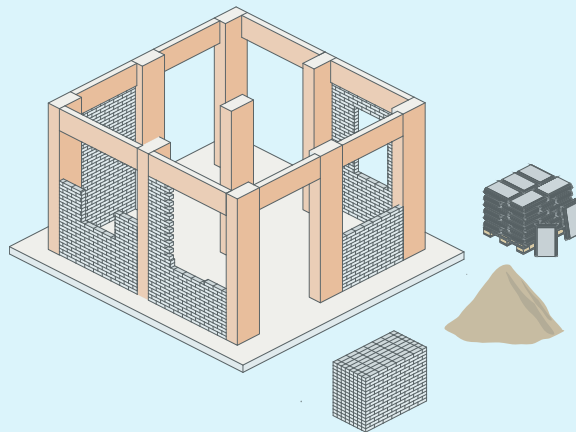


# 1

# LOW-COST HOUSING BUILDING TOOLKIT

I'm stuck! My house construction can't continue anymore. I have exhausted most of the money because I did not prioritise properly

Don't worry! Follow my lead and let's learn how to proceed step-by-step in house construction with the rest of the funds



Initiative By



**PAHAL**  
A NEW BEGINNING

Name of Field Officer (FO)

Contact Number (FO)

# Planning and Costing



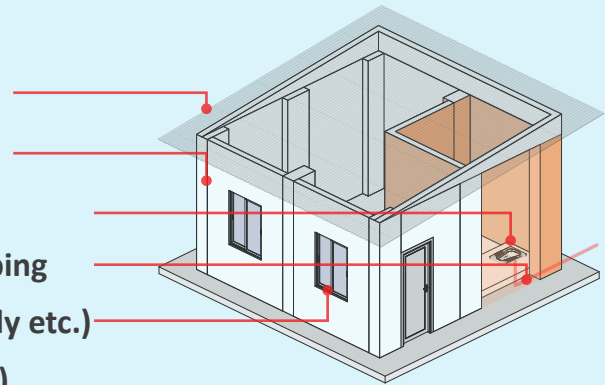
Pre-planning is important and fun! We suggest that you pre-plan your house with family members, and contractors to understand the construction stages and time for completion. This helps in planning for funds as well!

## Guide on Prioritization of Works for House Construction

Stages of Construction

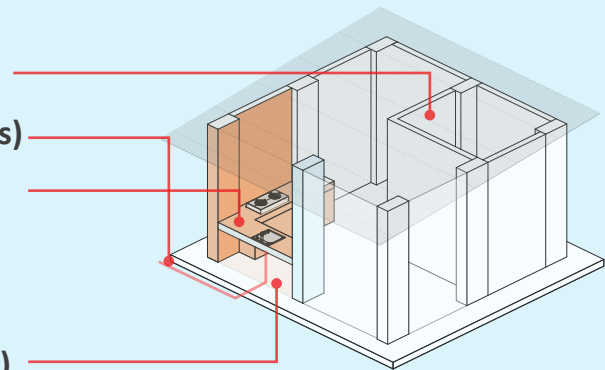
### Priority 01

- ☐ Columns and beams
- ☐ External Wall Construction
- ☐ Roof slab/sheet
- ☐ Toilets and Fixtures with Plumbing
- ☐ Services (Electrical, Water Supply etc.)
- ☐ Openings (Doors and Windows)



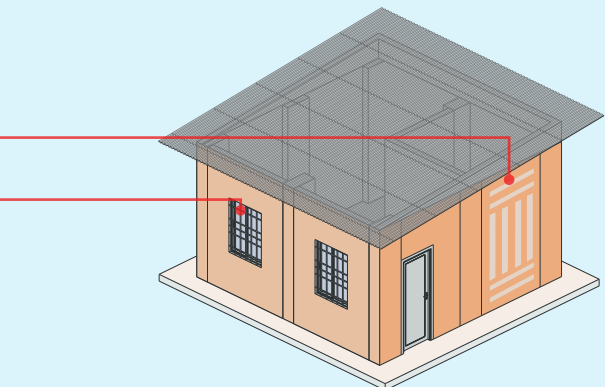
### Priority 02

- ☐ Internal Walls Construction
- ☐ Kitchen Services (Plumbing, Gas)
- ☐ Kitchen Slab and Storage
- ☐ Washing Area (if necessary)
- ☐ Plastering and Painting
- ☐ Flooring (Tiles, Stone, Concrete)



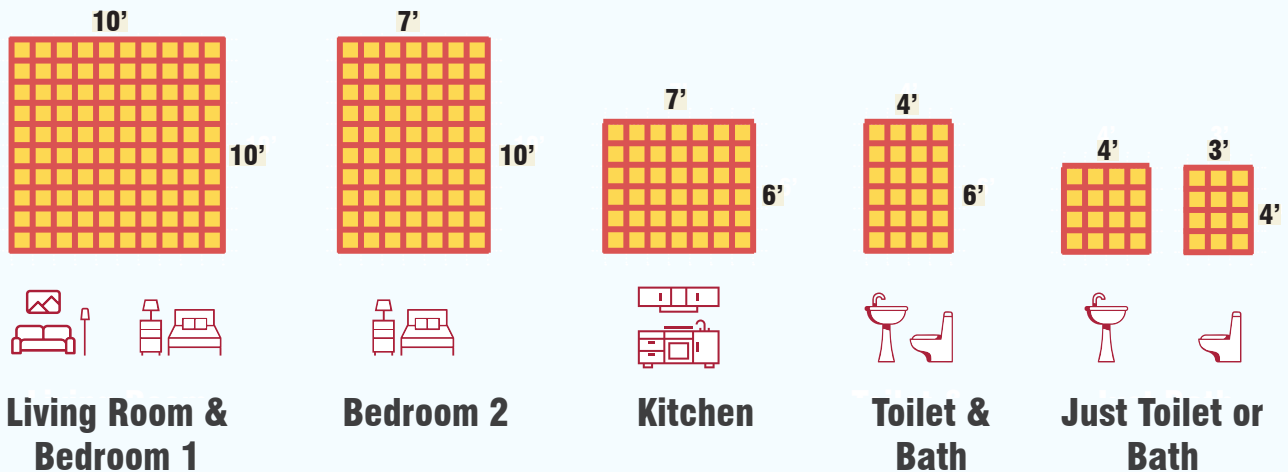
### Priority 03

- ☐ Facade Design and Finishing
- ☐ Metal Works (Railing, Grilles)
- ☐ Waterproofing
- ☐ Heatproofing

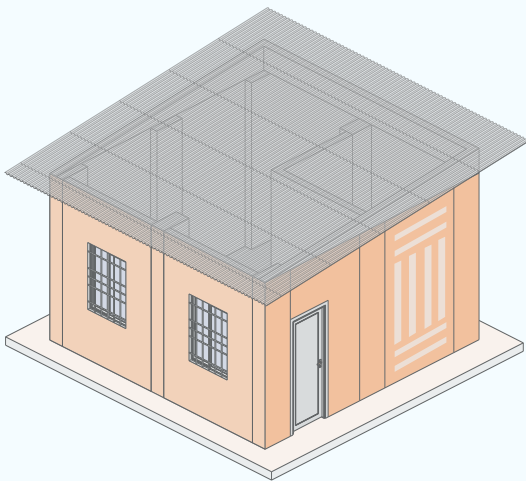


\*Note - These pamphlets are only meant to serve as a guide to affordable and sustainable home construction. Always consult an experienced professional prior to any construction work.

