

7. How to build a **STRONG** ROOF



Do you have a leaking roof or seepage?
Does your roof make your house very hot during the summers?
Worried that the roof is not strong enough?

This toolkit outlines key points to remember and follow while supervising the construction of the roof of your house.

Building a strong roof today to increase the safety and health of your family

Roofs are most exposed to weather conditions such as heavy rainfall, strong winds, and extreme heat.

A strong roof structure, and choosing roofing materials that are appropriate for the local climatic conditions is crucial. Integrating heatproofing and waterproofing elements in the roof design will prevent future repair costs and maintain the good health of your family.

Follow the steps in the manual, and consult with your local contractor in every decision.



Tips to build a STRONG ROOF



1. Select strong materials to construct the understructure of the roof
2. Choose roof materials keeping in mind the local climatic conditions such as heat, winds, and rainfall.
3. If your region is prone to strong winds, take additional precautions to secure the roof.
4. Integrate drainage and rainwater harvesting system with the roof.
5. Use adequate heatproofing and waterproofing measures.

How to select the right roofing system for you?

A. TYPES OF ROOFING SYSTEM

ROOFING SYSTEMS

Roof design and materials should be appropriate to the climatic and environmental conditions of the location, and must protect the interiors from excessive heat, wind and rainfall. This chapter introduces two main types of roofs, and provide general Do's and Don'ts for roof construction.

	Sloping Roofs	RCC Flat Roof	
LESS 	Usually less expensive	Usually more expensive	MORE 
	Good performance in hot and rainy locations.	Poor performance in hot and rainy locations.	
	Thermal insulation required depending on type of roofing material	Necessary additional thermal insulation & waterproofing for comfortable living	
	Good seismic resistance, if designed as per recommendations	Good seismic resistance, if designed as per recommendations	
LESS 	Roof not accessible, Sloping roofs can be dismantled & used in another place	Gives extra space on the roof for activities, and good for future vertical expansion	MORE 
NEEDED 	Engineer's expertise needed	Engineer's expertise needed	NEEDED 

- If you want to add another floor after some time, choose an RCC flat roof. If you don't need to build an additional floor, you should choose a sloping roof.
- A combination of both roof types can be used in a house as well.



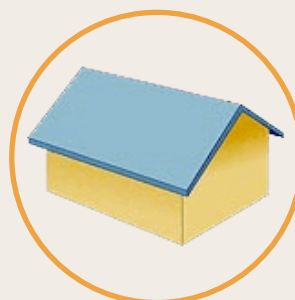
How can you supervise the installation of a strong sloping roof?

B. SLOPING ROOF

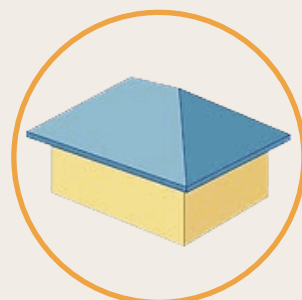
TYPES OF SLOPING ROOF

There are two types of sloping roofs -

1. Four-way sloping roofs
2. Two-way sloping roofs



2 Way Sloping Roofs

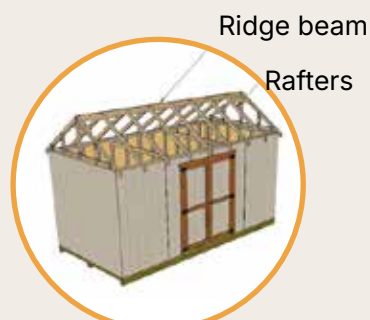


4-Way Sloping Roofs

STRUCTURAL SYSTEM

The structural system can be either a rafter system or a truss system, depending upon the size of the room & load of roofing materials

- The frame material can either be wood, steel or bamboo.
- Make sure that the frame members are properly embedded in walls
- Ensure all roofing material is securely tied to the frame members.



Truss System



Rafter System

DRAINAGE SYSTEM ON ROOF

- Design and provide gutters and rainwater pipes
- Provide a slope of minimum 30 degrees
- To protect walls from rainwater, extend the roof 2-3 ft from the wall.
- Ensure adequate overlapping of roofing sheets or tiles to avoid leakage.
- Provide waterproofing and heat proofing solutions (Pg. 62 and 64 respectively) to protect your house as per different types of roofing materials.



