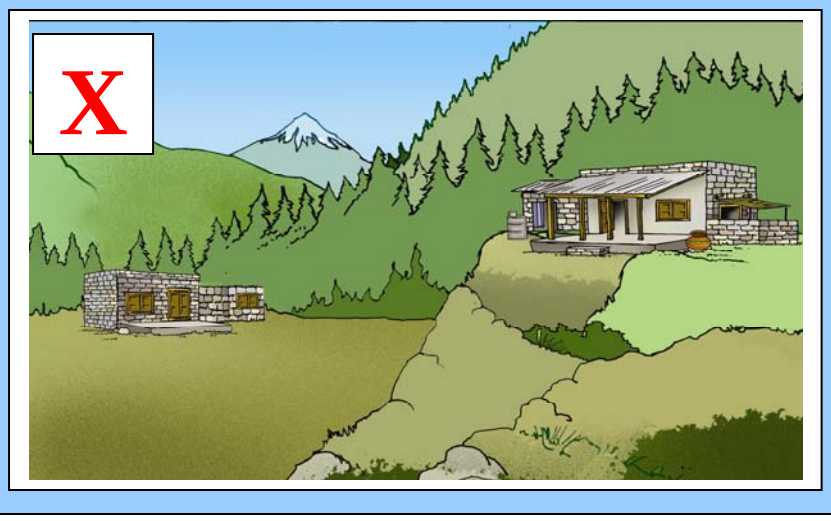
You can make your **NEW HOUSE** safe against **EARTHQUAKE!**

FOLLOW 10 RECOMMENDATIONS

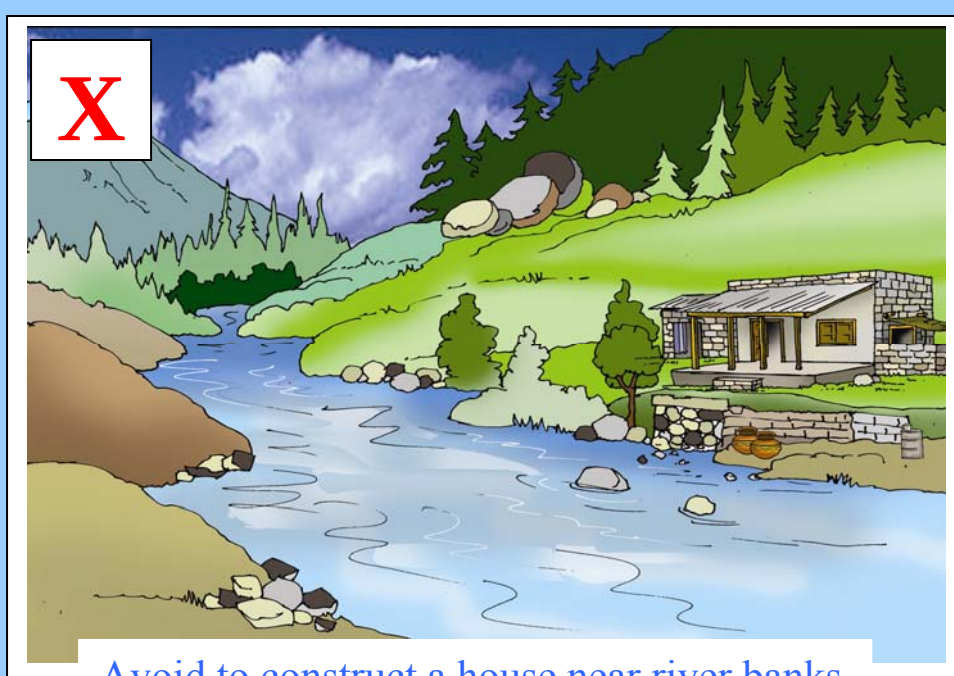
For Single Storey Masonry Houses in Cement Sand Mortar

1. Site Selection



Steep and unstable slopes

→



Avoid to construct a house near river banks

Rock Fall Area

- Avoid steep & unstable slopes;
- Avoid areas susceptible to landslides and rockfall;
- Avoid construction on loosely filled grounds;
- Place house away from the river banks;
- Avoid construction too close to visible, permanent, deep and active faults;
- Distance between house and tree or with adjoining house should preferably be at least equal to the height of the tree or house.
- Avoid construction abutting mountain-side retaining walls; ensure space between retaining wall and house is equal to height of the wall.

