

CSEB construction manual

Build Up Nepal
2017



Site Selection
Avoid any of these areas



**Slopes steeper than
20 degrees**



**Geological fault or area
susceptible to landslides**



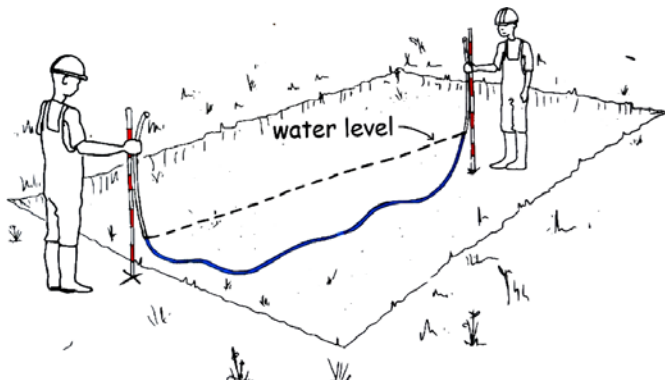
**River bank or
water-logged area**



Filled area

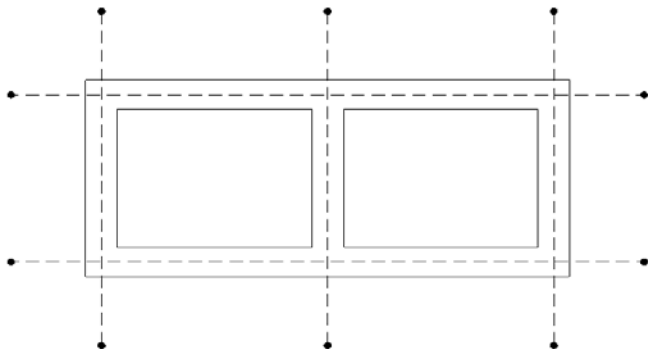
Tools required

1. Measuring tape
2. Straight edge
3. Spirit level pipe
4. Plumb line
5. String
6. Nail
7. Trowel (karni)
8. GI pipe to bend rebar
9. Hammer
10. Chisel
11. Club hammer
12. Bucket
13. Mixing box
14. Transparent water hose 10-20m
15. Pickaxe
16. Shovels
17. Rammer (dhurmus)
18. Grinder
19. Wheelbarrow
20. Hacksaw
21. Saw
22. Die (10mm-12mm) for bending rebar



1. Check if the ground is level using a water filled pipe.

This method can be used at any time when checking if level is the same in foundations, walls, beams etc.



2. Mark the foundation

Mark out all corners with strings attached to poles or rebar approx 1 meter outside the wall corners. Stick the poles deep in the ground so that the marks can be used later

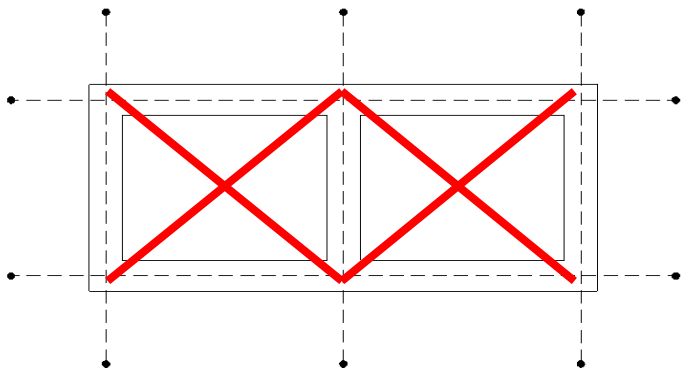
The poles must not be disturbed until the wall works starts.



Tip: use the plumb line to find the exact place, if the plumb line is not available tie a stone to a rope to find the exact place to put the pins.



**3. Check if corners are 90 degrees (follow the 3:4:5)
Measure 800 mm along one string, 600 mm along the other string, the diagonal between should be exactly 1000 mm.
If not, adjust your poles/strings in order to get 90 the right proportions.**



4. Check if the diagonals are equal

Measure the diagonals to check if the measurements are the same.



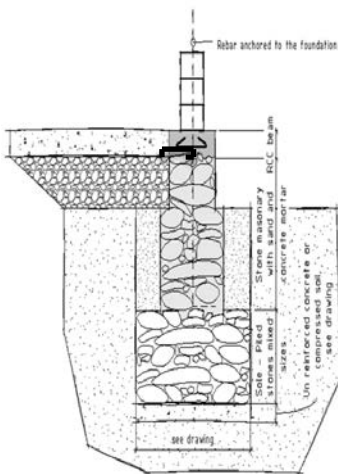
5. Mark 37.5 cm from centre string on each side of the string (i.e. 75 cm wide **or as per drawings)**

Mark out with a stick in the ground where to dig trenches for foundations. Normally 37.5 cm on each side of the string.



