

10. What are the important tips for ensuring good RCC Construction?



Are you constructing a house with RCC and want to ensure good quality?
Do you know the important tips and tests when doing an RCC construction?

This toolkit shares easy -to-follow tips to identify and select good materials.

Constructing your house with RCC, know all the major components!

A.

COMPONENTS OF A RCC CONSTRUCTION



This Structural system consists of RCC slabs, beams, columns & foundations.

Materials

RCC Structures are made of cement, sand, aggregate & ISI approved steel bars.



Composition -

Standard 'M20 grade' proportions - 1:2:4 i.e. (Cement: Sand: Aggregate)

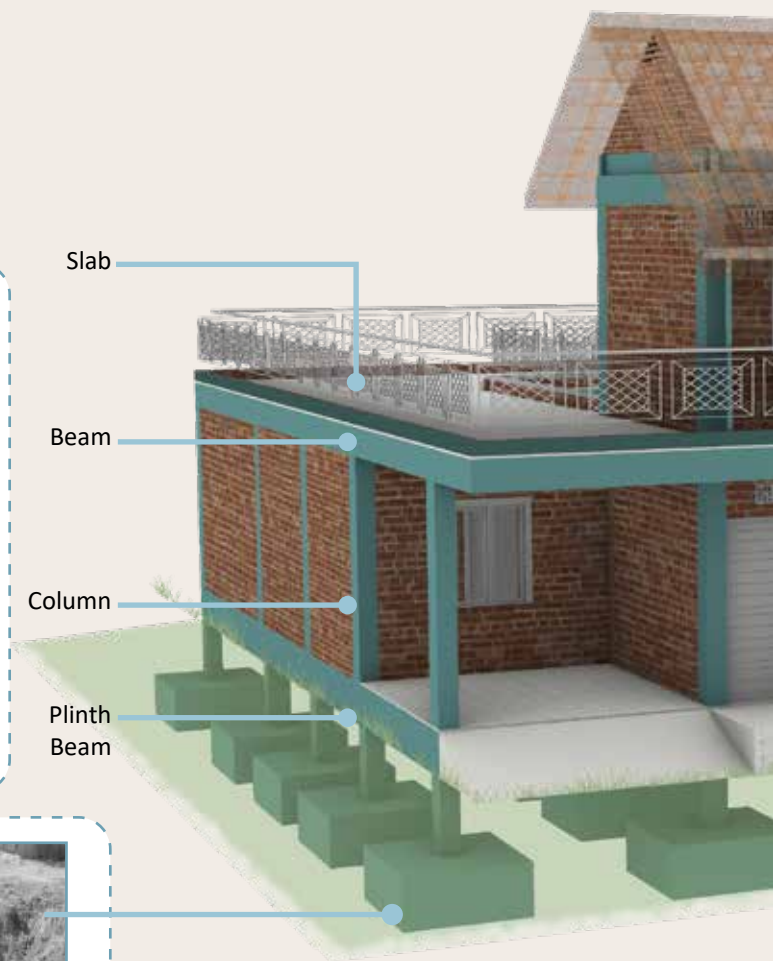


Foundation

RCC structures are supported by isolated footings, one for each column,

Materials - RCC

Sizes - Depends on design, size of house, and soil condition of the site. This should be decided by engineer.





Roofing

The type of roof should be decided based on local climatic conditions, material and skill availability, use purpose, and cost.

Material Options -

Common roofing options include sloping roof with slay tiles or sheets, OR RCC flat slab.



Infill Walls

The internal & external walls are built after the structural frame of the floor is complete.

Material Options -

Bricks, concrete blocks, Fly ash bricks, CSEB Earth blocks.

Minimum Thickness -

Interior walls - 4" or 115 mm width

Exterior walls - 9" or 230 mm width



Structural Frame

The Beams and Columns together make the RCC frame.

The frame is built first, then the walls are built.

Materials - Reinforced Cement Concrete (RCC)

Sizes - Depends on the structural load. This should be decided by the structural engineer.



Expanding your RCC house? Know all the important points to consider

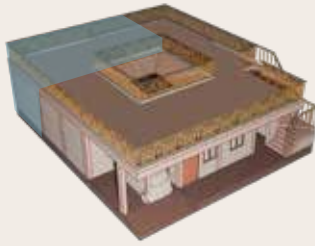
B.