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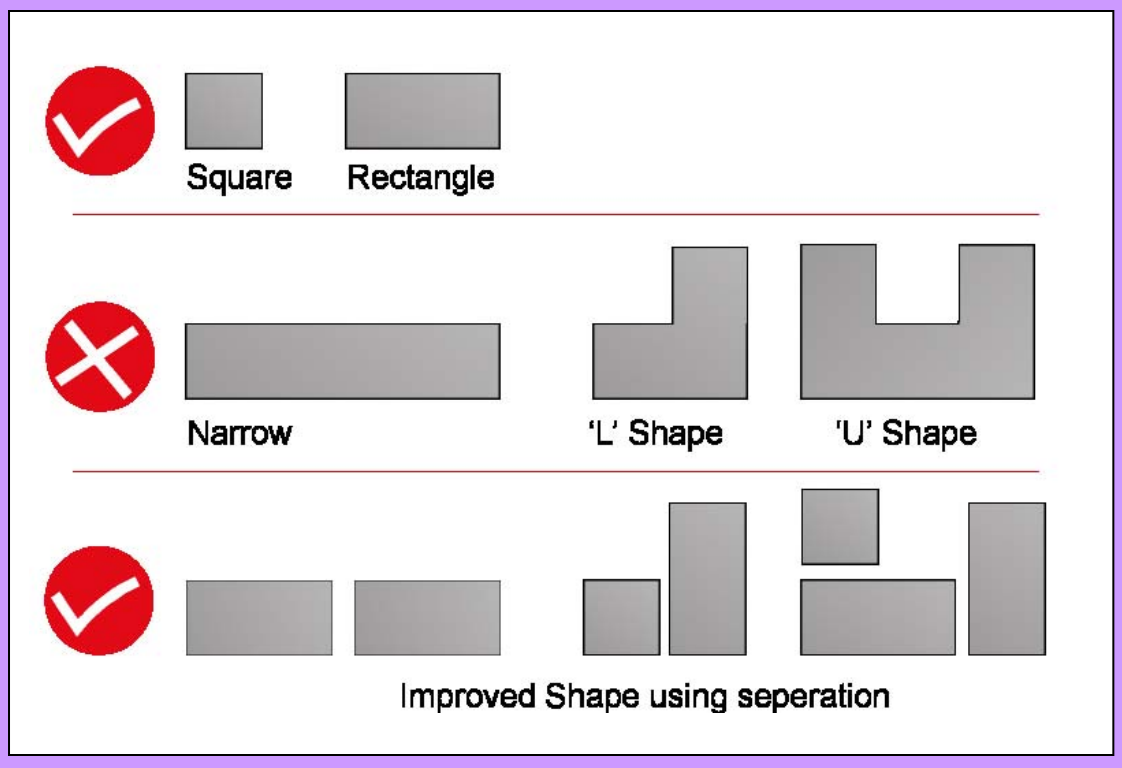
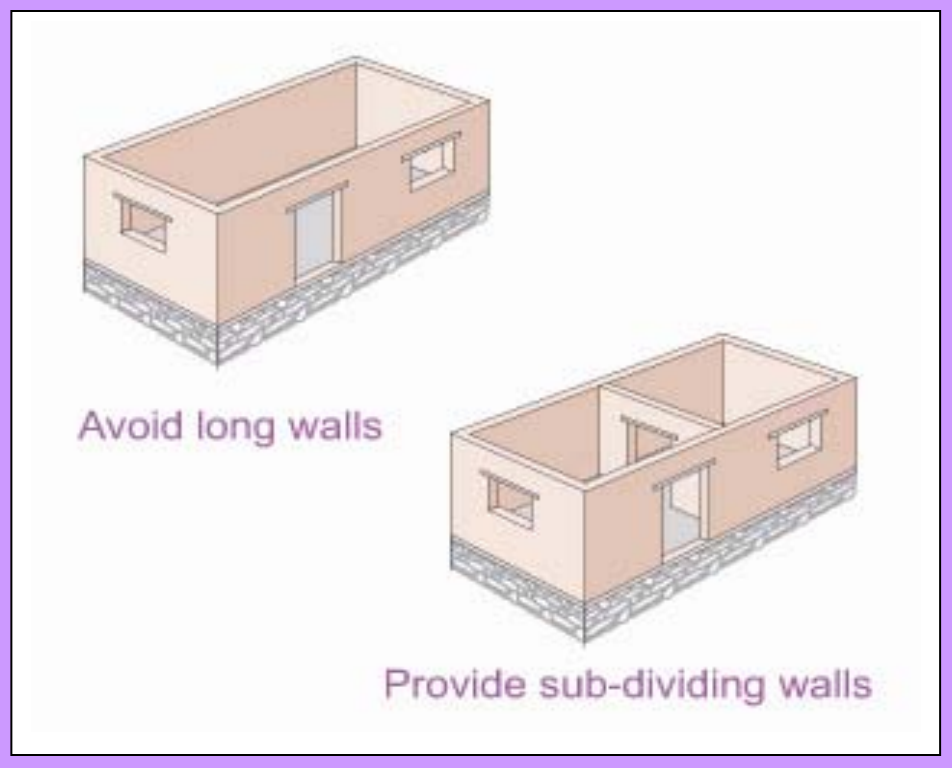
FOLLOW 10 RECOMMENDATIONS

For Single Storey Masonry Houses in Cement Sand Mortar

2. Shape of House





- Construct regular shaped houses like square, rectangular or circular;
- Subdivide complex shaped buildings by providing gaps at appropriate locations. The gap should be minimum 1 inch for one storied house;
- Avoid long and narrow structures. Length of a house should not be more than 3 times its width;
- Construct compact box type layout with all building components such as floor, walls and roof tied-up with each other ;
- Maximum room size should be limited to 15ft x 15ft.