## Minimum Area Requirements : Rooms



## Financial Planning for your house construction



R.C.C construction costs:

- For complete house : ₹ 1800 - ₹ 2500 per Sq.ft
- For without services : ₹ 1200 - ₹ 1500 per Sq.ft

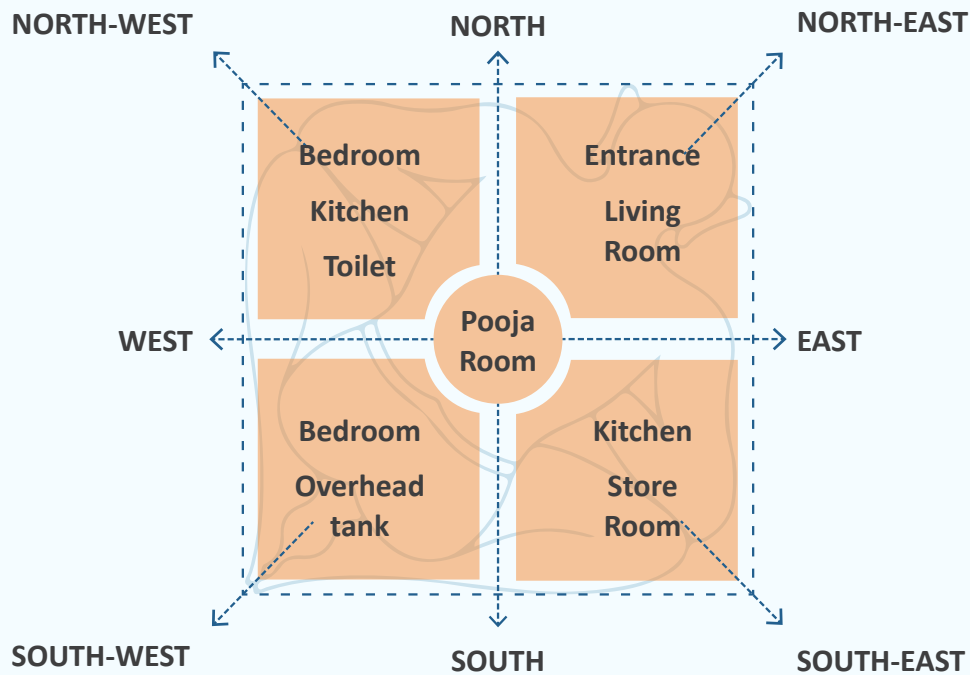
Estimated cost of construction

$$= \text{INR } \{(\text{Builtup area in sqft.}) \times (\text{Cost per sqft})\}$$

Please fill in the details below and share them with Pahal's Relationship Manager to discuss financing options

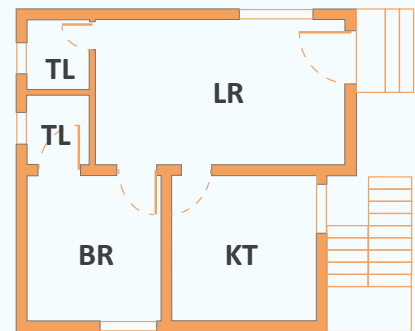
## Let's Help you in Planning your House!

- Name of Homeowner : \_\_\_\_\_
- Contact Number : \_\_\_\_\_
- Total Area for Construction : \_\_\_\_\_
- Purpose of Construction : \_\_\_\_\_
- Other Requirements : \_\_\_\_\_
- Services : \_\_\_\_\_
- Estimated Cost : \_\_\_\_\_



## Typical 1 BHK plan as per Vaastu

- One tip for designing a good floor plan is to think about the lighting and ventilation in each room; especially the bathroom and kitchen.
- Try to ensure that there are atleast 2 windows in each room.



LR - Living room; BR - Bedroom;  
KT - Kitchen; TL - Toilet

## Help us with your construction requirements so we can plan better!

### Primary Rooms

- |                                      |                                    |
|--------------------------------------|------------------------------------|
| <input type="checkbox"/> Living Room | <input type="checkbox"/> Toilet 01 |
| <input type="checkbox"/> Bedroom 01  | <input type="checkbox"/> Toilet 02 |
| <input type="checkbox"/> Bedroom 02  | <input type="checkbox"/> Kitchen   |

### Secondary Rooms

- |                                     |                                       |
|-------------------------------------|---------------------------------------|
| <input type="checkbox"/> Staircase  | <input type="checkbox"/> Washing Area |
| <input type="checkbox"/> Pooja Room | <input type="checkbox"/> Store Room   |

### Services

- |                                     |
|-------------------------------------|
| <input type="checkbox"/> Plumbing   |
| <input type="checkbox"/> Electrical |
| <input type="checkbox"/> Mechanical |

### Others

- |   |
|---|
| <input type="checkbox"/> Foundation/Plinth                        |
| <input type="checkbox"/> Masonry Walls                            |
| <input type="checkbox"/> Roofing                                  |
| <input type="checkbox"/> Finishing (Flooring/<br>Painting/Tiling) |
| <input type="checkbox"/> Doors and<br>Windows                     |

# Concrete Construction



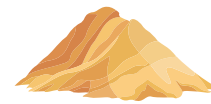
Once you decide on a house plan and budget, picking the right construction material is simpler. Let's first explore concrete for R.C.C construction!

## Concrete ratio mix

- OPC - Ordinary cement
- PPC - Portland cement



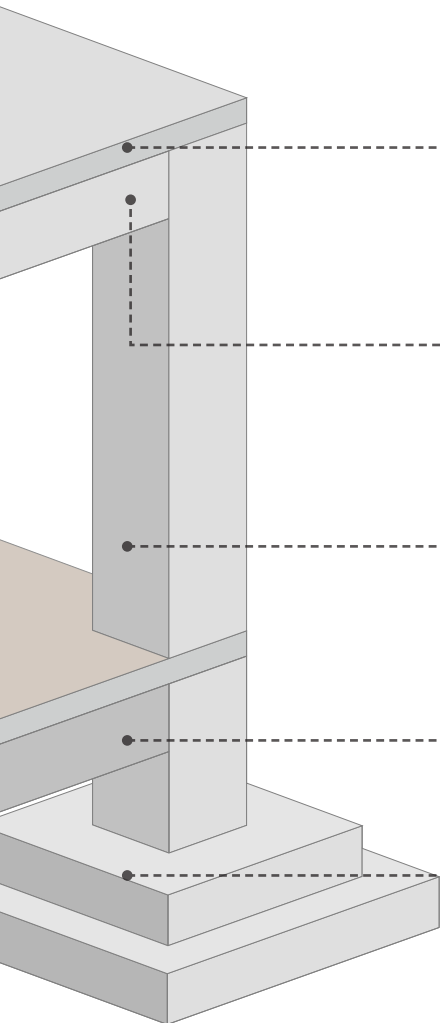
**Cement**



**Sand**



**Aggregate**



### Slab

|     |       |          |        |
|-----|-------|----------|--------|
| OPC | 1 Bag | 1.5 Bags | 3 Bags |
| PPC | 1 Bag | 1 Bag    | 2 Bags |

### Beam

|     |       |          |        |
|-----|-------|----------|--------|
| OPC | 1 Bag | 1.5 Bags | 3 Bags |
| PPC | 1 Bag | 1 Bag    | 2 Bags |

### Column

|     |       |          |        |
|-----|-------|----------|--------|
| OPC | 1 Bag | 1.5 Bags | 3 Bags |
| PPC | 1 Bag | 1 Bag    | 2 Bags |

### Plinth

|     |       |          |        |
|-----|-------|----------|--------|
| OPC | 1 Bag | 1.5 Bags | 3 Bags |
| PPC | 1 Bag | 1 Bag    | 2 Bags |

### Foundation

|     |       |       |        |
|-----|-------|-------|--------|
| PPC | 1 Bag | 1 Bag | 2 Bags |
|-----|-------|-------|--------|



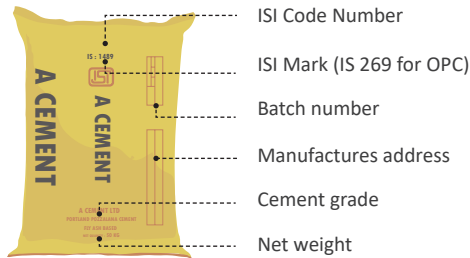
Ideally, Fe 500 & Fe 550 grade steel bars are used.

6mm to 25mm are used for structural reinforcement.