6. Dig 90 cm deep and 75 cm wide (or as per drawings)

At the start of each day put up the strings to ensure you are digging the right place. Level out both ground and trench. Compress the bottom of the trench.



Foundation details

Study the drawings and make sure you have necessary equipment available:

- Enough dressed stones (5-500mm)
- Rebars $\varnothing 12\text{mm}$
- Pipe to bend rebar
- Cement (OPC only)
- Rough sand and crushed aggregate (max 2 cm)



**7. Fill the trench with stone up to 15 cm from bottom.
Use a mixture of different sizes to avoid empty pockets in the
foundation. Ram the stones with a dhurmus.**

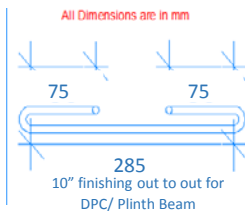


**8. Fill a thin mix of
concrete
Fill the first layer of
concrete to anchor the
corner rebars.**

**Concrete
mixture: (1:1.5:3)
1 part of cement (OPC)
1.5 parts rough sand
3 parts crushed stone
(max 2 cm)**



9. Cut the rebars
- 12 mm rebars are used for vertical reinforcement and should be cut to 2.3m to 2.5m length long.(or as per drawings)
 - 7 or 8 mm rebars are used for stirrups/links, and should be cut to 42cm (10" finishing C-Stirrup) long for DPC/ Plinth beam (or as per drawings)



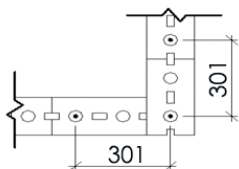
10. Bend the rebars & stirrups

The lap length must be 60 times the diameter of rebars

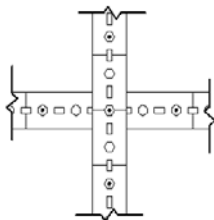
Main bar length required for 12 mm rebar = 720 mm overlapping

Placement of bricks & rebars 30x15 cm bricks

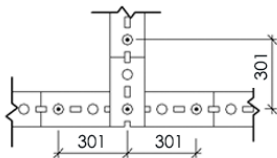
Corners



+ Corner



T-Corners



Placement of rebars in corners

The rebars must be placed exactly 301 mm apart to fit in the holes.



11. Put the corner rebars anchored deep in foundation
Put a layer of concrete in the corner to level it out, place one
12 diameter rebar in center of the corner, and one rebar from
the corner to each wall.

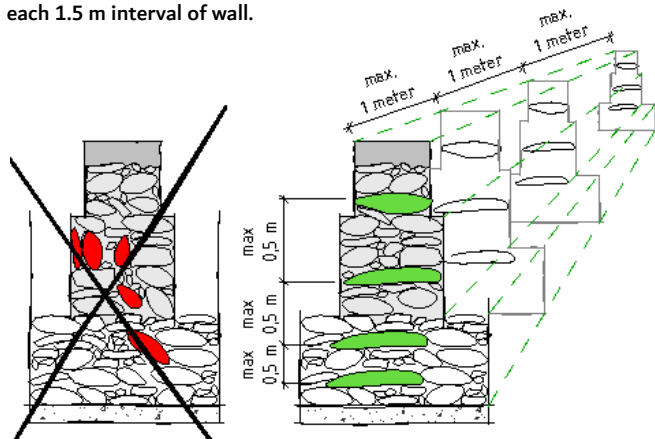


12. Fill with concrete to fix the rebars in place
Fill with 15 cm of (1:1.5:3) concrete around the rebars.
Concrete mix: 1 part of OPC cement, 1.5 parts rough sand, 3
parts crushed stone (max 2 cm)

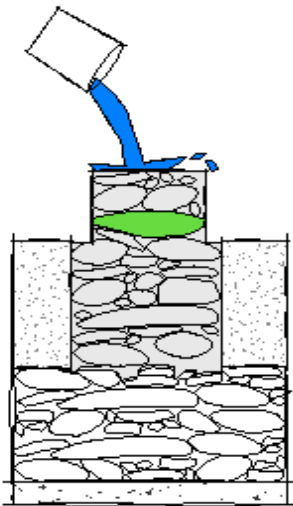


Rebars anchored

Put vertical rebars in all corners, at all doors and windows and each 1.5 m interval of wall.