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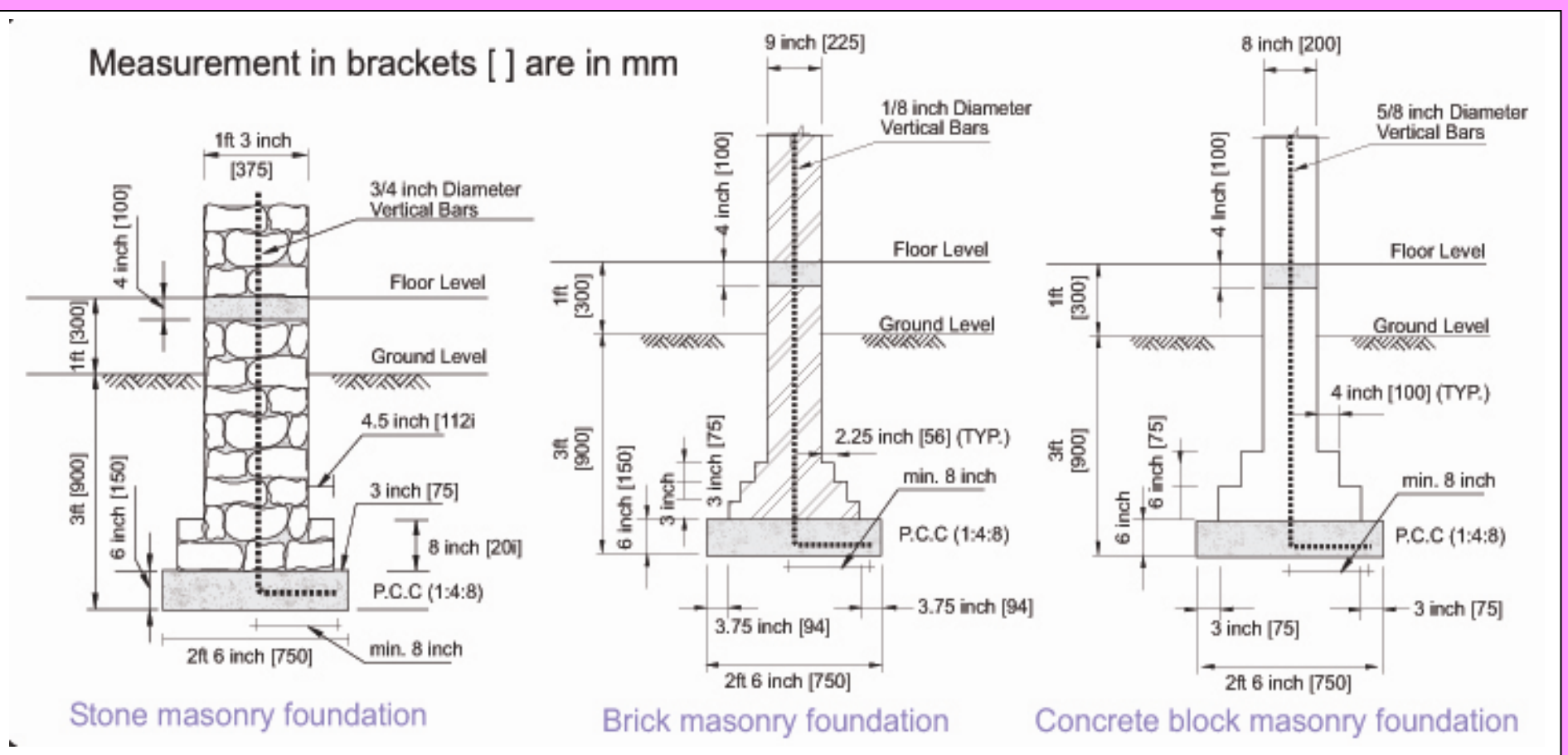
FOLLOW 10 RECOMMENDATIONS

For Single Storey Masonry Houses in Cement Sand Mortar

3. Foundation



- Use continuous strip footing;
- In case of soft soil, the depth of foundation below existing ground level should be at least 3 ft. For rocky areas minimum depth should be 1.5 ft.;
- Minimum width of footing should be 2.5 ft.;
- Make the excavated surface level before laying the foundation;
- In case of loose soil, provide some nominal reinforcement in foundation bed concrete;
- If stone soling is used under foundation, reduce the thickness of foundation strip to 3inch;
- Foundation Details: Foundation for various masonry options should be as shown in the figure.

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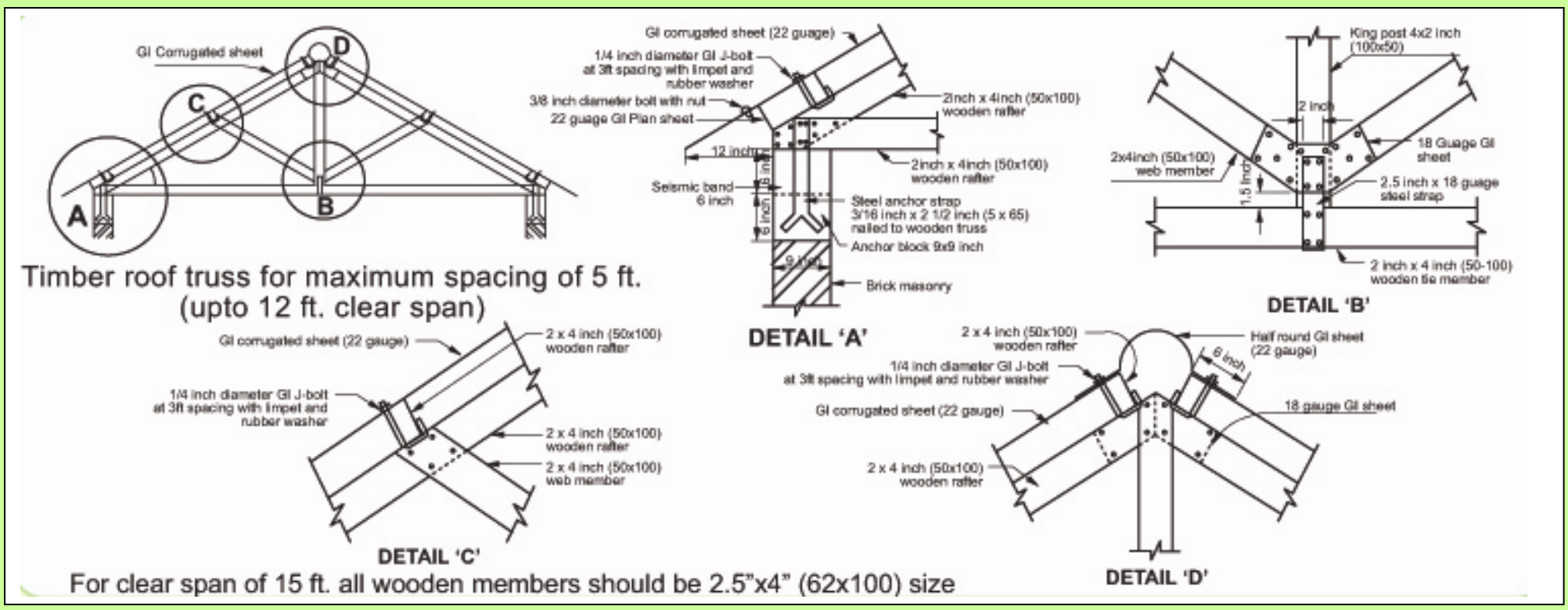
FOLLOW 10 RECOMMENDATIONS