# A checklist for quality assurance during construction

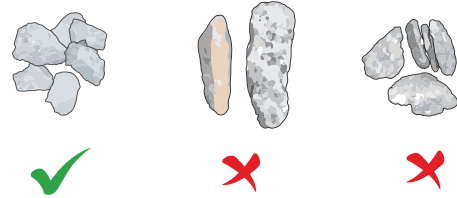
## ☐ Buying cement bags

Before buying cement please check for:



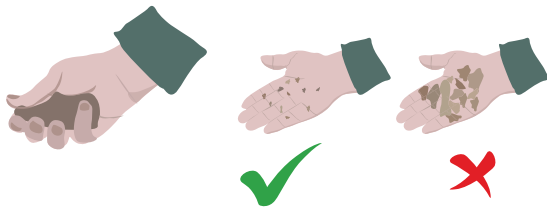
## ☐ Choosing aggregate

Coarse aggregate should roughly be cubical, not elongated or flaky.



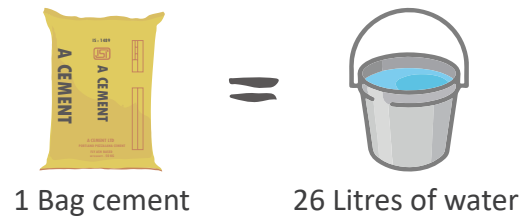
## ☐ Buying sand

Sand when squeezed by hand, leaves no stains or particles on palms



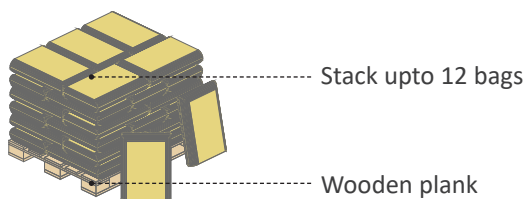
## ☐ Water for mixing

Seawater or brackish (salty) water should not be used for making RCC.



## ☐ Storage

Cement should not be kept under direct sun for long hours.



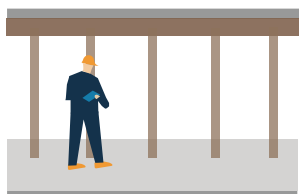
## ☐ Site Preparation

Ensure site is cleaned thoroughly before starting the project.



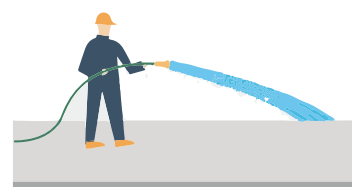
## ☐ Supervision and Inspection

Site supervision is essential to ensure timely application concrete, without any deformities.



## ☐ Curing

Hydration of concrete surfaces to be done at least 7 days to achieve desired strength before use.



# 3

Your Guide to

# Brick Construction

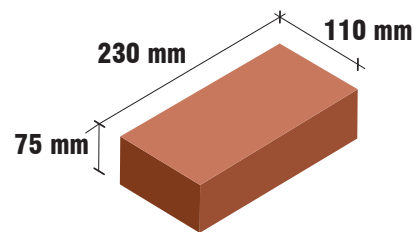
With many materials available, is brick still right for my house?

Yes! Bricks are versatile, varied, and perfect for enhancing home construction.

## Choosing the right brick for your house

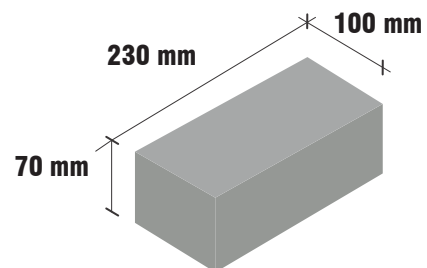
### Burnt clay bricks

- Commonly used in construction.
- Most cost-effective type of brick.
- Cost : ₹



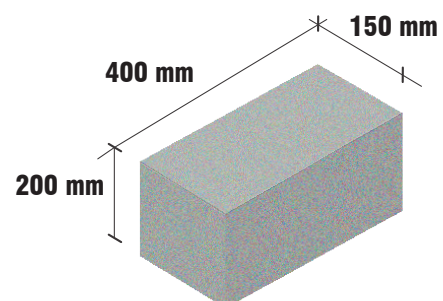
### Fly ash bricks

- Used for light weight construction.
- Eco-friendly, but costlier than clay bricks.
- Cost : ₹



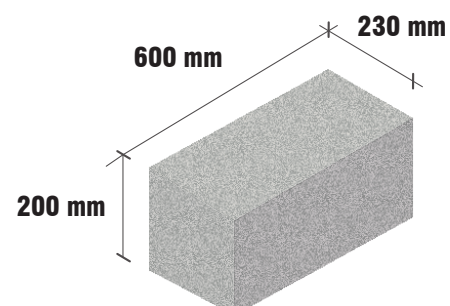
### Solid Concrete blocks

- Heavier and costlier alternative to clay bricks.
- Better water resistance than clay bricks.
- Cost : ₹ ₹



### AAC Blocks

- High heat insulating properties
- Reduce steel and cement usage for cost-effective construction.
- Cost : ₹ ₹

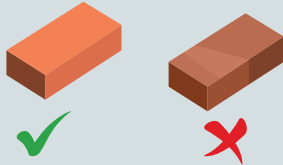


# Identifying the Right Quality of Brick

## Colour

Bright & uniform colour throughout the brick surface without any darkening.

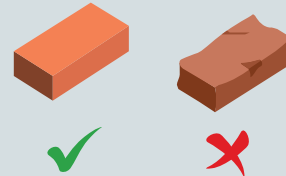
1



## Surface

Well burnt surfaces have smooth surfaces and sharp edges.

2



## Clap test

When you tap two bricks together, you should hear a ringing sound. Bricks of high quality should not break or crack when hit.

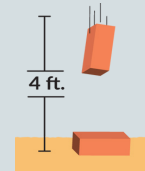
3



## Drop test

If you release a brick from a height of 4 feet, it should remain intact and not show any signs of cracking.

4



## Water weight test

When soaked in water, brick shouldn't absorb more than 15% of its weight.

5



## Scratch test

There should not be any scratch left on the brick when scratched with a fingernail.

6



## Things to consider during brick construction

- ☐ **Pre-Planning:** Estimate the quantity and type of brick required before construction.
- ☐ **Weather Conditions:** Brick construction shouldn't happen during extreme rains.
- ☐ **Curing:** Bricks with cement mortar require considerable time for curing to attain desired strength. Make sure that brick masonry walls are cured for 2-3 days.
- ☐ Brick construction is **time consuming**, so make sure the process has been well planned.
- ☐ Bricks are not recommended to be used in places with **high seismic activity**.

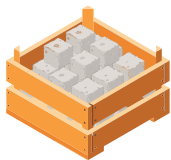
## How-to's for

# Stone Construction



Before we jump into details, let's understand where and how to decide whether stone is the ideal material for your house, through these factors..

## Things to consider before choosing stone



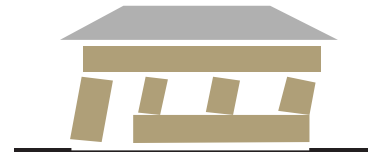
### Material Availability

Use stone if locally abundant.



### Skilled Labour

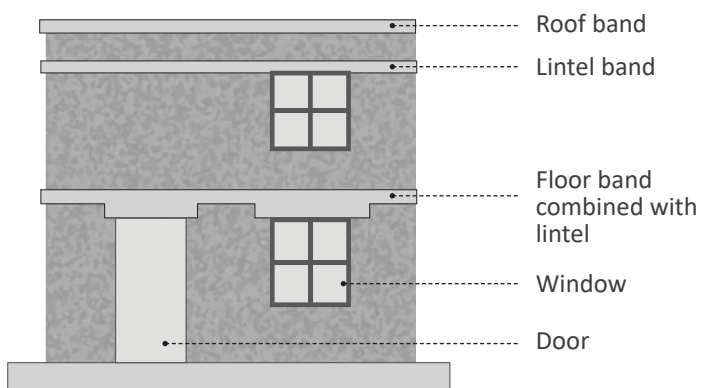
Stone works need skilled labour, and is expensive.



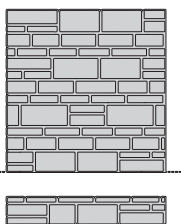
### Earthquake Prone

Don't use stone in high seismic zones.

## Working with stone masonry

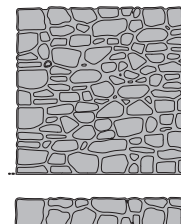


- Seismic bands can be provided at plinth, lintel, floor and roof levels
- A reinforced concrete plinth band should be provided atop the foundation
- A seismic band must be continuous.