EXPANDING AN RCC STRUCTURE

1. Existing Structure



2. Horizontal Expansion



3. Vertical Expansion



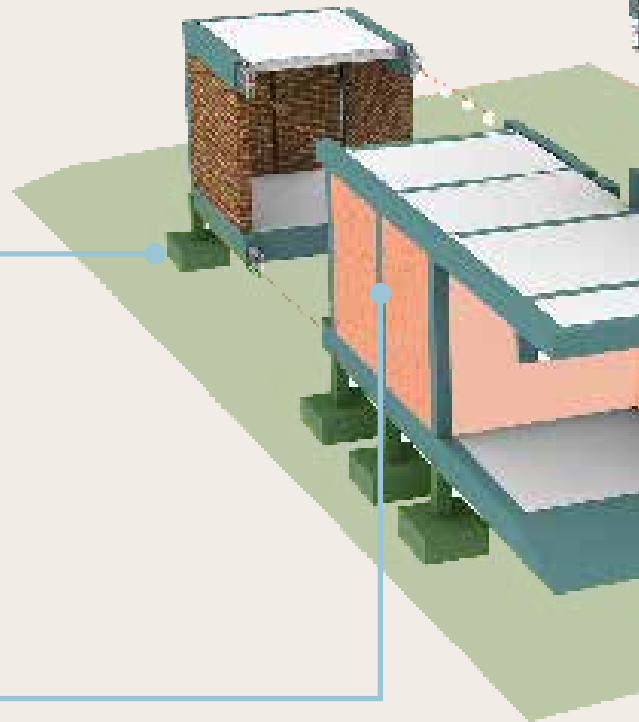
Horizontal Expansion

Foundations

1. Create a foundation under the new structure, by following the same rules of site preparation, foundation and building construction.
2. Extend the existing plinth beam over the new foundation.

Structural Frame

1. Connection between new and old beam needs to be done with same size of beam and RCC bars, and the same mixing proportion for concrete.
2. If the building is becoming too long after horizontal expansion, provide a 4 to 9 inch gap between old and new structure above ground.



Vertical Expansion

Lightweight Structure

1. Preferably, construct a sloping roof on new floor.

Structural Grid

1. Follow existing column and beams grid for horizontal or vertical expansion.
2. Avoid projections on new structures.
3. Do not keep steel bars exposed as they are prone to corrosion.
4. Vertical expansion of more than one floors is not advisable for structural safety.

1. Redo plaster on existing wall then continue the same coat new walls.
2. Add chicken mesh on new and old connection for better plaster work.

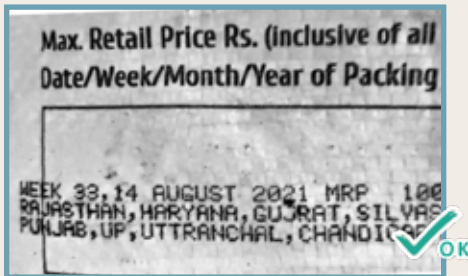
Adding more than one floor above original design needs assessment of current structural member load capacity and future expansion load capacity.



Building your house out of concrete? Choose all the materials well!

C. CEMENT

Check the following on the cement bags before buying:



Date of Manufacture, shouldn't be more than 3 months old. Always buy fresh cement bags.



ISI Mark with appropriate number.

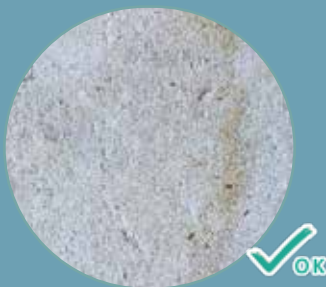


Check cement Grade is as ordered. Always use 'Grade 43' or 'Grade 53' Cement.



Cement bag should be well sealed & not have any holes.

How to test the quality of cement



- ✓ Texture should be very fine and smooth.
- ✓ Feel the temperature of the cement, it should be cool and not warm.



- ✗ Cement should not have lumps. If so, discard the bag.
- ✗ Never use hardened cement.

1. Store cement in a dry place.
2. Make a raised platform for storing cement so that it doesn't catch moisture from the ground.
3. Do not lean bags against walls that are prone to retain moisture.
4. Wrap in plastic bags to avoid moisture.
5. Never use hooks on cement bags.