For Single Storey Masonry Houses in Cement Sand Mortar

9. Roofs



- Use light roof comprising wooden or steel truss covered with CGI sheets;
- All members of the timber truss or joists should be properly connected as shown in figure;
- Trusses should be properly cross-tied with wooden braces as shown in figure;
- Well seasoned hard wood without knots should be used for roofing. Timber treatment, such as use of coal tar or any other preservative can prevent timber from being decayed and attacked by insects.

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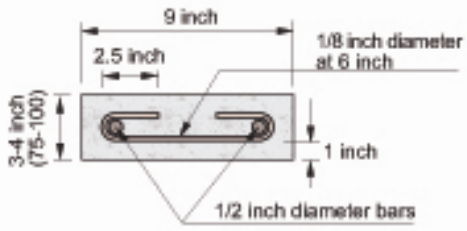
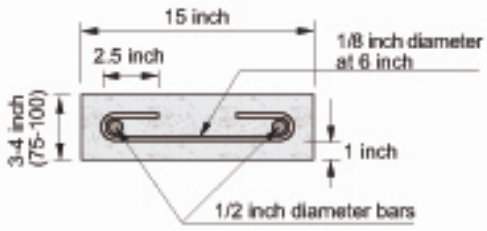
FOLLOW 10 RECOMMENDATIONS

For Single Storey Masonry Houses in Cement Sand Mortar

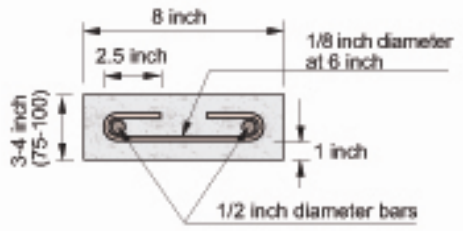
8. Horizontal Bands & Corner Strengthening



Brick masonry wall

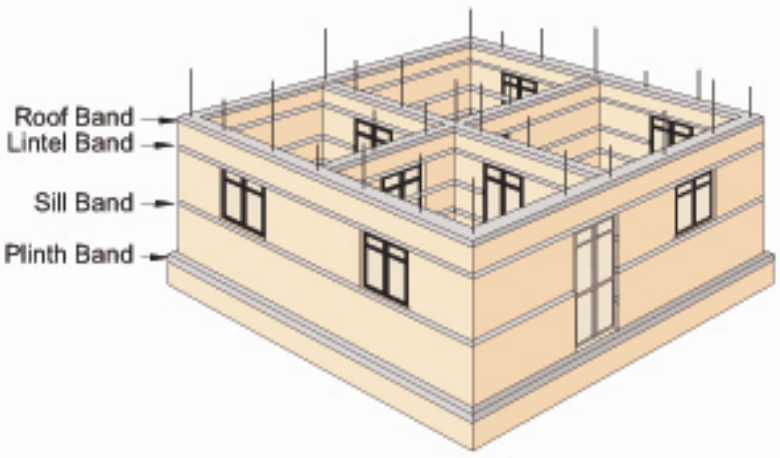


Stone masonry wall

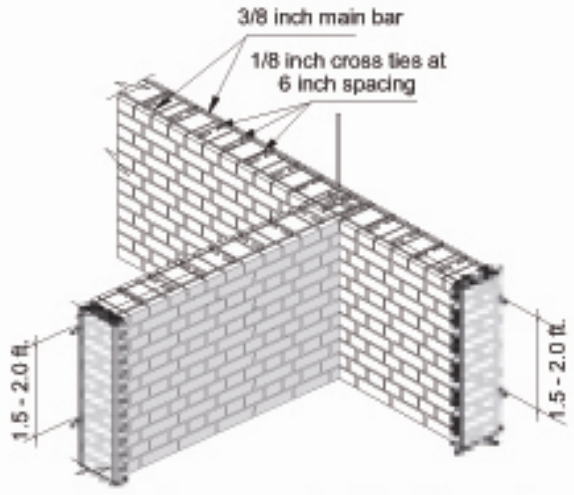


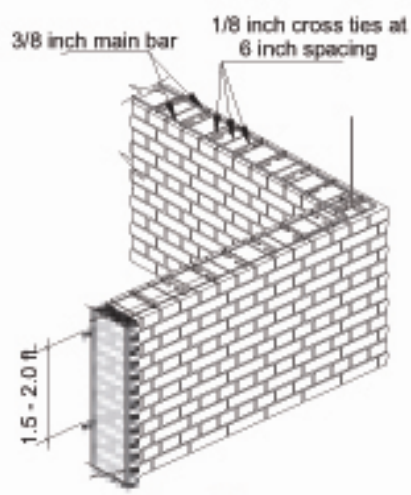
Concrete block masonry wall

Details of RCC bands at Plinth/Sill/Lintel/Roof level



Horizontal bands at different levels of wall





Reinforcement detailing at corners and junctions

3 to 4 inch thick horizontal RCC bands with 2 Nos. ½ inch (4 sutar) diameter main bars should be provided throughout the entire wall length at following locations. Properly anchor main bars at each end with standard hooks. Overlap horizontal bars at splice per Table 1 in POINT 10.