### Ashlar Stone Masonry Walls

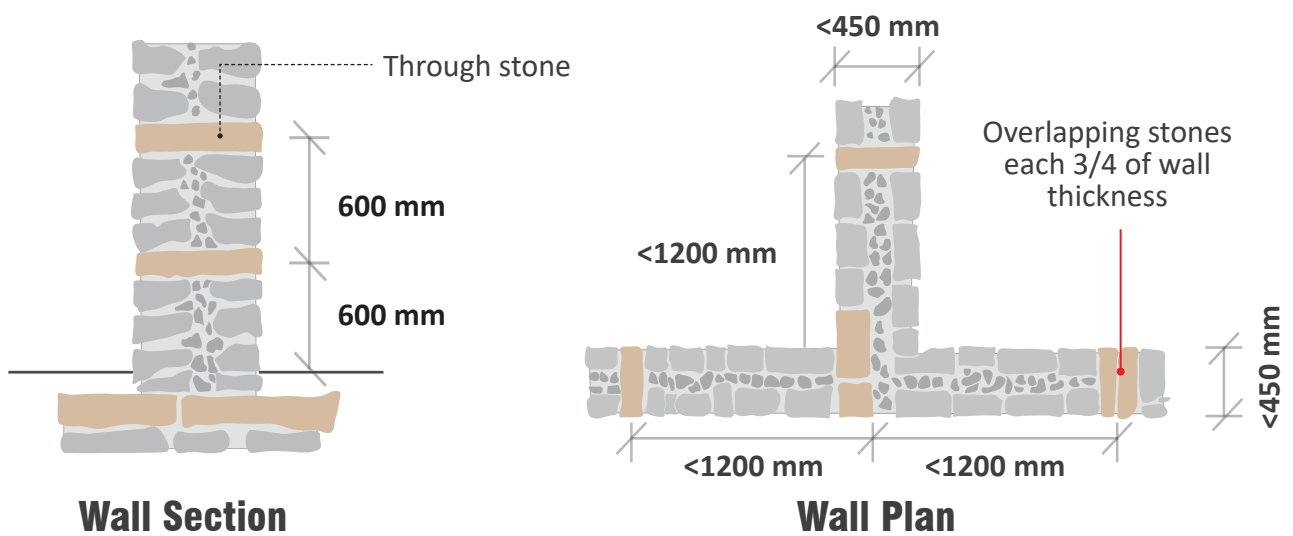
Stones are cut in precise shape and size, with uniform smooth finish.



### Rubble Stone Masonry Walls

Stones are of natural shape and size.

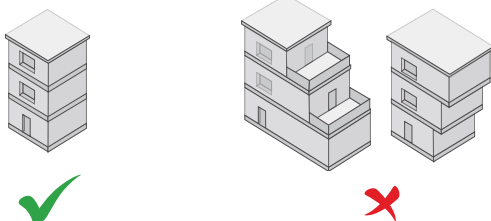
# Stone Masonry Wall Construction



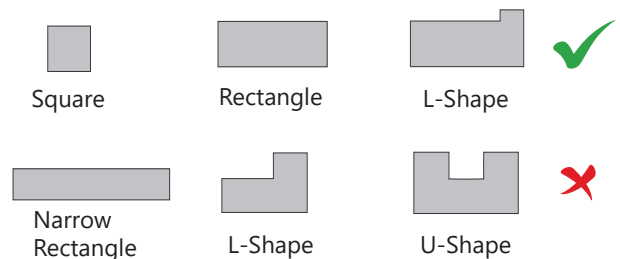
## Things to consider during stone construction

### ☐ Building restrictions

Setbacks or overhangs not recommended

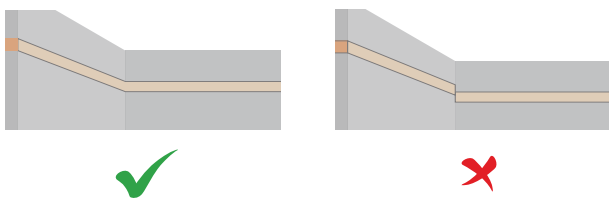


### ☐ Building configurations



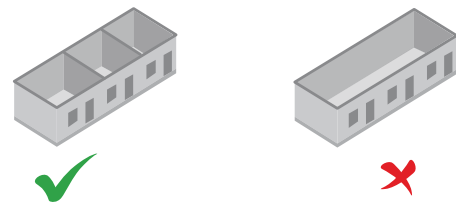
### ☐ Seismic Bands

Seismic bands should always be continuous



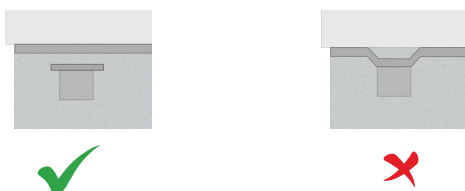
### ☐ Wall length Restrictions

Well-distributed cross walls are a must.



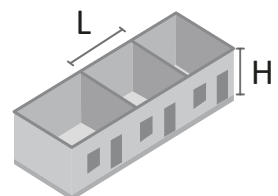
### ☐ Seismic Bands

Must stay level without height variations.



### ☐ Recommended length for wall

- 7m (L) x 3.5m (H) in cement mortar
- 5m (L) x 2.7m (H) in mud mortar

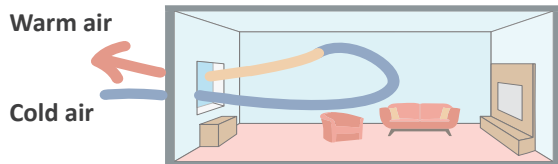


\*Note - These pamphlets are only meant to serve as a guide to affordable and sustainable home construction. Always consult an experienced professional prior to any construction work.

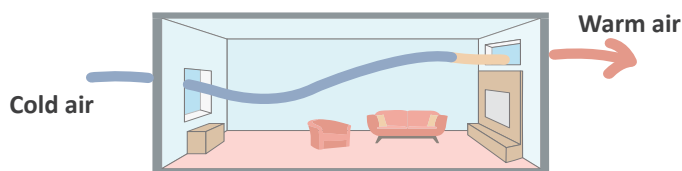
# 5 Ventilation & Openings

## Guide to Planning for Doors and Windows in your house

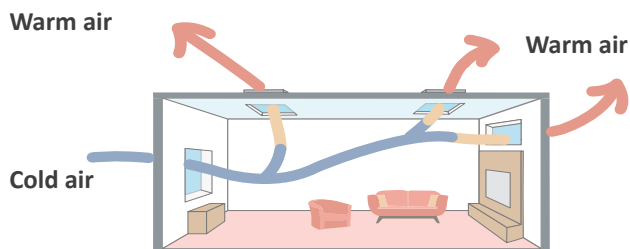
### How to Naturally Ventilate your house ?



Single sided ventilation

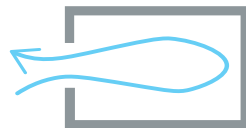


Cross ventilation

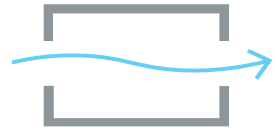


Stack ventilation

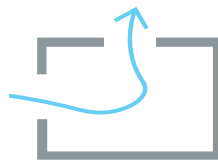
#### In plan



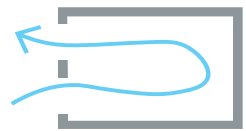
Single opening



Two openings  
Opposite walls



Two openings  
Wing walls

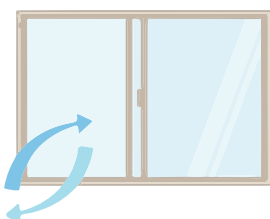


Two openings  
Same walls

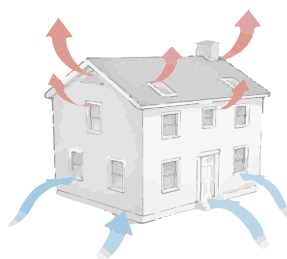
- By placing a window on both sides of a building/room, you create a pressure difference between the two sides.
- This means that one side of the building brings in cool air, while the other side releases warm air.