Sloping roof & its drainage



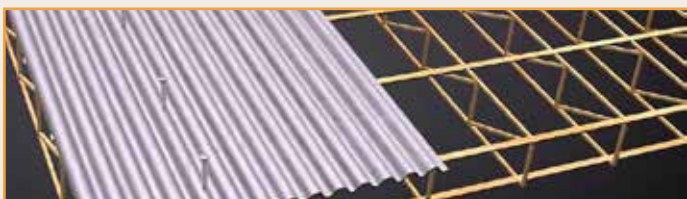
Do not underestimate the importance of installing a good drainage system on your roof.

How should your site be prepared for construction?

C.

ROOFING MATERIALS FOR SLOPING ROOF

A. Corrugated Galvanised Iron (CGI) Sheets



- These sheets are fixed to the frame using J bolts.
- Ensure adequate overlap of sheets.
- Coated CGI sheets available in the market help in reducing heat gain.



Fast & easy to install



Requires additional insulation layers



Affordable



Basic skills required



Good for heavy rainfall regions

B. Local Clay tiles



- The tiles are mounted and tied to the frame using wires.
- Ensure adequate overlap of tiles.



Takes time to install`



Good for hot temperature



Affordable



Special skills are required



Good for heavy rainfall



How can you supervise the correct method for site layout?

D.

ROOFING DESIGN FOR RCC FLAT ROOF

ROOF CONSTRUCTION GUIDELINES

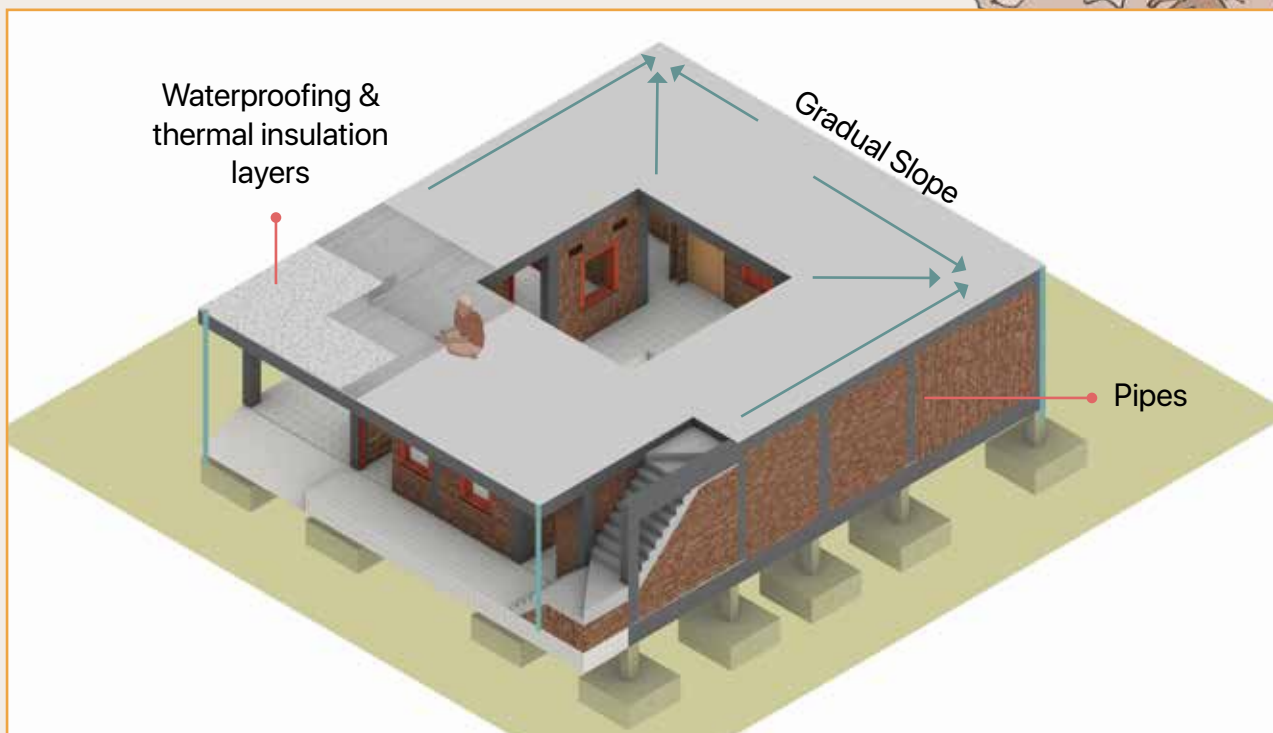
- Follow all guidelines for RCC construction (Pg. 43) and Material standards (Pg. 26).
- Ensure that reinforcement bars are not exposed and projecting out of the slab. Consider putting a concrete cover on the steel bars.



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

What are some other types of roof designs you can use, which are more cost-effective?