13. Build a stone masonry wall with wide stones uniformly. For each meter horizontally and each half meter vertically there should be a stone long enough to go from one side of the foundation to the other. Use cement mortar 1:6. All stones should lie horizontal, not standing vertical.



14. Back fill soil around the foundation walls.

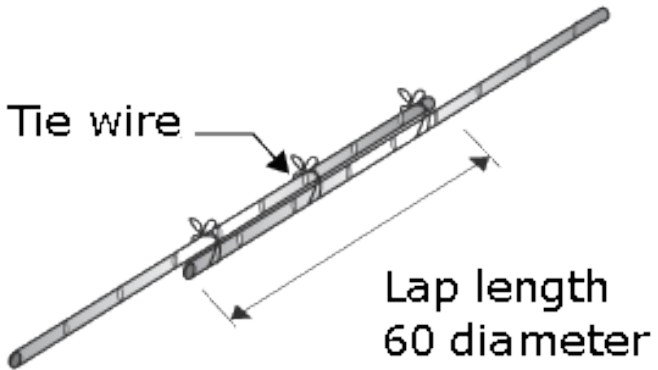
From ground level build a stone wall, with stone and 1:6 mortar. Make sure the top of the foundation is level to make it easy to place the rebars in the foundation beam.

Keep the foundation wet for at least 3 days.



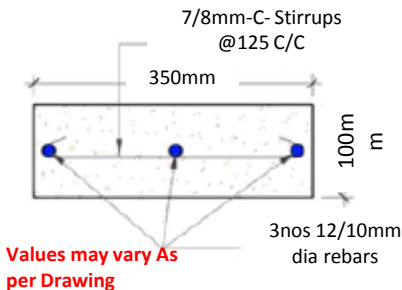
15. Stone with cement mortar

Fill the trenches with stone in cement (OPC) mortar. Build up the wall to 35 cm above the ground level.



Overlapping rebars

Make sure the rebar has minimum 60ϕ overlap ($720\text{mm}@\phi 12$). This applies in corners also. Make sure the rebars are in the corner of the stirrups



Plinth band section

Make sure the stirrups are properly bent

It is important that the stirrups are well bent around the horizontal rebars and fixed 150 mm apart maximum. See typical section below – but check and follow drawing!



Tie the vertical rebars together in the rcc-beams
Above is a typical reinforcement of a RCC beam at corner.



16. Use plywood to make a form for casting the beam.
Mark the top of the beam everywhere and check with a level
pipe. The beam is 150 high and 350 wide – or as per drawings

Before you continue please make sure:

- Vertical rebars are placed on both sides of all windows and doors
- Vertical rebars are placed in all corners
- Vertical rebars are placed every 1.5 meter of wall
- Reinforcement is correctly placed in order to hit the hole in the brick.
- At each vertical bar, add a stirrup in the corner at the bent bar.
- Is there sufficient overlap for horizontal rebars?
- All reinforcement has at least 25mm cover (room for concrete on outside)?
- Are vertical rebars tied together?
- Are the formwork securely fastened so it will not displace during casting?



17. Casting the beam

- Make sure all surfaces are wet before casting
- **Make sure that all vertical rod fits into the bricks holes!**
- Poke in the concrete with a steel rod to remove any air pockets (use vibrator if available)
- **Make sure the top of the beam is horizontal all the way around.**



Before the beam dries

- Check position of vertical bars. Use a brick to measure.
- Check that the whole beam is straight and in level



18. Water the foundation for 10 days

The first days after casting the concrete, keep it moist and if possible cover it from direct sunlight. Water it with good amounts of water at least 3 times a day the first 10 days



19. Soak the foundation.

After the foundation beam and the flooring concrete is complete soak it in water for at least 48 hours.

Continue watering it for at least 7 days.



20. Clean the beam

Brush the RCC Beam for sand and dust and soak it slightly. Make the surface rough. Apply dry cement or cement paste on the concrete in very thin layer.



21. Apply mortar in corners

For the first course after a RCC-beam, apply mortar, 7-10mm. Put mortar in one corner first.

Select the corner with high level to apply mortar first.



22. Soak CSEB in water before putting.

Soak the CSEB, and stick it on the mortar. Press it well on mortar to fix it.