### Improving Natural Ventilation

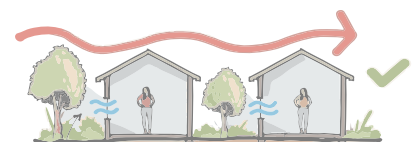
1 Large openable windows for coastal areas



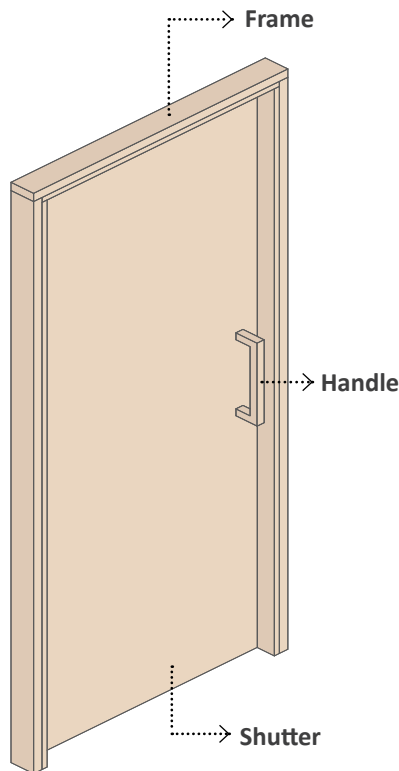
2 'Chimney effect' is used for drier climates



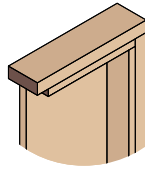
3 Landscaping can be used to enhance or diminish ventilation.



## Choosing between different types of doors



### Wood



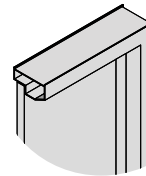
Cost



Durability

50 years

### Stainless steel



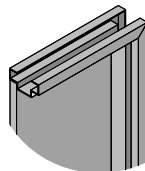
Cost



Durability

40 years

### Aluminium



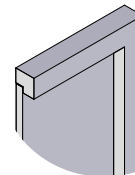
Cost



Durability

50 years

### Concrete



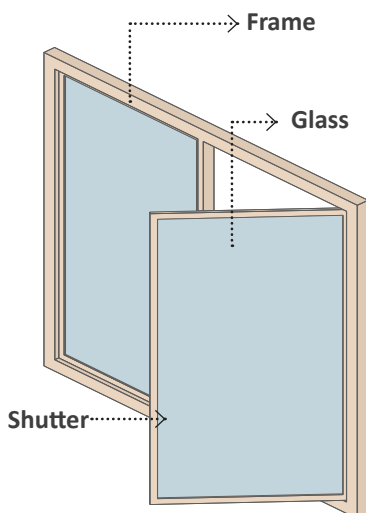
Cost



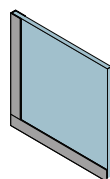
Durability

60 years

## Choosing between different types of windows



### Aluminium



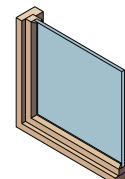
Cost



Durability

50 years

### Wood



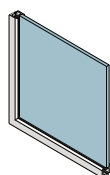
Cost



Durability

40 years

### Stainless Steel



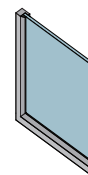
Cost



Durability

30 years

### Concrete



Cost



Durability

50 years

\*Note - These pamphlets are only meant to serve as a guide to affordable and sustainable home construction. Always consult an experienced professional prior to any construction work.

# 6

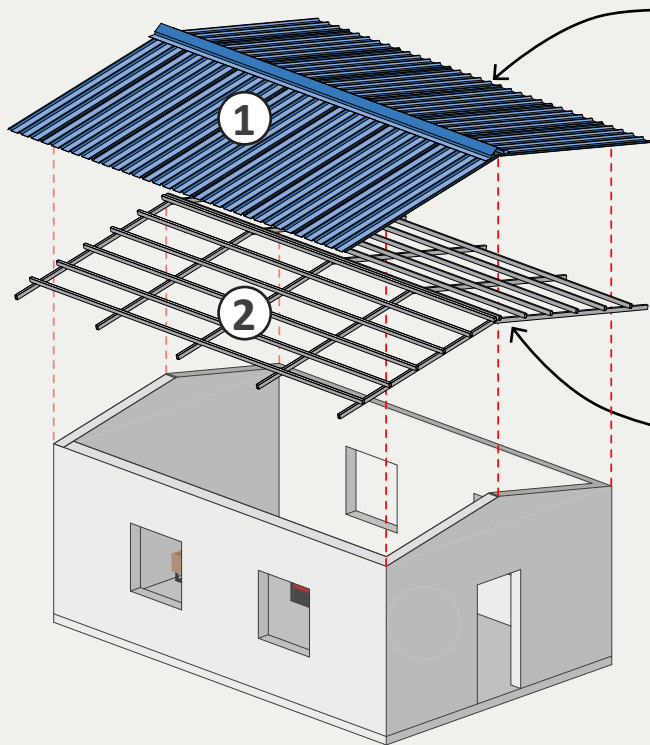
# Building with Metal

## Guide to Metal Sheet Roofing

Metal roofing involves not just the sheet but also the frame support as well as the joineries and bonds. Let's explore how we can build a permanent, durable and resilient metal roof..



### Components of Metal Roofing

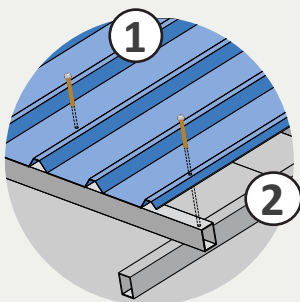


#### 1. Metal Sheet Cover

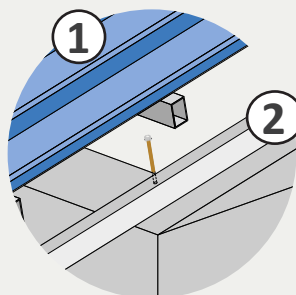
- Galvanised Iron (GI) Sheet
- Aluminium Sheet
- Stainless Sheet

#### 2. Metal Support Frame

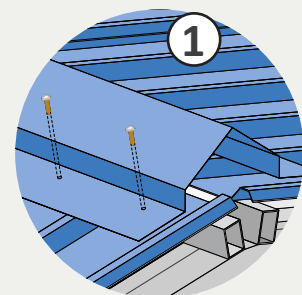
- Mild Steel (MS) Frames
- Stainless Steel (SS) Frames
- Aluminium Frames



**Metal roof and purlin fixing**



**Rafter and wall fixing detail**



**Ridge fixing detail**

# Choosing the right metal sheet for your roof

## Galvanised Iron Sheet

Most commonly used metal sheet for **small to medium scale** domestic use

### Cost (per kg)

INR ₹

## Aluminium Sheet

Used in high end **residential** and **commercial** areas for lightweight construction.

### Cost (per kg)

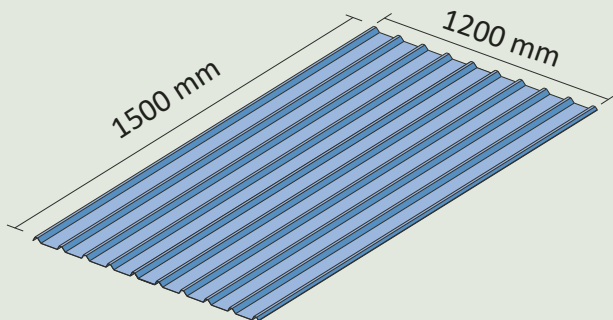
INR ₹ ₹

## Stainless Steel Sheet

Used in high end **residential** and **commercial** for all purposes.

### Cost (per kg)

INR ₹ ₹ ₹



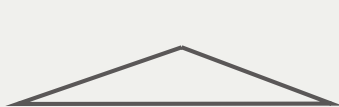
GI Sheets are widely used for metal sheet covers both during construction as shuttering as well as roofing. These are generally 3 mm thick



## Things to consider while working with Metal

### ☐ Pre-Planning

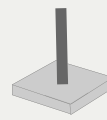
Plan your roof construction before starting to build.