- Plinth Band at Plinth Level (DPC Level);
- Lintel Band above Doors & Windows; In case of window size more than 3 ft., provide min. 6 inches lintel above the window;
- Roof Band at Wall top;
- Sill Band – below window level (Sill level);
- In addition to the horizontal RCC bands indicated above, provide horizontal steel comprising 2 Nos. 3/8 inch (3 sutar) diameter bars with 1/8 inch ties at 6 inches apart (or expanded metal mesh), set in a 1:3 cement-sand mortar bed, at a vertical spacing not to exceed 24 inches.

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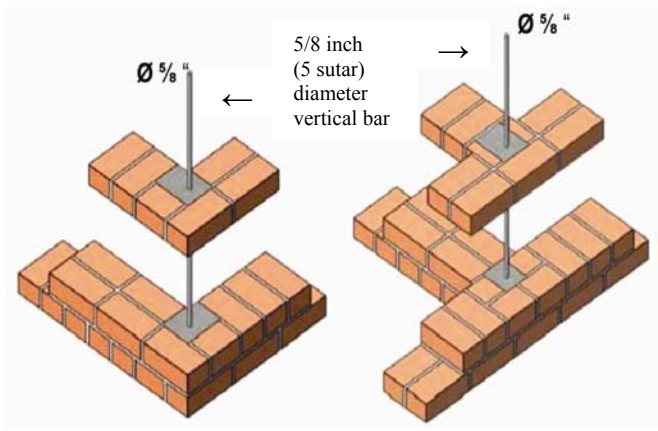
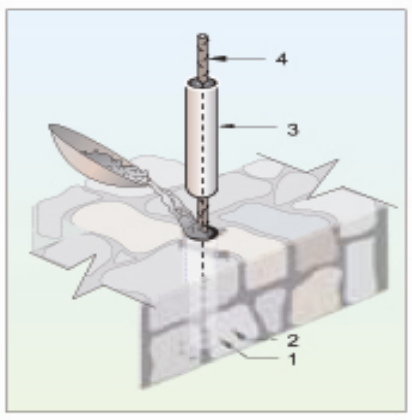
FOLLOW 10 RECOMMENDATIONS

For Single Storey Masonry Houses in Cement Sand Mortar

7. Vertical Reinforcement in Walls

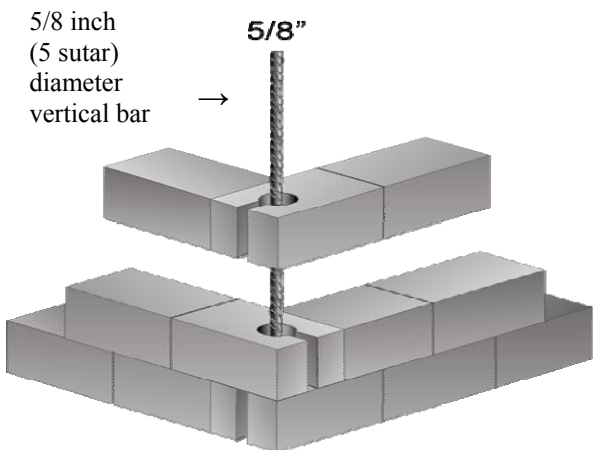


Reinforcement in brick masonry wall

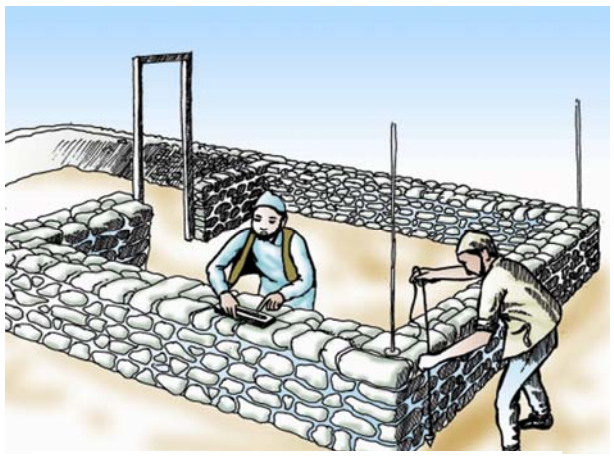


Use of pipe sleeve to create uniform void for reinforcement as per following steps:

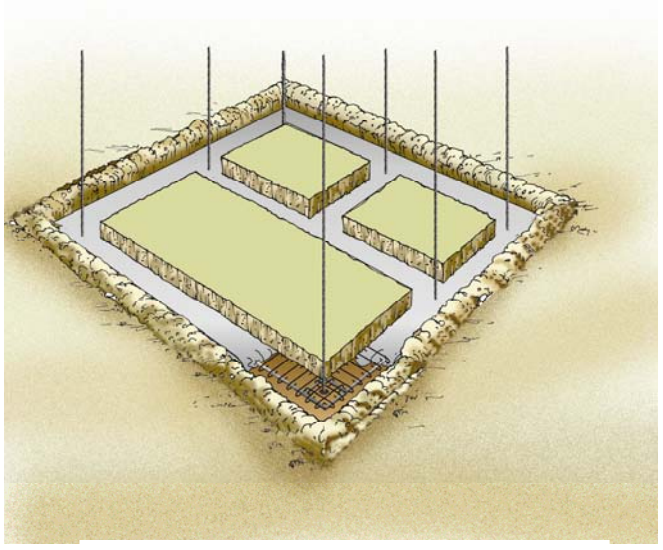
1. *Place pipe sleeve around reinforcement*
2. *Build masonry around the pipe sleeve*
3. *Lift the pipe sleeve leaving hollow in masonry and fill the void with concrete or mortar.*
4. *3/4 inch (6 sutar) diameter vertical bar*