23. Check the corners are square.

Check if corners are 90 degrees (follow the 3:4:5 rule)

Measure 800 mm along one string, 600 mm along the other string, the diagonal between should be exactly 1000 mm.

If not, adjust your poles/strings in order to get 90 the right proportions.



24. Check for highest point.

Check all the corner levels and start laying from the highest point of the plinth beam

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25. Apply mortar in corners

For the first course after a RCC-beam, apply mortar, 7-10mm. Put mortar in one corner first.

Select the corner with high level to apply mortar first.



26. Soak the CSEB in water before placing.

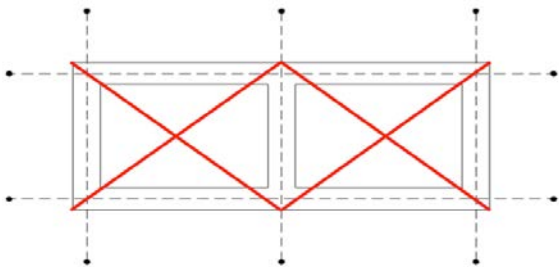
Soak the CSEB, and stick it on the mortar. Press it well on mortar to fix it.



27. Check level and direction carefully.

Adjust CSEB with a spirit level, adjust its direction with a straight edge.

Place the first brick in all four corners and check the level with water pipe level. Make sure all corners are in same level



28. Make a line from corner to corner.

Put one block in the same way in the opposite corner and stretch firmly a string between them. Stretch the string firmly through all 4 corners.

Measure the diagonals to check if the measurements are the same.



29. Place the bricks in a line

Apply mortar to the beam next to the placed brick, soak a CSEB and place it in the mortar, adjust linearity by following the string line. Repeat the same process until the first layer of wall is complete. Check the levels in both direction carefully with spirit level



Use two numbers of $3/4^{\text{th}}$ i.e 225mm bricks at every T-Joints in long wall.

30. Second and third layer

Start with the half brick at corner of second layer by overlapping the bricks with interlocks and with dry CSEB bricks (no mortar in the joints or underneath)

Note that the 1st layer is repeated on 3rd and 2nd on 4th layer.

Common mistakes to avoid



Make sure there are nothing in between bricks, else it will make the interlock weak



Make sure all the bricks used are of same height



31. For every 2 or 3 layers fill the holes with mortar

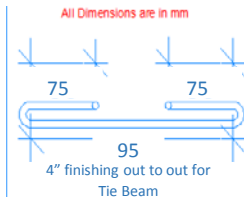
- Use 1:2:3 Cement:Sand:Chips micro-concrete with slurry like consistency.
 - Use a rebar to push the concrete down to fill all holes.
 - For the holes with rebar, be sure to provide 720 mm overlap (or 60 x diameter) at rebar ends.
- Repeat this process until sill level. (window bottom level)

Carefully make sure to

1. Before putting the bricks make sure that the surfaces are clean from dirt, sand or stone.
2. Make sure the bricks are in perfect level by spirit level pipe
3. Make sure that the bricks are always overlapping.
4. The rebar stirrups should be tight enough that it doesn't lose its place
5. Before pouring the mixture inside the holes, make sure they are correctly placed and are in plumb as well as in level.
6. Don't try to pull the rebars from the place because it might break the whole bricks arrangements .

33. Reinforcement for Sill beam.

Apply reinforcement and cast sill beam. The beam should be 100 mm high and the same width as the wall. It should be reinforced with 2 nos 12/10mm rebar. Stirrups width 100 mm + 30 mm bend on both sides. Stirrups shall be arranged such that bends faces opposite direction alternately.

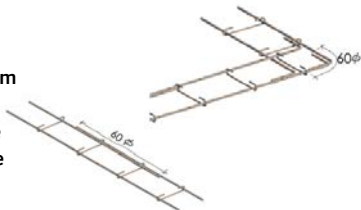


Make sure the stirrups are properly bent

It is important that the stirrups are well bent around the horizontal rebars, as seen in the left photo above.

Overlapping rebars

Make sure the rebars has minimum 60ϕ overlap ($720\text{mm}@\phi 12$). This applies in corners also. Make sure the rebars are in the corner of the stirrups.



Make sure the stirrups are properly bent

It is important that the stirrups are well bent around the horizontal rebars.