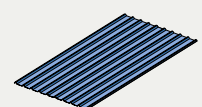
Size and slope of roof



Number of supports needed



placement of supports on ground



Type of sheet

### ☐ Finishing works:

Fastening or welding should be done such that there are no visible gaps or spaces between joints or between supports and surfaces. In case of gaps, use adhesives and sealants in corners and gaps to waterproof the surface.

### ☐ Proofing/Coating:

**Apply Reflective paint to reduce heat gain on roofs and use MS frames to ensure longevity and durability of the frame structure.**

# 7

# Finishing Works

Guide to Flooring and Wall Finishes for your house

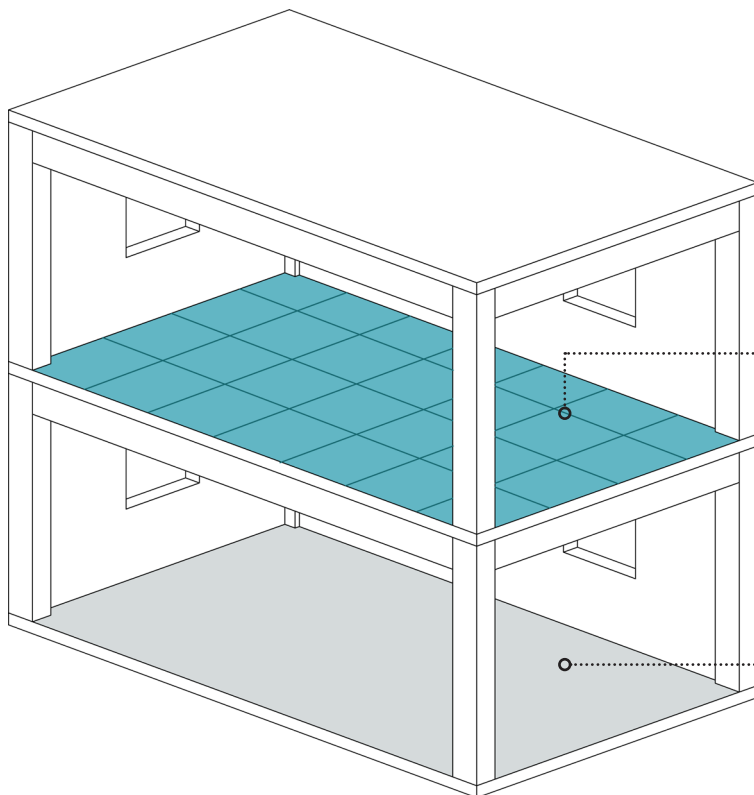


Wow my house is almost done! I am so excited to move in! But it looks quite plain..

Finishing is what makes your house beautiful. It is the one place where you can try and get materials to your liking. You can get opinions from your family too to decide on these items.



## Flooring: Material Selection and Specifications



Flooring is a permanent covering in the interior of the house over the floor slab with a finished material to provide a smooth and even walking surface.

### Ceramic Tile Flooring

#### Available Sizes

12"x12", 16"x16", 18"x18" and more

#### Cost

Cheap flooring material, but more expensive than concrete flooring

### Concrete Flooring

#### Available Sizes

Concrete poured and spread as per dimensions of slab

#### Cost

Most cost-effective flooring

We recommend that you finish the flooring before beginning to paint your house.

## Painting

Applied to buildings for aesthetic value, surface durability, chemical protection, and pest protection.

Painting reduces water seepage in walls.

Paint should be applied with on plastered surface to get a smooth finish.



**Mix the plaster**



**Apply Plaster**



**Sand the surface**



**Apply Primer**



**Mix the paint**



**Apply min. 2 coats of paint**

Avoid VOC paints!  
VOC is harmful for  
your health Instead,  
ask for ECOS paint.

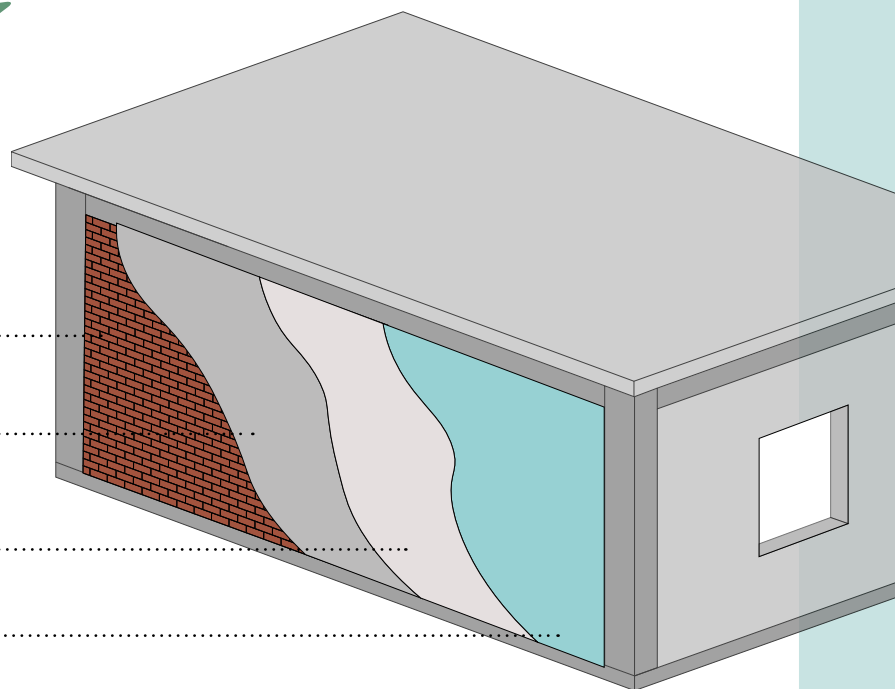


9" (230mm) thk Brick wall

6-12mm Plaster  
(for Internal & External walls)

Primer

Plastic Paint (min. 2 coats)



**Prepare the surface**



**Mix the tile adhesive**



**Apply the adhesive**



**Lay the tiles**



**Adjust the levels**



**Grout the surface**

## Tiling

Tiling is durable and waterproof, needing only regular cleaning.

Ceramic tiles, available in various colours, designs, sizes, and thicknesses, are applied on smooth concrete.

For new tiling work, make sure to use a waterproofing chemical before laying the tiles.

# Plumbing & Sanitation

## Guide to proper sanitation in your house

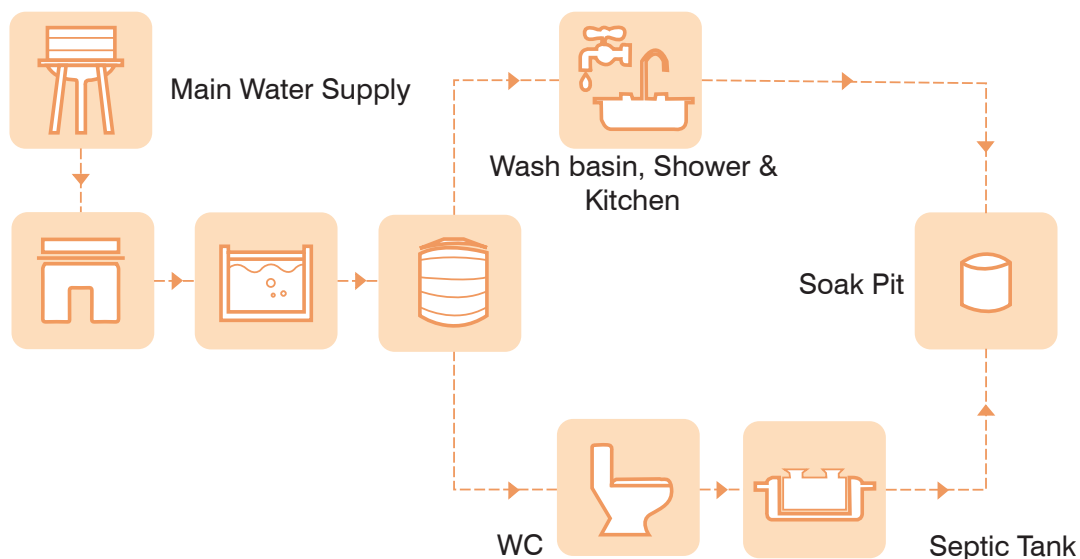


There are so many components to plumbing? What are they? How do we do it right?