E. OTHER TYPES OF COST-EFFECTIVE ROOF DESIGNS

Apart from the 2 types of roof structures explained above, there are other roofing mechanisms which can sometimes be more affordable and long lasting, if constructed properly. Consider these as cost effective solutions for small spans (about 6m), keeping in mind local material, skills & climate conditions.

1. Precast Concrete Joists With Stone Slab



- Made by precast concrete joists on which locally available stone slabs are laid.
- Recommended for floor slabs.



Waterproofing & Insulation needed



Allows vertical expansion



Basic skills required



Fast & easy to construct

2. Precast Concrete Panel Roof



- This roof is made of precast RCC panels supported on Steel joists.
- Finished with layers of waterproofing & cement slurry.



Waterproofing & Insulation needed



Fast & easy to construct



Basic skills required

3. Filler Slab



- In this type of RCC slab roof, pots or clay tile are placed in between reinforcement bars to reduce cement use.
- This technique is eco-friendly and saves cost.



Provides heat insulation



Allows vertical expansion



Expert skills required



Eco-friendly

What are some other types of roof designs you can use, which are more cost-effective?

E. OTHER TYPES OF COST-EFFECTIVE ROOF DESIGNS

4. Jack Arch Roof



- Made of small brick arches resting on precast concrete beams.



Suitable for rainy regions



Heat Insulation needed



Allows vertical expansion



Easy to construct but takes more time



Expert skills required



5. Guna Tiles Roof



- A series of arches are made using clay pots 'kulhar'.
- Finished with layers of waterproofing & cement slurry.



Suitable for hot & rainy regions



Time consuming construction



Expert skills & training required



- Choose a roof that is suitable to local climate & availability of skilled labour.
- Ensure proper waterproofing and heat insulation on the roof.

Explore the different roof designs that are climate-friendly and cost effective.



What are some ways to securely waterproof your roof?

F.

WATERPROOFING THE ROOF

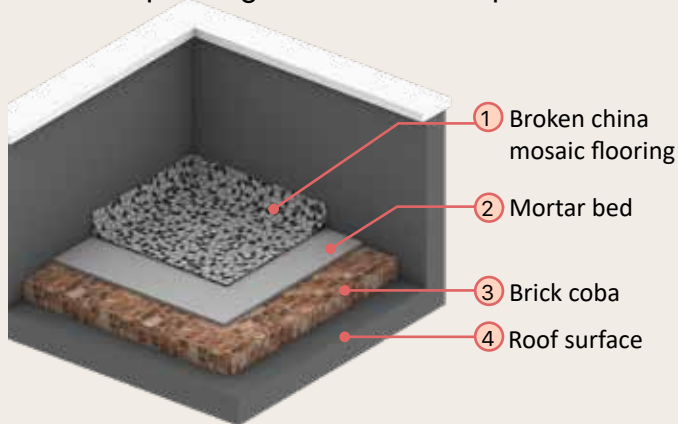
- Seepage can result in structural damage and a weak structure
- Seepage causes mold growth, which increases chances of asthma and other respiratory illnesses.
- Expensive & recurring repairs are needed to remove water seepage once it starts.
- The waterproofing method should be chosen according to the regional temperature and rainfall conditions
- Ensure that damp proofing and waterproofing is done in the dry season



Here are some waterproofing options for your roof, that can protect your house from damages:

1. Broken China Mosaic Flooring

This method involves laying bricks over the roof slab and filling the gaps with a mix of cement and waterproofing compound. To finish it off, you can add a top layer of broken mosaic tiles set in cement mixed with waterproofing material for extra protection.



This method helps in both waterproofing and heat proofing your house.



 Expert skills required

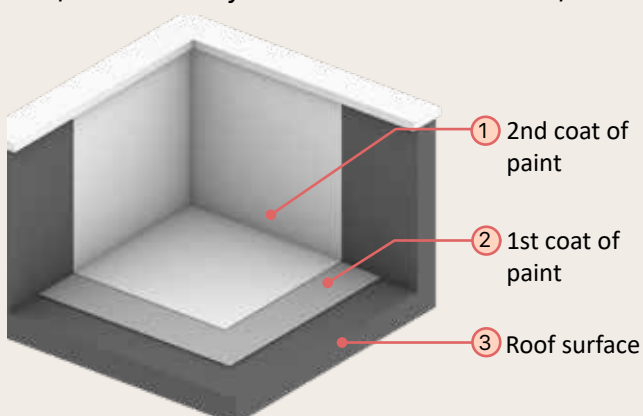
 Provides insulation

 Takes time to lay

 Easy to repair

2. Epoxy Waterproofing Paint

This method involves adding multiple coats of epoxy waterproofing paint on the roof slab. It is inexpensive, available at your local hardware store, and can be easily applied on an existing roof.



