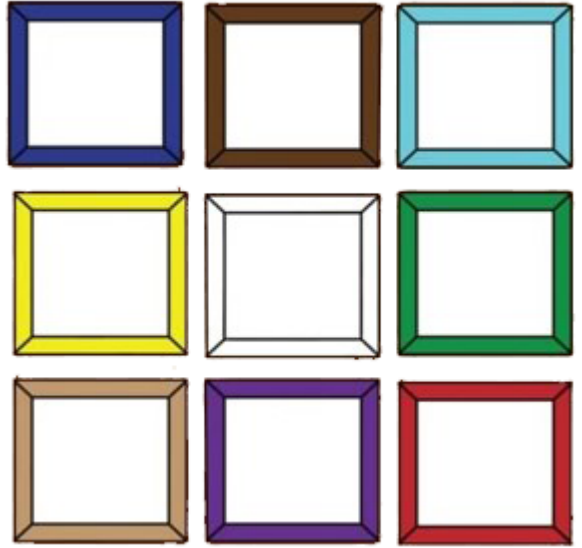
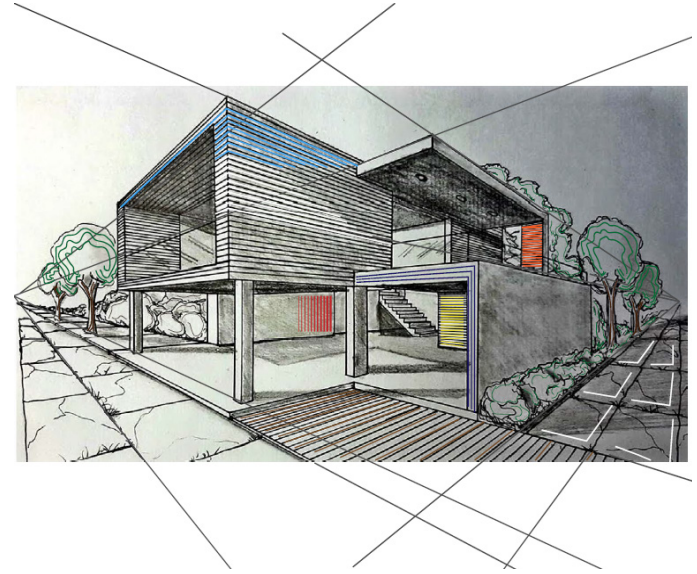




CONSTRUCTION DEMYSTIFIED

AR. SANTOSH BAFNA



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Practical Insight to Construction

AR. SANTOSH BAFNA

About the Author

Santosh Bafna is an architect and interior designer who has designed commercial corporate office buildings, prefabricated industrial sheds and residential projects. Her zeal and love for designing spaces has shaped her career and created a niche for herself in the field of designing. She has also taken up interior projects of both office spaces and residences.



With an enthusiasm and responsibility towards the environment, she has taken up renovation projects where reuse of waste material, reduce carbon emission and minimum use of natural resources and recycling is incorporated effectively.

She completed her Bachelors of Architecture from BMS College of engineering Bangalore (1994-1999)

She has a passion for detailing, quality workmanship and a human approach to design. She has a passion for hobbies like reading, trekking, music, health and fitness, swimming, badminton, art and craft and painting. With her creativity and knowledge she would like to blend sustainable architecture and design with modern living standards. Giving it a win- win approach to design, space, aesthetic, lifestyle and environment at large.

“Form Follows Function”, the famous quote by Louis H Sullivan is what she believes in and all her architectural designs follow.

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Preface

“Take one step at a time and you will reach your goal “

This is so true in the construction of any structure .That this is a journey of two dimension drawings taking three dimensional forms. This book will be an insight for people who have yet to travel on this path.

This is a handy booklet which gives an idea as to how to go about the different stages of construction. I have tried to make it very simplistic and easy to understand the different construction stages and the little things to take care about when we go about the different stages. This booklet will help a person with little to no knowledge about construction.

This booklet includes everything, from the substructure, to the superstructure and basically the overall construction phase of any building involving plaster, painting and waterproofing. This will help anyone trying to embark on a construction project while keeping in mind important details like vastu and other points often skipped by people.

Once you have decided to start your journey of building then start making a list of your requirements based on your need and necessity. When you approach an architect then this will surely help the architect to understand your need and with his help you surely will reach your GOAL.

Good workmanship and good quality products not only increase the life of the structure but also provide hygienic and aesthetically pleasing environment to reside in.