**Proper plumbing ensures hygiene by preventing water leakage and stagnation in toilets and kitchen areas.**



## Water Supply and Discharge System



Proper supply of clean water and drainage of waste water helps keep your home clean and hygienic. Metal pipes, though cheaper, are subject to corrosion and damage. Therefore, you may consider PVC pipes for water supply and drainage in your home.

## Underground Sump

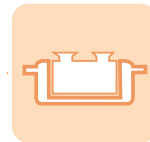


Used for storage of  
freshwater for domestic use

## Overhead Tank



## Septic Tank



## Soak Pit



Used for treating waste water discharged from domestic use

**Remember to maintain a sufficient distance of at least 30ft (9m) between septic tank and borewell, so as to reduce contamination of ground water.**



# Your Guide to Plumbing in Kitchen and Toilet

## Things to consider during bathroom plumbing works

### ☐ Underground Pipes

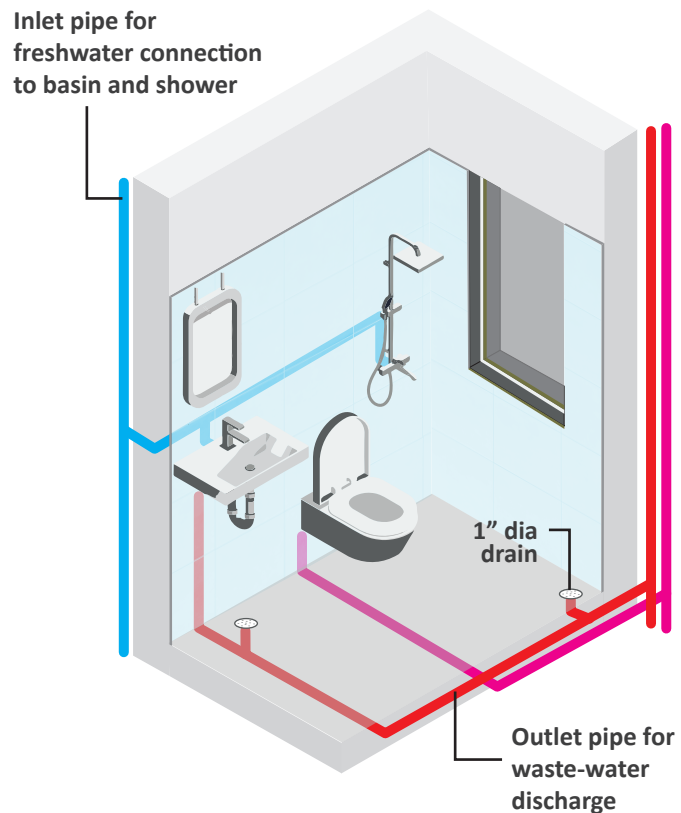
Ask your plumber to test the inlet and outlet flow of freshwater and waste water once underground pipes are laid.

### ☐ Installing drains and vents

Drains and vents are usually **1-1.15 inch** in diameter. Pipes must have gradual slope to drain efficiently.

### ☐ Waterproofing

The joints between floor and walls are vulnerable points for water seepage. Use a sealant or tape to seal the joints thoroughly.



## Things to consider during kitchen plumbing works

### ☐ Location of Sink

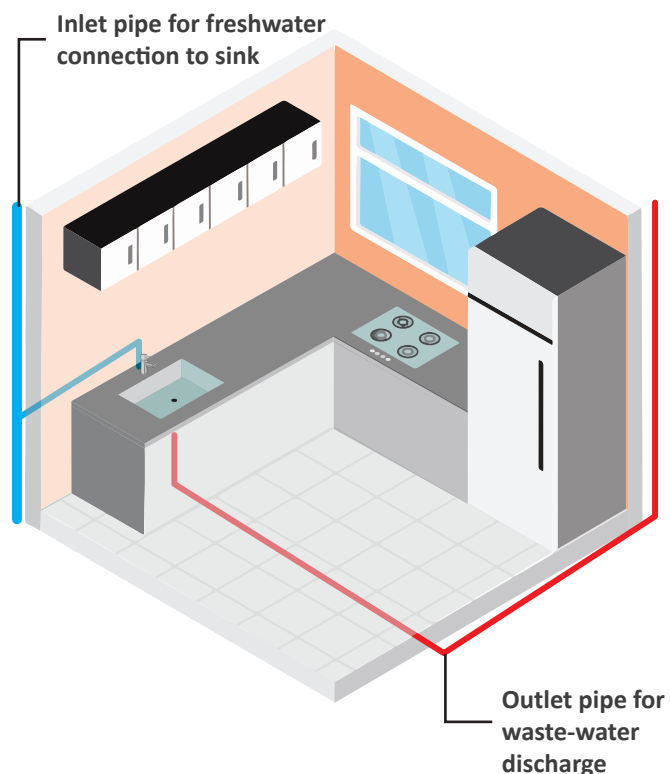
The location of sink drain should be ideal for inlet and outlet pipes.

### ☐ Piping

Ask the plumber to check the connections of the sink faucet and the water flow through the pipes.

### ☐ Final Testing and Proofing

Make sure that water doesn't overflow from the drain and gaps around the drain are filled with white cement.



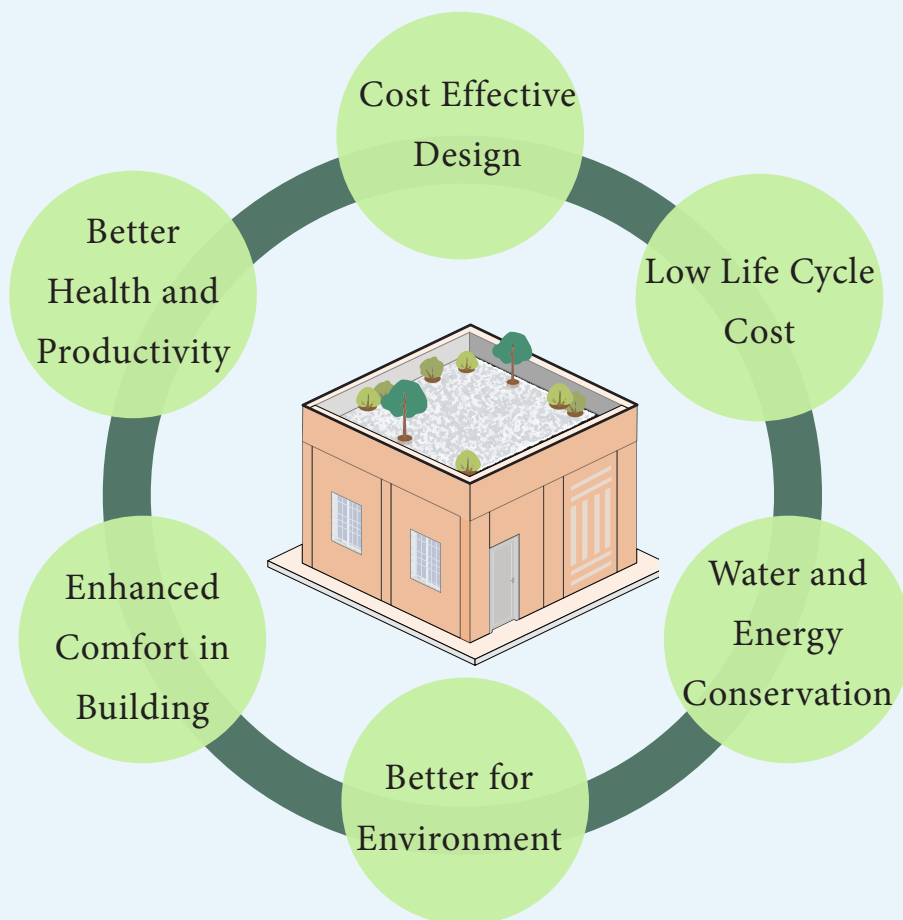
# Sustainable Building

Eco-friendly construction for healthier environments



Did you know that green construction practices can not just enhance comfort and reduce environmental impact but also lower costs!?

That's great to hear!  
Can you explain more about this 'Green Building'?