If cement is so prone to damage while being stored, what should we do?



It should be purchased in small quantities, just enough to take care of immediate needs. Bags must be opened only when the cement is to be used.



Points to note!

- ✓ *If cement fails the above tests, be sure to discard the whole bag.*
- ✓ *Never use old, damaged or low quality cement for construction, as that can lead to grave damage expensive repairs.*
- ✓ *All construction involving cement needs to be cured with water. Water helps cement gain its strength & harden.*

Ordering some cement, and want to know if it is of good quality?

D. STEEL

Do!

- Bars should have ISI mark
- Check bar diameter before use
- Steel bars should be ribbed
- Steel bar should pass the bend test



Don't!

- Do not use steel bars that are rusted.
- Always store steel bars away from water



'Bend Test' for Steel Bars

1. Strong Steel bars should pass the bend test on site.
2. Don't use steel bars that are brittle & crack on Z-bars bend at larger radii.



How to make sure the sand being used is of good quality?

E.

SAND

Do!

- Filter Sand using Jaali mesh before use
- Sand should contain only a small amount of clay



Don't!

- Do not use sand having dirt & organic material, or high clay content
- Do not use sand with salt content



Testing of Clay in Sand

Sand should contain only a small amount of clay (not more than 8%)

1. Fill the one-third jar with cleaned, sifted sand to be tested
2. Add one tablespoon of powdered dish-washing detergent
3. Fill the jar with clean water, & shake well
4. Leave the jar on a level spot for 48 hours
5. Mark & measure the height of each type of soil layer of different color



The topmost layer, i.e. clay, should not have a height more than 8% of the total height of soil layers

How can you supervise the laying of the foundation?

F.

MAKING A BASE FOR THE FOUNDATION

For Rocky/Hard soil

Excavate between 1-3feet deep minimum for foundations.



1. Make sure the trench bottom is clean of roots and loose material.
2. Compact the bottom by watering & ramming with sand.

For Soft soil (Eg. Black cotton soil)

Excavate 6 feet deep or till you reach hard murrum, whichever is lesser.



1. Make a PCC base OR a brick bat layer in case of soft soils.
2. This is necessary for saving the foundation from sinking or water logging.

Points to note!

In the areas with severe white-ant problem, treat the foundation with Anti-termite treatment before laying the foundation.

1. *Ensure good compaction of soil below, and good drainage around the foundation*
2. *Ensure steps to avoid foundation settlement or sinking.*
3. *Make sure that the footing location & alignment is perpendicular and as per designed plan.*
4. *Ensure there is proper water drainage system on the constriction site.*
5. *Always construct the foundation in dry summer months*



Deciding between foundation types, start here!

G.

TYPES OF FOUNDATION

1. Load-bearing foundations
2. RCC foundations
3. Special Foundations for Weak soils

1. LOAD BEARING FOUNDATION

Load-bearing Foundation is a continuous foundation, made of a cement base, brick stepped walls and single reinforcement bars.



Single steel bar reinforcement at junctions



Stepped brick foundation

Steps to follow

1. After laying out the plan on the site excavate in a continuous manner all along the walls in the building.
2. Minimum width of the foundation and the PCC base should be 900 mm (3 ft).
3. Ensure that all reinforcement vertical steel bars used in the structures should be embedded in the PCC bed.
4. Ensure stepping in the brick foundation till it reaches the ground.
5. Do not backfill without curing the masonry.

Issues with foundation construction are very expensive, and often impossible to repair. Ensure that all the guidelines are followed by your mason/contractor.



Starting out with laying the foundation? Keep this points in mind

2. RCC FOUNDATION

RCC Foundation has isolated footings made of RCC, which connects to the columns of the building.



Steel cage positioned on PCC base using spacers



Concrete poured & shuttering

Steps to Follow

1. Excavate under column position, maintaining depth as per soil type & engineer's advice.
2. First lay a PCC bed, & then lay the RCC foundation over it.
3. Use minimum 10mm Steel bars for the reinforcement cage.
4. Backfilling should be done only after 10 days of curing for the RCC work.

Points to note!