I would like to acknowledge someone with deep knowledge of vastu based on practical experiment, experience and research (no bookish knowledge). I would also like to thank my family and extended family for supporting me in this wonderful journey. The experiences I have gained through different kind of projects, I have tried as much as possible to put them into words.

Thank you

Sub Structure

Define

Any structure below the ground level is the substructure. It consists of foundation for your building, footing for the columns, Reinforced cement concrete (RCC) walls for basement and walls below the ground level. Basement and parking, no matter how many levels, if it is under the ground then it is included in the sub structure.

Importance

The way there are roots of a plant which gives the plant firmness and support, that's the way substructure is for a building. It plays a very important part in the load distribution of the super structure, though hidden from view it's a critical part and needs special designing and protection from water and dampness.

An Architects role here is to investigate programmatic considerations such as the building codes, zoning codes, parking requirement, sign ordinances, access to public transportation, landscape requirement, handicap accessibility, and many non-physical considerations.

Substructure Stages

1. Before excavation we may have to go for soil testing if the site demands it, like clayey soil will require testing.

Excavation – On excavation tons of underground sand is dug, so will need to manage that by disposing it or retaining it for refill, especially if site is small and has problem of space.



2. Leveling & Plain cement concrete (P.C.C) for foundation - Leveling is another critical element for durability of building. In PCC we use mixture of cement, sand and aggregate as specified. This needs to be cured for 14 days.

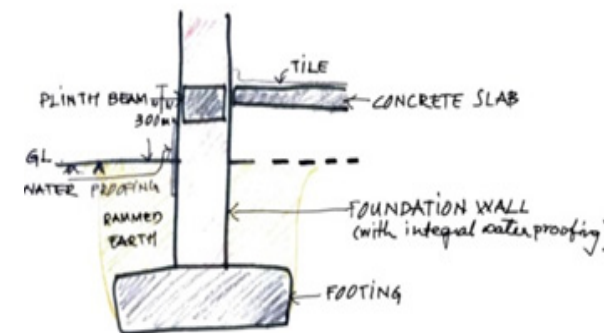
3. R.C.C. for foundation - RCC is the use of reinforcement for foundations which are specified by the structural engineer.

4. R.C.C. columns up to plinth level - Here according to the size of the column, the form work is done and with the use of steel, cement, aggregate and sand, the column is completed.

5. We should give proper curing time for the cement to bond well, so as to prevent future cracks in the building.

6. For load bearing structure after PCC (according to the structural drawing supplied by the structural engineer), bricks are laid in trenches with decreasing width as we come towards the ground up to the plinth beam.

SUB STRUCTURE



7. Underground tank – Firstly will need to decide on the capacity, based on the usage of the building.



Here proper integral waterproofing and upper coating of waterproofing is important to prevent future water seepage problems. Placing of underground submersible or other motor should also be considered at this point.

Tank cover should be such that it will not allow dirty water to get in from the ground during rains.

The extra excavated trench which is filled with sand should be given proper time for natural compaction. If there are no rains, then we will need to provide lots of water to the filled earth so that it settles and becomes hard. This will prevent sinking of super structure during heavy rains. This place a very important part in the durability of the structure.

Also should ideally plan excavation and completion of the substructure below plinth level before monsoons.

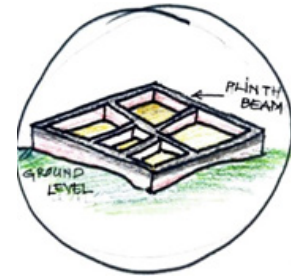
Mistakes to be avoided based on Vastu during construction

1. Always do the boundary first, followed by underground tank.
2. Always dig from north-east portion of the site and start constructing from the south-west portion of the site. This enables smooth execution of work on site. If digging columns then start digging from north-east and start footing etc. from the south-west.
3. Checking the 90 degree at corners is very important not only because of Vastu but also gives a first class construction of the super structure.
4. Always make sure site is free of unwanted material and north-east section of the site to always be spic and span.

Plinth

Define

Level at which the plinth beam ends is the plinth level of a building. It should be minimum 1ft from the ground level. It also acts as a tie beam for the sub structure and above this starts the super structure.



Importance

Plinth height is taken to protect the super structure from dampness due to contact with ground. At the plinth level we have the damp proof course giving additional protection to the building or else water seeps into the structure due to capillary action. Plinth is important as if there is a

settlement in the foundation and any crack developments then it prevents the cracks from rising up to the super structure and distributes the top load evenly over the foundation below.

Plinth Stages

1. Casting of plinth beams –shuttering and centering is done followed by reinforcement, before pouring concrete mix with waterproofing chemical.