 Suitable for rainy regions

 Can be laid quickly

 Provides insulation

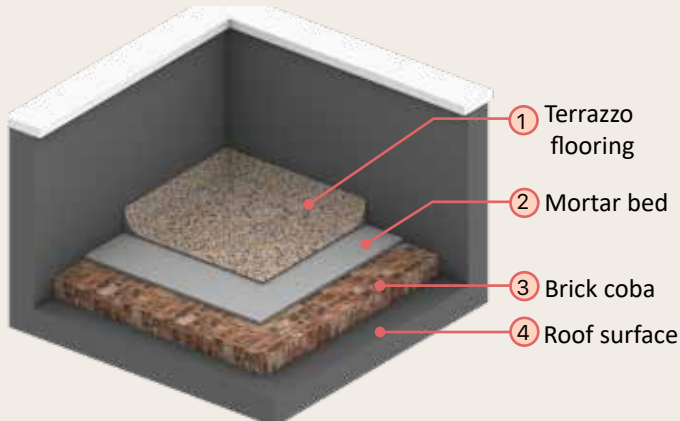
What are some ways to securely waterproof your roof?

F.

WATERPROOFING THE ROOF

3. Terrazzo Flooring (or Marble Chip Flooring)

For more decorative options, the terrazzo flooring consists of marble, granite, and other types of chips, flushed within cement flooring, mixed with a waterproofing compound.



Takes time to lay



Provides Heat insulation



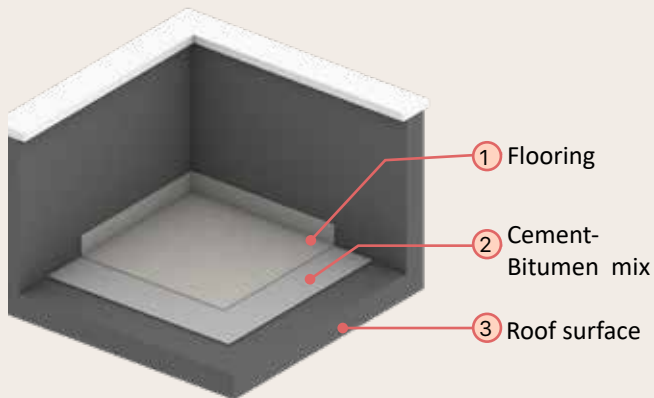
Expert skills required



Difficult to repair

4. Cement & Bitumen Based Waterproofing Chemical

In this technique, cement or bitumen based products are applied on a clean surface. This is recommended only for internal areas such as toilet floors.



Expert skills required



Suitable for rainy regions



Fast Method



Easy to repair

What is the local waterproofing method?

Consult masons for local, traditional practices using local material for waterproofing of your house roof!



What are some ways to keep your rooms cool?

G.

HEATPROOFING THE ROOF

Roof Thermal Insulation goes a long way!

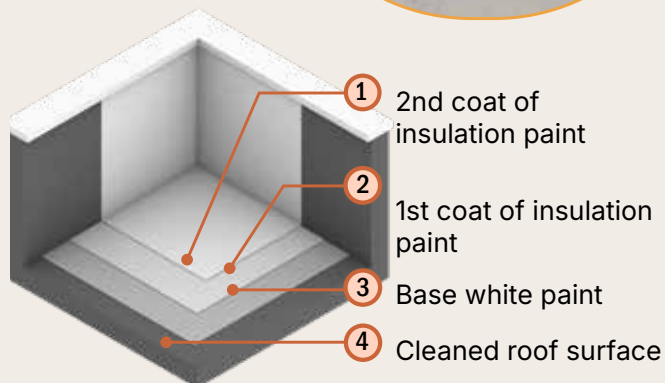
- Use heat absorbing materials for insulation for your roof.
- This will help to reduce indoor temperature when it is sunny outside.
- In the long run, this results in a naturally comfortable house with reduced electricity bills.



Here are some ways to heatproof your roof:

1. White Insulation Roof Paint

This method includes multiple coats of insulation paint, and can easily be applied on an existing roof surface.



These methods are very easy to install, and affordable! Ask your local contractor about them.