Reinforcement in concrete block masonry wall



Reinforcement in stone masonry wall



Vertical Reinforcement starting from foundation band

- Place vertical steel bars in foundations and walls, at all corners and junctions of walls and adjacent to all doors and windows. The maximum spacing between two adjacent vertical bars should not be more than 4 ft.;
- Anchor all vertical steel bars in the foundation and roof band with standard hooks as shown in POINT 10;
- Use 5/8 inch diameter (5 sutar) steel bars in case of brick and concrete block masonry. Provide ¾ inch diameter (6 sutar) steel bars for coursed stone masonry;
- Fill the pocket around steel bars with 1:2:4 concrete for brick and concrete block masonry. Cement sand mortar 1:3 may also be used for concrete block masonry;
- For stone masonry place 2 inches diameter PVC pipe around the steel bars, and build masonry around it. Extract the pipe and fill the hole with 1:3 Cement sand mortar or 1:2:4 concrete.
- Overlap vertical bars at splice per Table 1 in POINT 10.

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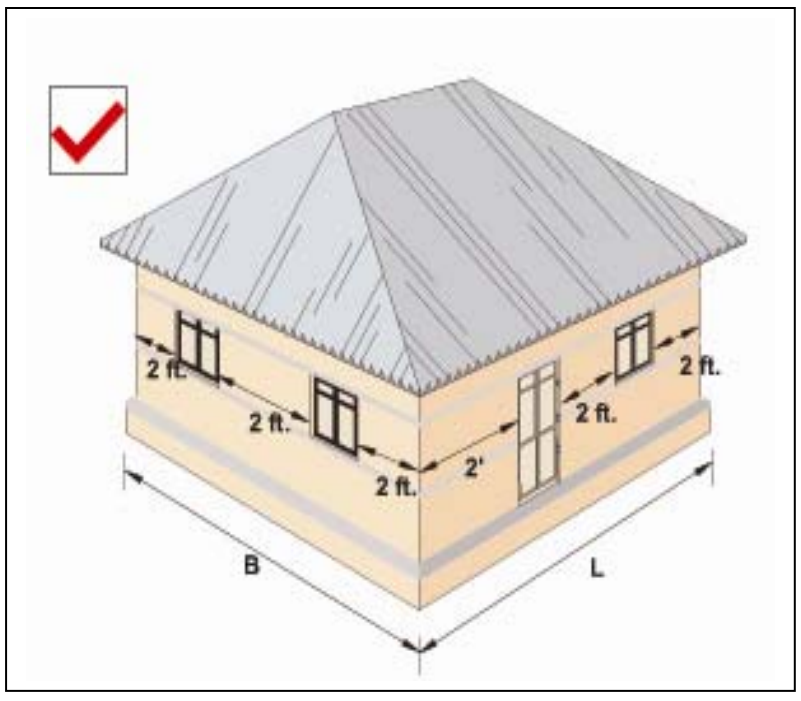
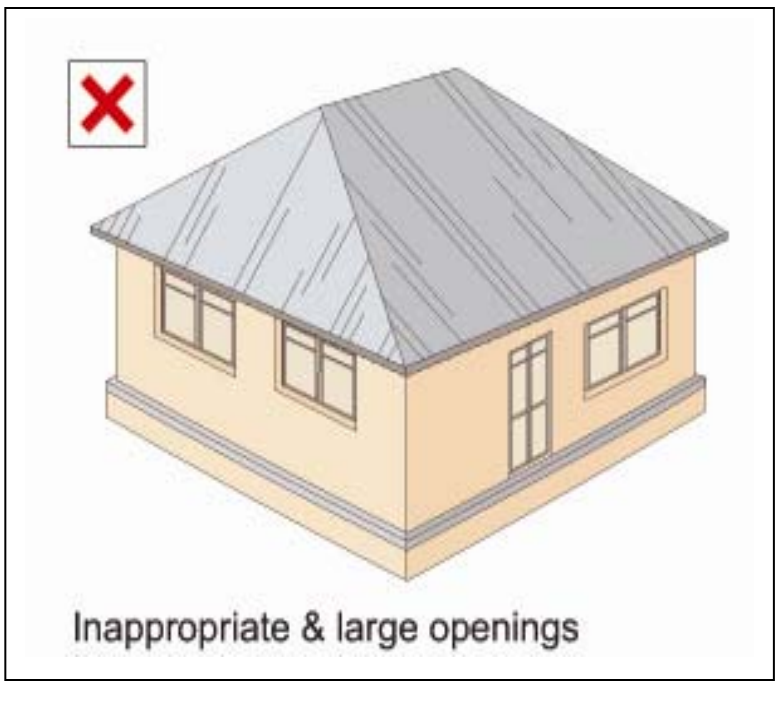
FOLLOW 10 RECOMMENDATIONS

For Single Storey Masonry Houses in Cement Sand Mortar

6. Doors & Windows





Inappropriate & large openings

- Location of Doors & Windows: Doors and windows should be placed at least 2 ft. away from the wall corner;
- The total length of doors and windows in a wall should not be more than 50% for single storey construction;
- Gap between two openings: Wall length between any two openings (doors and/or windows) should not be less than 2 ft.;
- Keep lintel level same for doors and windows.