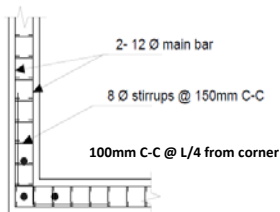


33. Make formwork and cast the beam

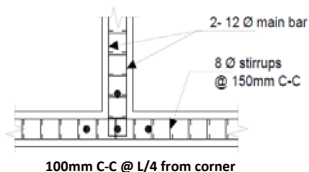
- Make all surfaces are wet before casting
- Poke in the concrete with a steel rod to remove any air pockets
- **Make sure the top of the beam is horizontal all the way around.**
- Make sure minimum 25mm cover is provided to the rebar throughout the beam
- Concrete mixing ratio 1 OPC to 1.5 coarse sand and 3 crushed aggregate (M20) for all beams.



Rebars Details at corners and T- joints



BAND DETAIL at CORNER



BAND DETAIL at T- JUNCTION

34. Repeat the process to build the wall up to top of the door/windows.



35. Apply reinforcement and cast lintel beam (top of door)

The process is same as in sill beam.

Beam is 100mm high and the width is the same as the wall.
Stirrups width 100 mm + 30 mm bend on both sides and
150 mm length of the stirrup rebar.

Common mistakes to avoid



Insufficient overlap. The overlap must be 720 mm (or 60 x diameter of the rebar)

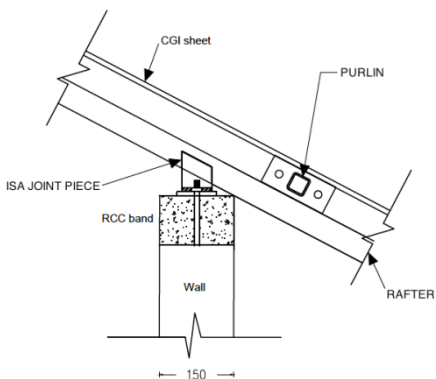


Clean the wall immediately after casting a beam or pouring concrete. It is difficult to remove the concrete later!



36. Repeat the process to build up to ceiling level.
 Then cast the tie-beam. Same process as other beams.
 However make sure that each rebar ends in an L-shape bent at least $60 \times \text{diameter}$ into the beam.
 Cast bolts into beam to fix the truss/rafters down as shown in drawing below – CHECK THE DRAWING FOR RAFTER LOCATION

In the short wall we need long rebars protruding for the gable wall.





37. Gable wall (triangular wall)

Now we need to build triangular walls for holding the building roof. This is done by full bricks and half-bricks.

Don't use slope cut bricks for gable wall

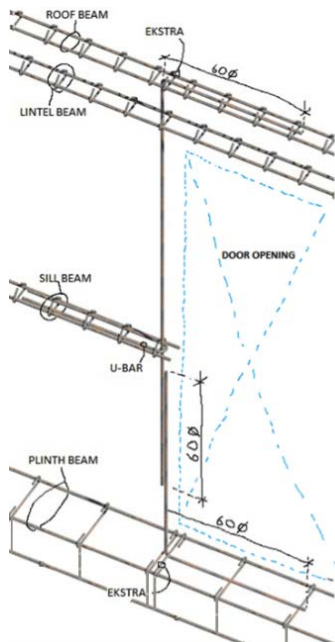


How to do the Gable walls?

1. First find the center of the width of the Building (i.e. front to back of building) at all short walls.
2. From the center of ceiling level measure as per drawing for gable wall height above it and mark it
3. Tie a string at both ends of building (i.e. front and back of building) at the ceiling level from the marked point. It will make a triangular section under which the wall are to be confined making it a triangular wall.
4. This wall is done using the full and half Bricks. Complete the triangular wall and provide a tie beam at the top so that all the gaps are filled with concrete and it makes it full at every place. See photo on next page.
5. Ensure that the vertical rebar are bent in an L-shape with at least 720 mm (60 x diameter) overlap into the gable beam.

Details of gable beam

1. Place two 12mm rebars and stirrups at 150mm c/c above the bricks.
2. Tie the 12mm rebars with the rebars coming from the top tie beam.
3. Make sure the vertical rebars are bent in an L-shape.
4. Cast bolts into gable beam as per drawing.
5. Place the formworks and cast the beam.



Details of reinforcement

Note how the vertical rebars are bending in L-shape both in plinth beam and the top beam. Also notice how all layers are connected together and the overlap of 60* diameter.



Add grouting in seams of the brick.

*** TIP mix a little bit of red mud (raato maato) in the grout to make a nice red color instead of cement color.**



Use a plastic pipe to make the seams nice and even

Then a sponge to clean the wall. Clean the wall before the cement has time to harden.

CONGRATULATIONS! Your walls are now completed!

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