- *Sizes and proportions of the foundation vary depending upon the design and size of house, soil condition of the site.*
- *The RCC Foundation should be designed by a structural engineer.*
- *All vertical reinforcement bars should be embedded to the PCC bed.*
- *Laying a PCC bed and a plinth band is a must in case of weak soils*
- *For weak solid the foundation depth should be minimum 6ft or till you reach hard murrum, whichever is lesser*
- *Foundation types suitable for black cotton soil are Raft foundation or Pile foundation, which are very expensive and require a structural engineer.*



Black Cotton Soil

Starting out with laying the foundation? Keep these points in mind

H.

CASTING RCC STRUCTURES

The structure is the main element in a RCC house.

For the building to be long-lasting, and durable against disasters, it is crucial that all elements are constructed following proper cement and steel construction practices mentioned below.

1. Design & Planning

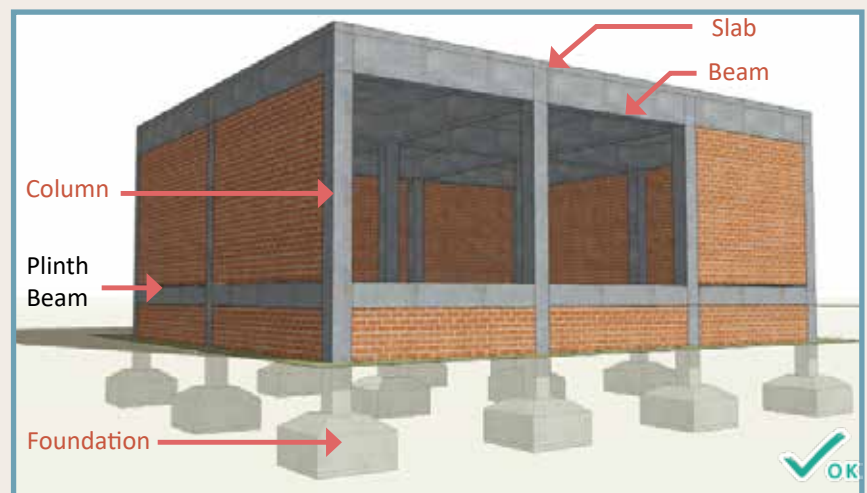
All RCC members (columns, beams, slabs and foundation) should be designed and supervised by an engineer.

2. Complete Structural Frame

1. The structural frame is made of the following interconnected members:

- Slab
- Beams
- Columns
- Foundations

2. Do not omit any of these members.



Keep in mind!

1. *Shuttering material should be of good quality and have smooth surfaces.*
2. *Never Expose Steel*

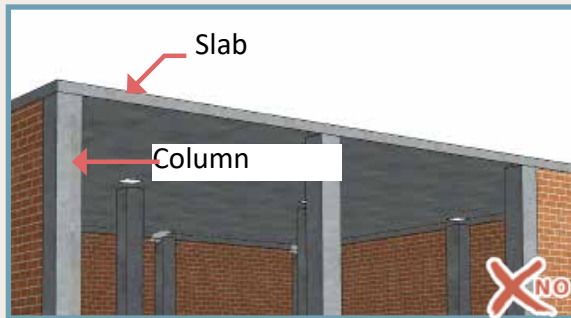
- *Steel should never be exposed in RCC. A steel bar exposed at any point loses its strength.*
- *Cover all steel bars, especially if the RCC structure is to be extended upwards in future.*
- *To ensure steel cage is covered adequately at all points, these practices should be employed:*



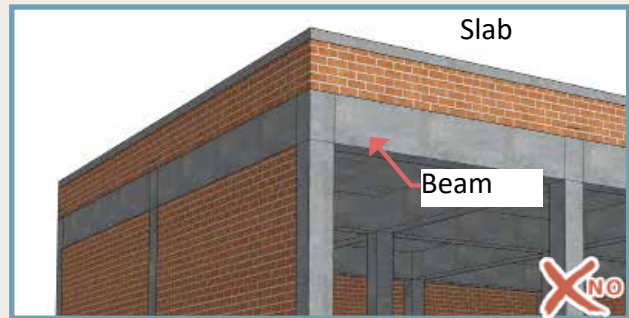
H.