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FOLLOW 10 RECOMMENDATIONS

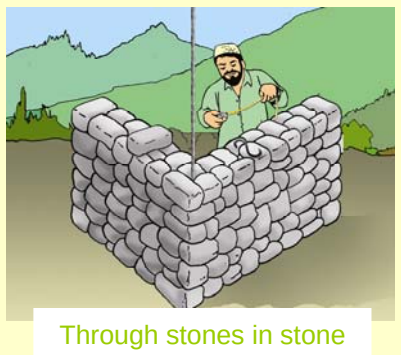
For Single Storey Masonry Houses in Cement Sand Mortar

5. Walls

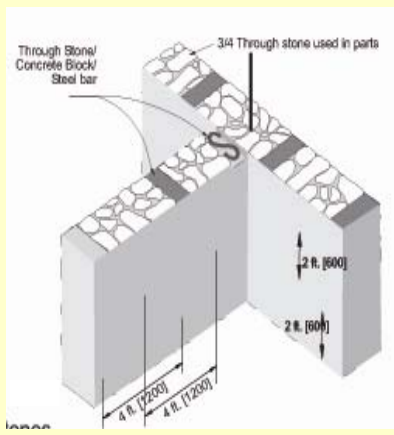
- Masonry should be laid staggered so that the vertical joints don't form a continuous line.
- At corners or wall junctions, through vertical joints should be avoided by properly laying the masonry. Never make vertical "teeth".

Stone Wall

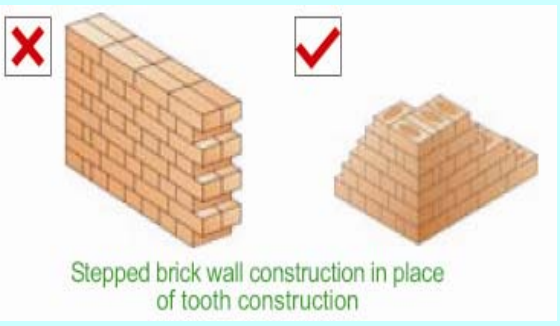
- Wall Thickness: 15 inches
- Boulder stone should not be used in its natural shape. Boulders should be dressed or semi-dressed before they are laid.
- The inner and outer whythes of the wall should be interlocked with through stones. No large space between two whythes should be left for filling with pebbles or mortar.
- Through Stone: Through stone of full length equal to wall thickness should be used in every 2 ft. lift at not more than 4 ft. apart horizontally, placed in staggered position. A through stone could be a stone, concrete block or an S-shaped steel bar of min. ¼ inch diameter (2 sutar) well packed with mortar.



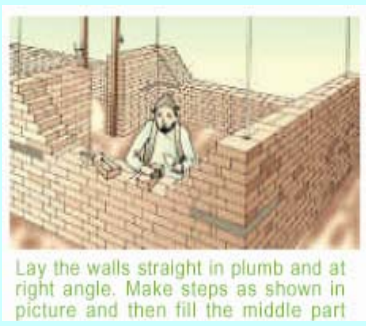
Through stones in stone masonry wall



Dressed or semi dressed stones should be used, instead of rubbles and rounded stones.



Stepped brick wall construction in place of tooth construction



Lay the walls straight in plumb and at right angle. Make steps as shown in picture and then fill the middle part

Brick Wall

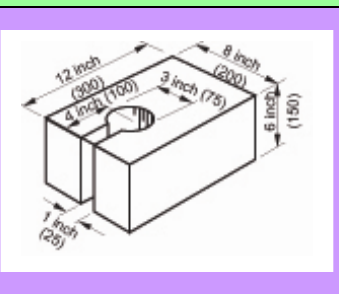
- Wall Thickness: 9 inches
- Stepped Construction: Stepped wall construction is better than toothed, when there is a need for future extension or continuation of work.

Use well burnt, regular sized bricks. Over/under burnt and deformed bricks shall not be used.

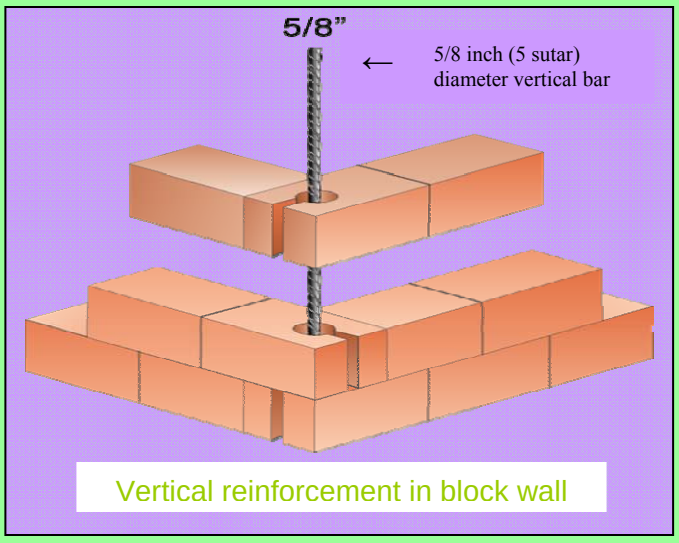
Concrete Block Wall

- Wall Thickness: 8 inches
- Solid blocks are preferable as compared to hollow blocks.
- Special corner blocks with side hole are required for placing vertical reinforcement.

