

6

## 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 shall 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.



Inappropriate & Large Openings

7

## Vertical Reinforcement in Walls

- Place vertical steel bars in the wall at all corners, junctions of walls and adjacent to all doors and windows. The spacing between two adjacent vertical bars should not be less than 4 ft, therefore, if the spacing between any two bars is more than 4 ft, put another bar in between.
- Anchor all vertical steel bars in the foundation and roof band;
- Use 5/8 inch diameter (5 sutar) or min. 1/2 inch diameter (4 sutar) steel bars in case of brick and concrete block masonry. Provide 3/4 inch diameter (6 sutar) or min. 5/8 inch diameter (5 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.



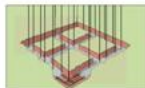
Reinforcement in brick masonry wall



Reinforcement in concrete block masonry wall



Reinforcement in stone masonry wall



Vertical Reinforcement starting from foundation band

8

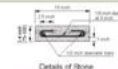
## Horizontal Bands

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

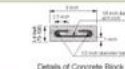
- Plinth Band at Plinth Level (DPC Level);
- Lintel Band above Doors & Windows;
- Roof Band at Wall top;
- Sill Band - below window level (Sill level) - Optional;
- In case of window size more than 3ft, provide min. 6 inches lintel above the window;
- Provide horizontal steel comprising 2 Nos. 3/8 inch (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.



Details of Brick Masonry Wall Bands



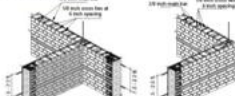
Details of RCC bands at Plinth/Sill/Lintel/Roof level



Details of Concrete Block Masonry Wall Bands



Horizontal bands at different levels of wall

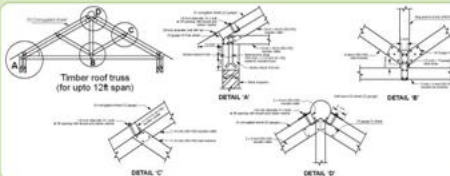


Reinforcement detailing at corners and junctions

9

## 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.



Timber roof truss (for upto 12ft span)

Reinforcement detailing at corners and junctions

Reinforcement detailing at corners and junctions

Reinforcement detailing at corners and junctions

Reinforcement detailing at corners and junctions

Reinforcement detailing at corners and junctions

Reinforcement detailing at corners and junctions

Reinforcement detailing at corners and junctions

Reinforcement detailing at corners and junctions

Reinforcement detailing at corners and junctions

Reinforcement detailing at corners and junctions

Reinforcement detailing at corners and junctions

Reinforcement detailing at corners and junctions

Reinforcement detailing at corners and junctions

Reinforcement detailing at corners and junctions

Reinforcement detailing at corners and junctions

Reinforcement detailing at corners and junctions

Reinforcement detailing at corners and junctions

Reinforcement detailing at corners and junctions

Reinforcement detailing at corners and junctions

Reinforcement detailing at corners and junctions

Reinforcement detailing at corners and junctions

Reinforcement detailing at corners and junctions

Reinforcement detailing at corners and junctions

Reinforcement detailing at corners and junctions

10

## 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 shall 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, following minimum lap length should be provided; (see Table 1)

Concrete 1 (part)	Sand 2 (part)	Aggregate 4 (part)
Mix proportion for concrete		
Concrete 1 (part)	Sand 4 (part)	
Mix proportion for mortar		

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

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.