CASTING RCC STRUCTURES

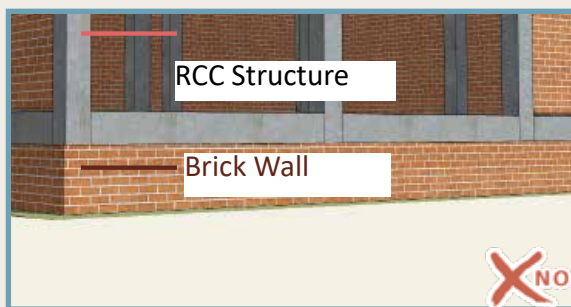
3. Placement of structural elements



1. Do not mount the slab on columns directly without a beam.



2. Do not place bricks between the beams & slab.



3. Do not position columns without foundations.

Points to note!

Vibration while pouring:

- Mixing of concrete, and vibration & compaction should be done properly.

Concrete Cover on Terrace:

- Give a concrete covering to steel bars on terrace left for future expansion. This cover can be broken at the time during expansion.



4. Curing Concrete

- Use Gunny bags for saving water while curing.
- Make sure water is clean not containing silt or sand.
- Curing should be done for 10 days minimum, after removal of shuttering.
- During Hot-dry weather, Curing to be done for 14-17 days after removal of shuttering.



Precautions for Steel Reinforcement in RCC



- *Ensure that steel bars are overlapped sufficiently at joints.*
- *Tie-rings must be bent inwards.*
- *In beams, the reinforcement bars at 'L shaped' junctions must overlap adequately.*

*Hire only skilled workers for RCC construction.
Always take advice from a structural engineer for all aspects of structural design.*



Are you planning to build a flat RCC roof ?

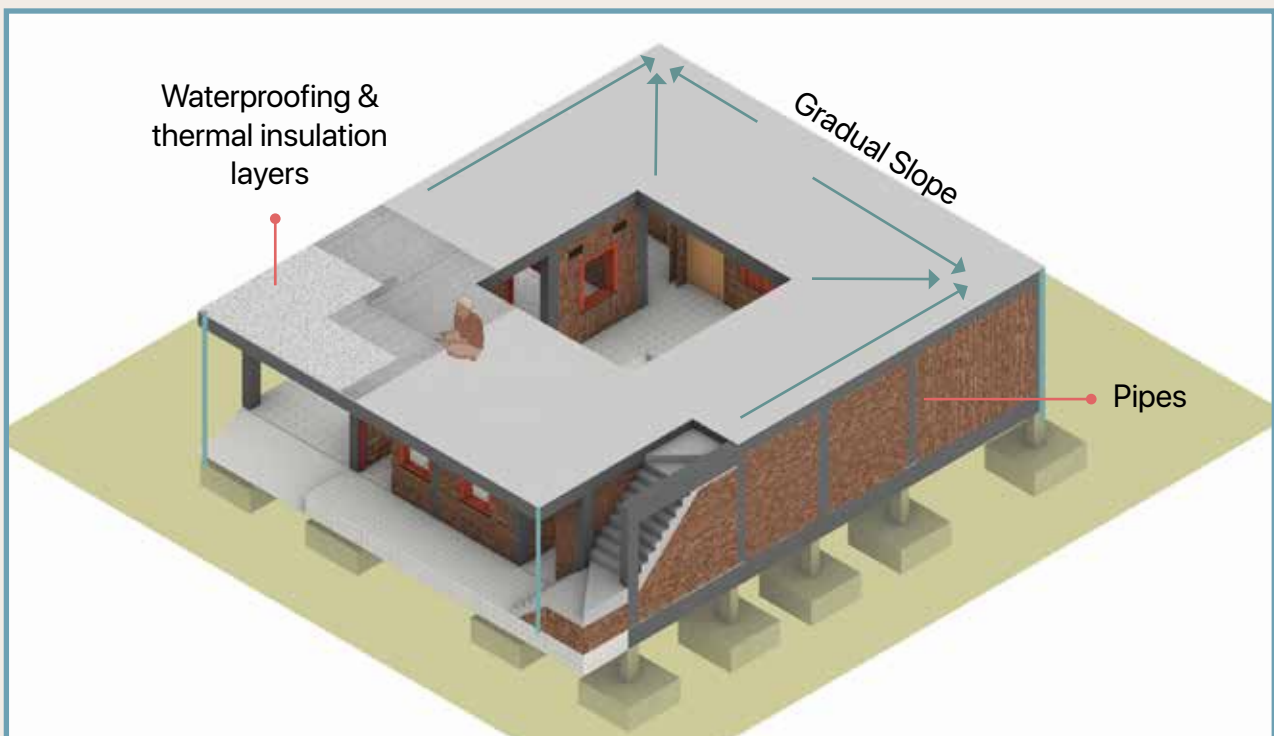
I. CASTING RCC ROOFS

1. Structural System

- Follow all guidelines for RCC construction (Pg. 43) and Material standards (Pg. 26).
- Ensure that reinforcement bars are not exposed and projecting out of the slab.

