

FEW RECOMMENDATIONS

For Single Storey Masonry Houses in Cement Sand Mortar

1



Steep and unstable slopes

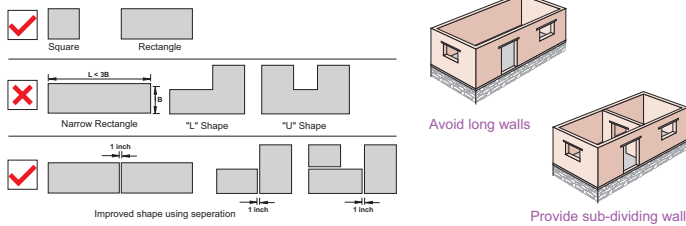
Rock fall area

Avoid to construct a house near river banks

Site Selection

- 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 be preferably at least equal to the height of tree or house, whichever is larger.

2



Avoid long walls

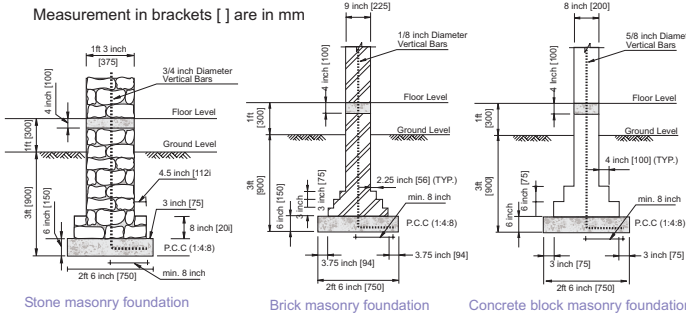
Provide sub-dividing walls

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.

3

Measurement in brackets [] are in mm



Stone masonry foundation

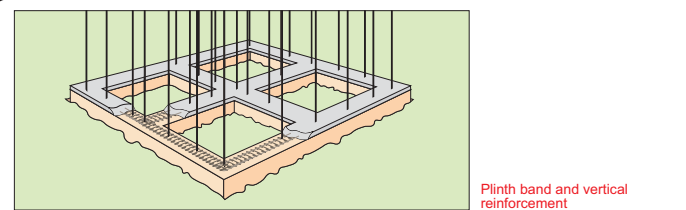
Brick masonry foundation

Concrete block masonry foundation

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 3 Inch;
- Foundation Details: Foundation for various masonry options should be as shown in figure.

4



Plinth band and vertical reinforcement

Plinth

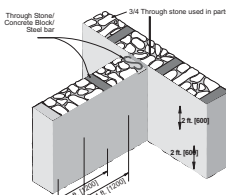
- Plinth should be at least 1ft. above the ground level
- Provide a reinforced concrete band at plinth level, as shown in figure.
- Minimum thickness of plinth band should be 3 to 4 inch and width should be equal to wall thickness. Main reinforcement should be 2 Nos. 1/2 inch diameter (4 sutar) bars. 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.

5



Through stones in stone masonry wall

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



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

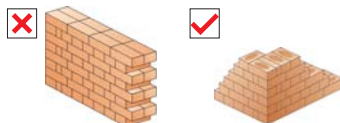
- Wall Thickness: 15 inches
- Boulder stone should not be used in its natural shape. Boulders should be dressed or semi-dressed before they are laid.
- The inner and outer wythes of the wall should be interlocked with through stones. No large space between two wythes should be left for filling with pebbles 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 4ft. apart horizontally, placed in staggered position. A through stone could be a stone, concrete block or an S-shaped steel bar of min. 1/4 inch diameter (2 sutar) well packed with mortar.

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.

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.

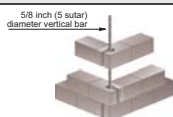


Stepped brick wall construction in place of tooth construction

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



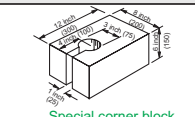
Lay the walls straight in plumb and at right angle. Make steps as shown in picture and then fill the middle part



Vertical reinforcement in block wall

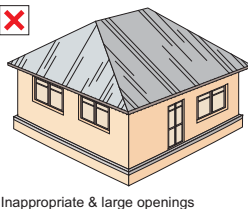
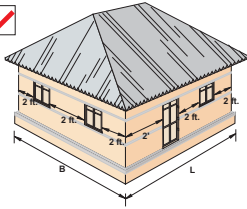


Concrete block wall



Special corner block for placing vertical reinforcement

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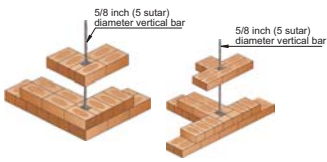


Inappropriate & large openings

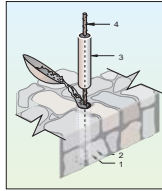
Doors & Windows

- 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.