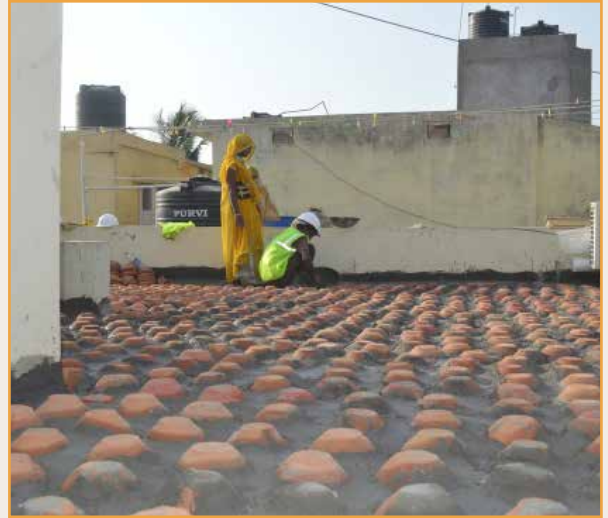
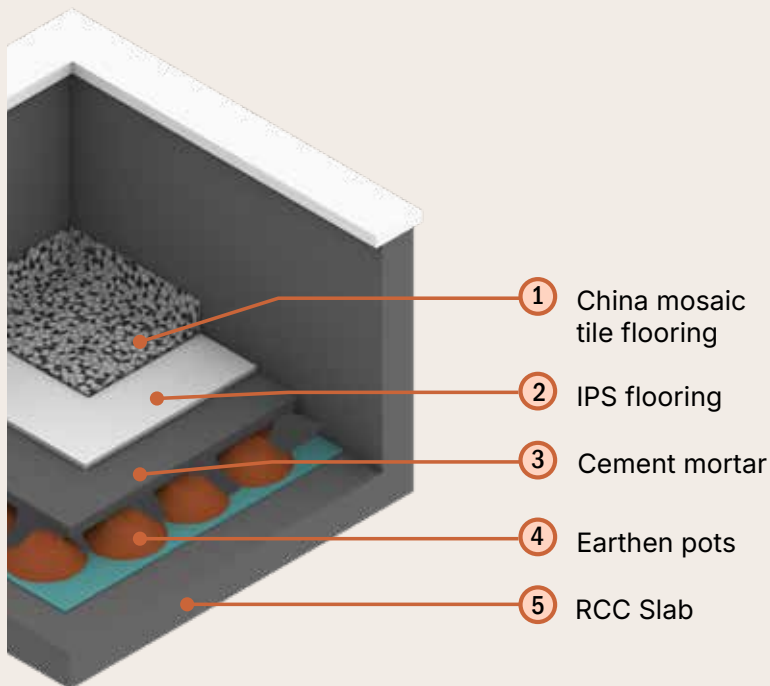
What are some ways to keep your rooms cool?

G.

HEATPROOFING THE ROOF

2. Earthen Pot Roofing

This method uses easily-available earthen pots in constructing the roof slab, and can be laid by your local mason.



Points to note!

- ✓ Clean the roof surface well
- ✓ Arrange the pots upside down, leaving small gaps between them for cement filling
- ✓ Add cement mixture based on correct proportions in the gaps, and even it out with a horizontal bar
- ✓ After the cement dries, apply white paint or lime wash to increase heat protection



What are some ways to keep your rooms cool?

G.

HEATPROOFING THE ROOF

3. Green Net Shading

This method involves installing a shed on the roof using inexpensive materials that allows you to use the space all year round, while keeping the floor below cool.



① Green net

② Metal frame



LARGE USABLE AREA ON THE ROOF

4. Insulation layer above and below tin sheet

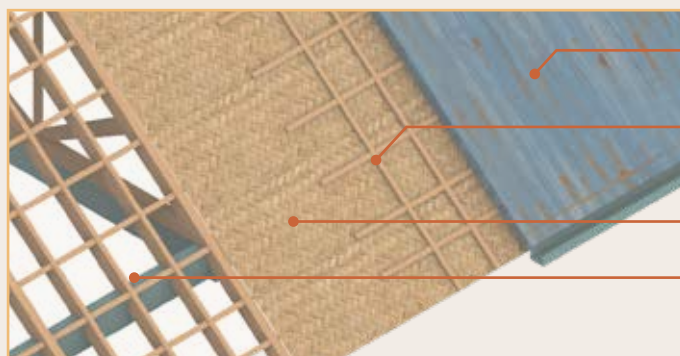
Simply add a layer of bamboo mats (or chick-mats) below the metal sheets to increase roof insulation.

Another option is to add jute bags, bamboo sheets, or dried hay on top of the tin roof to increase insulation.



plastic tarp

jute bags



① Roofing sheet

② Roof frame

③ Bamboo mat

④ Secondary frame







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.



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