2. Drainage

- Provide a gentle slope on the roof slab for the water to flow towards water outlet pipes for rainwater run off.
- Design and provide storm-water pipes to drain rainwater from the roof slab.
- Provide waterproofing and heat proofing solutions to protect your house.



Drainage of RCC roof

How to make sure your concrete mix is well prepared?

J.

MIXING RATIO AND PROPORTIONS FOR CONCRETE

1. Proper Mixing Method



Measuring utensil must be filled to the brim while measuring quantities.

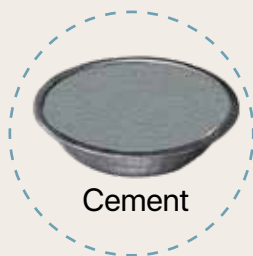


Mix all dry ingredients for concrete thoroughly before adding water.



Use the cement within 45 minutes after adding water. Do not use the cement once it begins to harden.

Ensure that correct proportions for cement are followed by your team. Compromise in the quantity of cement, sand, aggregate and water will weaken the structure of the house, and reduce its safety and lifespan. For explaining the various proportions, the 4 main elements have used:



Cement



Sand



Aggregate



Water

2. Concrete mix for PCC



1. What is PCC?

PCC' or 'Plain Cement Concrete', means the use of concrete without any steel bars.

2. Where is PCC used?

PCC is used to make a steady, leveled base over compacted earth, for foundations, flooring, etc.

3. What is the Grade for this type?

Minimum grade is 'M15'

Mixing Ratio for PCC



+



+



+



=

**1 : 2 : 4
or 'M 15' Grade
Concrete**

1 Unit
Cement

2 Units
Sand

4 Units
Aggregate

Water for
mixing

J.

MIXING RATIO AND PROPORTIONS FOR CONCRETE

3. Concrete mix for RCC



1. What is RCC?

RCC or 'Reinforced Cement Concrete', means the use of concrete with steel bars.

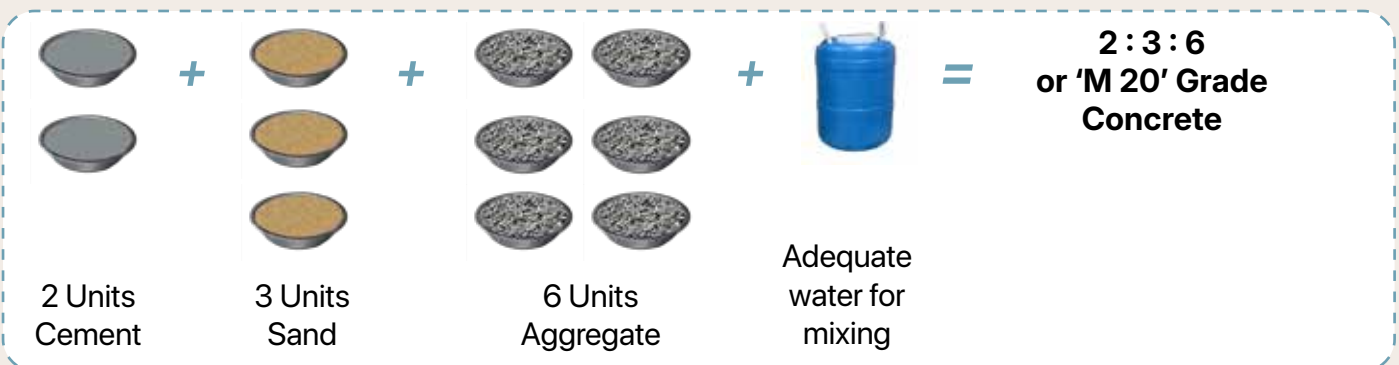
2. Where is RCC used?