A green sustainable building is an eco-friendly structure that minimizes environmental impact, optimizes resource efficiency, enhances occupant comfort, and achieves cost savings through energy efficiency, water conservation, and sustainable materials. These features lead to lower utility bills and greater economic viability.

Initiative By



**PAHAL**

A NEW BEGINNING

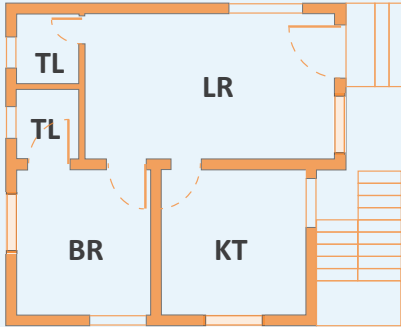
Name of Field Officer (FO)

Contact Number (FO)

# Green Building Construction

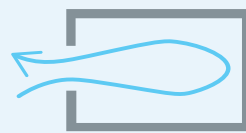


## Tips for green construction from pamphlets



- One tip for designing a good floor plan is to think about the lighting and ventilation in each room; especially the bathroom and kitchen.
- Try to ensure that there are atleast 2 windows in each room.

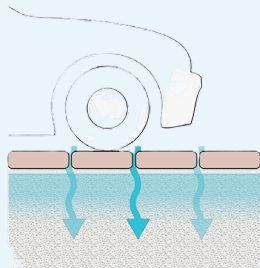
- By placing a window on both sides of a building/room, you create a pressure difference between the two sides.
- This means that one side of the building brings in cool air, while the other side releases warm air.



Single opening



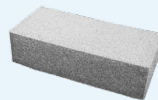
Two openings  
Opposite walls



- Use permeable materials for Parking, driveways and walkways to allow rainwater to seep into the ground, reducing runoff and recharging groundwater.



- Avoid VOC paints! VOC is harmful for your health. Instead, ask for ECOS paint.



- Use Fly Ash bricks as they are made from recycled materials.



- Use recycled or non-potable water to reduce use of potable water in concrete works.



- Incorporate recycled materials from other construction sites whenever possible.



- Please make sure to use water meters to keep the track of water usage in case of any leakage.

\*Note - These pamphlets are only meant to serve as a guide to affordable and sustainable home construction. Always consult an experienced professional prior to any construction work



That's Interesting, Could you tell me more about this Green building techniques and how can I do it more effectively.

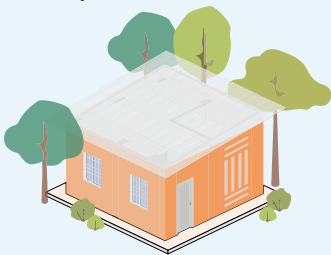
Sure Why not !  
Here are few eco-friendly, energy-efficient techniques available for various construction stages



## Eco-friendly measures for low-cost construction

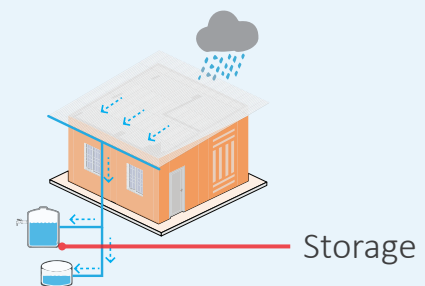
### ☐ Vegetation

- Retain existing trees on site.
- Native plants reduce water consumption.



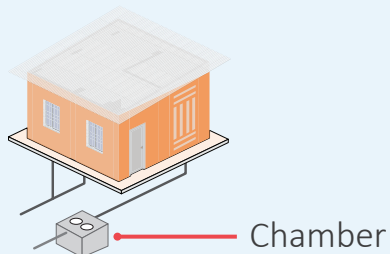
### ☐ Rainwater Harvesting

- Collecting, storing, and using rainwater for irrigation, washing, drinking.



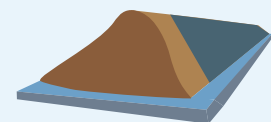
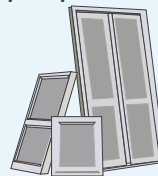
### ☐ Reusing grey water

- Non-toilet waste water reused in gardens, toilets, laundry.



### ☐ Reuse of old materials

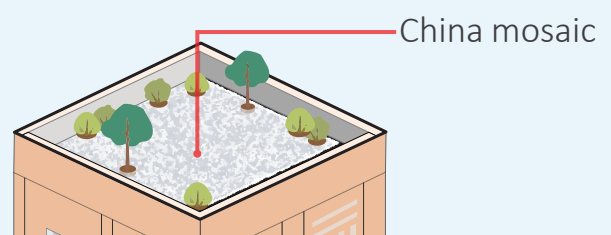
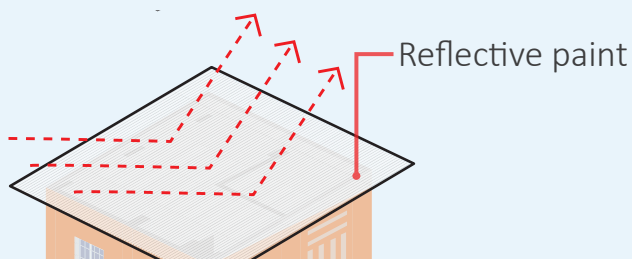
- Reuse old building materials; preserve topsoil for landscaping purposes.



Top soil

### ☐ Reducing heat gain on roofs

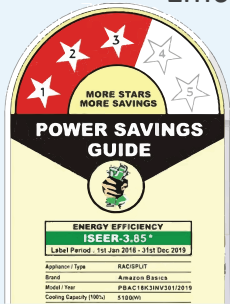
- Painting roofs with high SRI paints, increasing shading, and using china mosaic reduces roof heat gain.



## Purchasing energy-saving appliances & fixtures

Solar energy and BEE 3-star fixtures lower electricity bills;

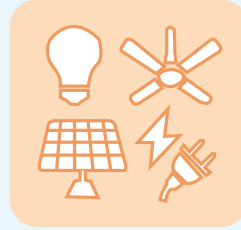
Efficient plumbing includes aerators, dual flush cisterns.



**BEE 3-star rating**



**AC, Fans**



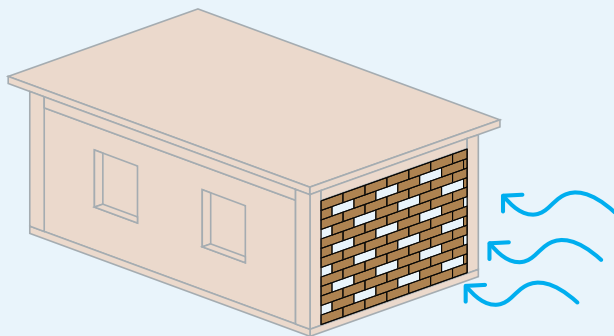
**Solar devices**



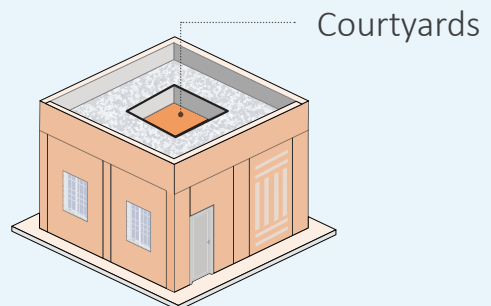
**Plumbing**

## Cost, material and energy saving construction practices

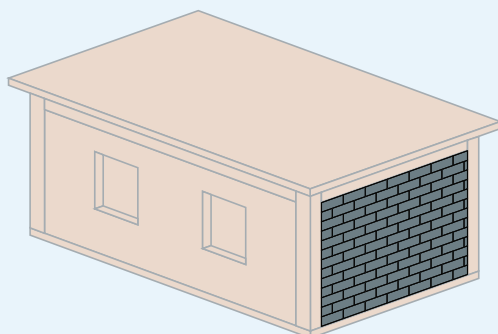
- **Jali walls** enhance light, ventilation, and aesthetic appeal in buildings.



- **Courtyards** optimize sunlight, reducing need for artificial lighting in buildings.



- Use fly-ash based blocks/hollow blocks for **external walls**



- **Filler** slabs conserve energy and reduce material usage in construction.