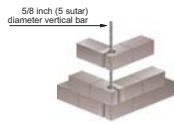
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Reinforcement in brick masonry wall



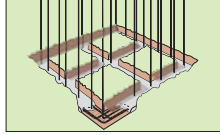
Use of pipe sleeve to create uniform void for reinforcement as per following steps:
 1. Place pipe sleeve around reinforcement
 2. Build masonry around the pipe sleeve
 3. Lift the pipe sleeve leaving hollow in masonry and fill the void with concrete or mortar.
 4. 3/4 inch (6 sutar) diameter vertical bar



Reinforcement in concrete block masonry wall



Reinforcement in stone masonry wall

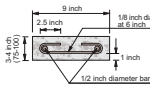


Vertical reinforcement starting from foundation band

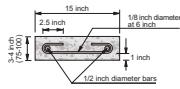
Vertical Reinforcement in Walls

- Place vertical steel bars in the walls, at all corners and junctions of walls and adjacent to all doors and windows. The spacing between two adjacent vertical bars should not be less than 4 ft.;
- Anchor all vertical steel bars in the foundation and roof band;
- Use 5/8 inch diameter (5 sutar) steel bars in case of brick and concrete block masonry. Provide 3/4 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.

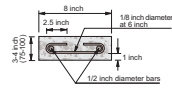
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Brick masonry wall

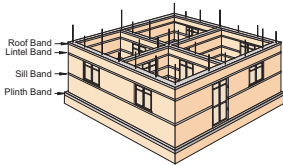


Stone masonry wall

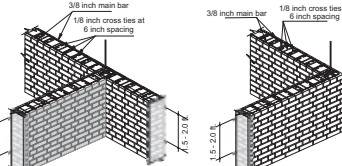


Concrete block masonry wall

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



Horizontal bands at different levels of wall



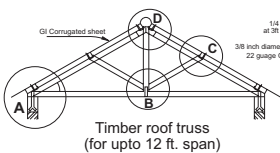
Reinforcement detailing at corners and junctions

Horizontal Bands

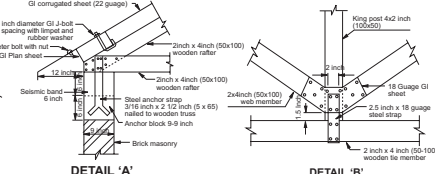
Horizontal bands should be provided throughout the entire wall with minimum thickness of 3 to 4 inches at following locations:

- Plinth Band at Plinth Level (DPC Level);
- Lintel Band above Doors & Windows;
- Roof Band at Wall top;
- Sill Band - below window level (Sill level) - Optional;
- In case of window size more than 3ft, provide min. 6 inches lintel above the window;
- 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 at vertical spacing of 18 inch to 24 inch in addition to the horizontal bands at plinth, sill, lintel and roof; throughout the length of the wall.

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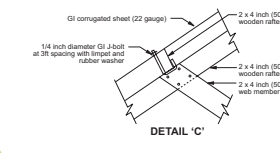


Timber roof truss (for upto 12 ft. span)



DETAIL 'A'

DETAIL 'B'



DETAIL 'C'

DETAIL 'D'

Roof

- 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.

10

Mix proportion for concrete
 Cement = 1 part, Sand = 2 part, Aggregate = 4 part

Mix proportion for mortar
 Cement = 1 part, Sand = 4 part

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.

Materials

- 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)
- Reinforcement:** Reinforcing steel should conform to Grade 40, having minimum yield strength of 40,000 psi. Plain steel should not be used except for ties. Whenever two bars need to be lapped, minimum lap length as shown in Table 1 should be provided.

This publication has been prepared for assisting in rural reconstruction of earthquake affected areas and is believed to be helpful in assuring the enhanced earthquake safety of rural houses. This will provide easy and ready to use solutions for common rural houses. This construction checklist is for single storey rural housing units, the provisions mentioned here are only for such houses. If the house is other than this, standard provisions for those specific types should be followed. For further details related to the provisions mentioned in this checklist, detail guidelines can be followed.