RCC is used to make beams, columns, slabs and foundation, that carry the load of the building.

3. What is the Grade for this type?

Minimum grade is 'M20'

Mixing Ratio for RCC



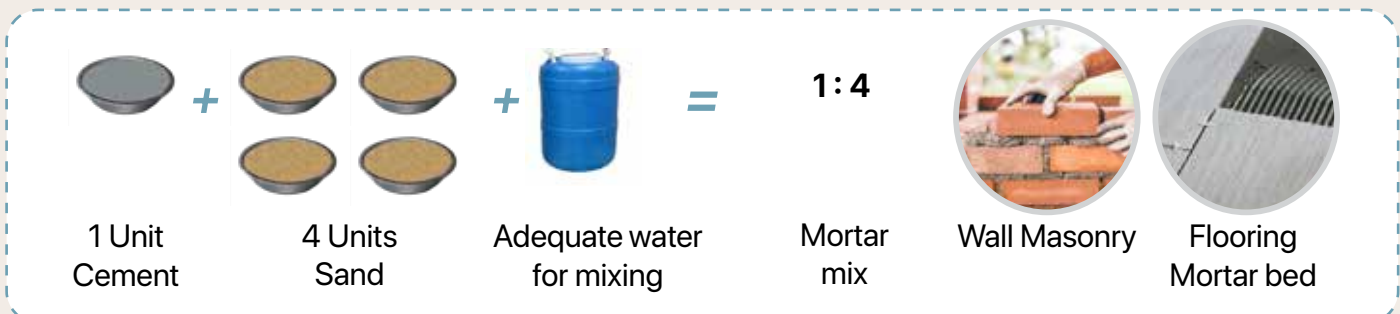
4. Cement Mortar mix



What is Mortar?

Mortar is used to bind building blocks such as stones, bricks, and concrete masonry units

Mixing Ratio for Cement Mortar



5. Cement Plaster mix



What is Plaster?

Cement plaster is a mixture of cement, sand and water, and is applied on internal and external walls. It protects the walls from excess moisture, thus increasing the lifespan of the walls.

Mixing Ratio for External Wall Plaster



1 Unit
Cement

4 Units
Sand

Adequate
water for
mixing

Plaster
mix

1:4



External Wall Plaster

This is important & needs to be richer in cement than internal plaster as it is in direct contact with natural elements.

Mixing Ratio for Internal Wall Plaster



1 Unit
Cement

6 Units
Sand

Adequate water
for mixing

Plaster
mix

1:6



Internal Wall Plaster

Points to Note!

Any compromise with mixing and proportions of materials as mentioned above will lead to an unsafe structure, and require expensive repairs in future.

In heavy monsoon areas, add waterproofing chemicals to the plaster.

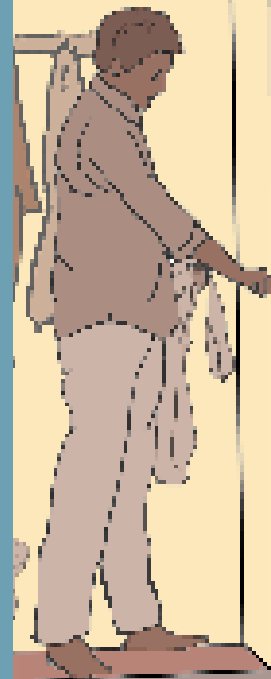


Explore other Durable Homes Toolkits by Lokal Habitat Labs:

1. How do I heatproof my home?
2. How do I waterproof my home?
3. How do I select the right materials?
4. How do I select the right construction team and supervise the work?
5. How to develop the site and construct a strong foundation?
6. How to build strong walls and design windows?
7. How to build a strong roof?
8. How to choose the structural system for your home?
9. How to build a well-serviced home?
10. What are the tips for good RCC construction?
11. How do I maintain my home after construction?
12. How do I design my home?

Disclaimer:

The toolkits offer general guidance based on hot and dry climate conditions in India, and is intended for informational purposes only. It does not replace professional advice. For safe and effective construction, please consult a qualified architect or engineer in your area. We are not liable for any outcomes from the use of this toolkit. If you want us to customise this toolkit for your geographic context, or need more information, feel free to contact us.



lokalhabitatlabs.com

LOKAL
Habitat Labs