Concrete block wall



Special corner block for placing vertical reinforcement



Vertical reinforcement in block wall

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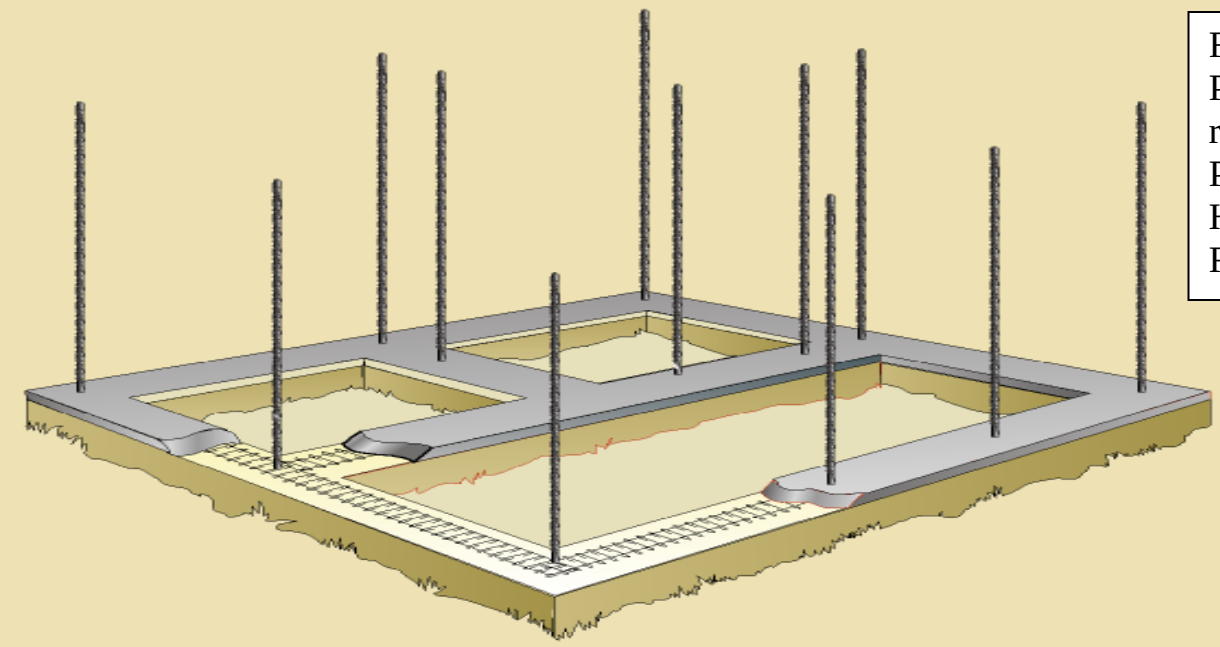
FOLLOW 10 RECOMMENDATIONS

For Single Storey Masonry Houses in Cement Sand Mortar

4. Plinth



For detail of Plinth Band refer to POINT 8 – Horizontal RCC Bands.

Plinth band and vertical reinforcement

- Plinth should be at least 1 ft. above the ground level;
- Provide a reinforced concrete band at plinth level, as shown in figure;
- Minimum thickness of plinth band should be 3 to 4 inch and width should be equal to wall thickness. Main reinforcement should be 2 Nos. ½ inch diameter (4 sutar) bars. Anchor main reinforcement at each end with standard hook. Use 1/8 inch diameter (1 sutar) rings at 6 inch. Hook length should be 2.5 inch. Bars should have a clear cover of 1 inch.

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FOLLOW 10 RECOMMENDATIONS

For Single Storey Masonry Houses in Cement Sand Mortar

10. Materials

Cement =1 part

Sand = 2 part

Aggregate = 4 part

Mix proportion for concrete

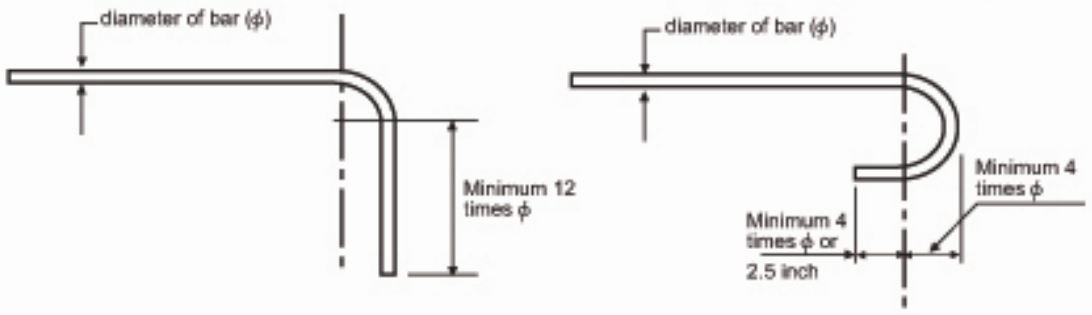
Cement = 1 part

Sand = 4 part

Mix proportion for mortar

Table 1

Bar dia.	3/8 inch (3 sutar)	1/2 inch (4 sutar)	5/8 inch (5 sutar)	3/4 inch (6 sutar)
Lap length	1.5 ft.	2 ft.	2.5 ft.	3 ft.



Standard hooks for 90 degree and 180 degree bend

Mortar: Cement sand mortar should not be leaner than 1:4 (1 part cement and 4 parts sand) for masonry and 1:6 for plaster.

Concrete: The concrete mix for seismic bands should not be leaner than 1: 2:4 (1 part cement, 2 parts sand and 4 parts aggregate). Water for mixing should be limited to 60% of the weight of cement for hand mixing i.e. 30 liters of water for making concrete with 1 bag of cement. Concrete should be cured with water for at least 14 days after casting.

Reinforcement: Reinforcing Steel should conform to Grade 40, having minimum yield strength of 40,000 psi. Plain steel shall not be used except for ties. Whenever two bars need to be lapped, minimum lap length as shown in Table 1 should be provided. Wherever required use standard hooks as shown in the figure.