Plinth Stages

1. Casting of plinth beams –shuttering and centering is done followed by reinforcement, before pouring concrete mix with waterproofing chemical.

2. Plinth filling – Backfilling the trench using well-draining material to help keep the basement dry. Sandy or gravelly soil is preferred; soil containing clay and organic matter should not be used.

3. Damp Proof Course water proofing which is done over the plinth beam uses a polymer-based compound.

Mistakes to be avoided based on Vastu during construction

1. After form work start filling the beam from south-west part of the building.

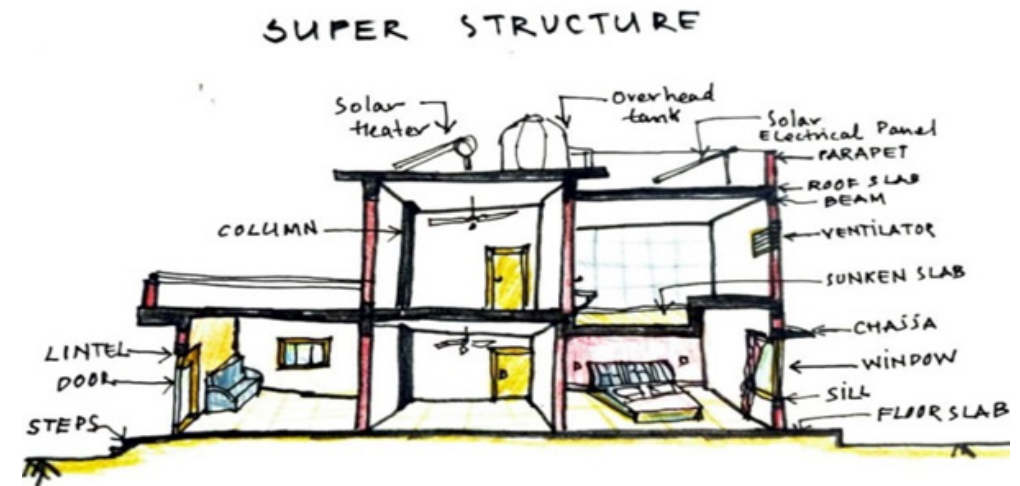
2. Checking 90 degree is important at this stage too.



Super Structure

Define

The columns, beams, slab, sill, lintel, chajja, masonry and parapet form the components of super structure as they lie above the ground level. These elements help to transfer loads to the sub structure



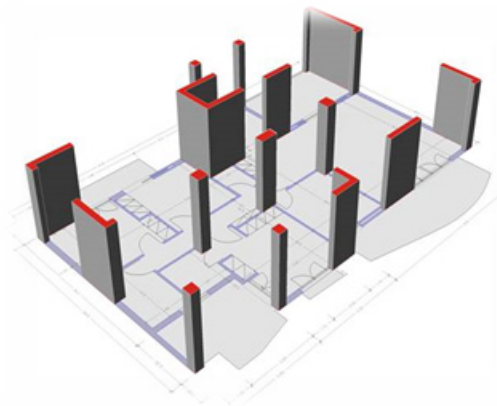
Super structure defines that space which needs to be designed and used by the user.

Super Structure Stages

1. Walls and Columns

Columns transfer the load from beam to the sub-structure. It takes the vertical load of the structure.

Walls are those which define and differentiate space in the super structure, they can be built of red brick or fly ash bricks. Use of fly ash bricks is good for the environment and saves a lot of labour as curing is not required. Bigger bricks are available which are lighter, thus the speed of workmanship increases. Quality of wall is also



very precise, so that saves a lot of material even during plastering. The juncture of the column and brick (red) gives way to cracks which are visible after some time. Hence, it is ideal to place a mesh during plastering to give strength to the juncture. Fly ash bricks does away with these issues too.

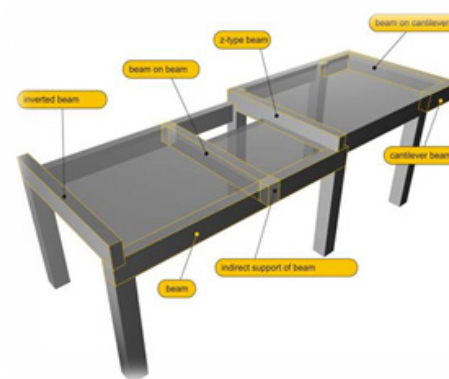
As we use cement in construction, curing of the structure plays a major role in the strength of the structure.

Mistakes to be avoided based on Vastu during construction

1. Try keeping bigger and wider openings like balconies and large windows in the north and east of the building.

2. Walls to be made in vertical plum-line always. Fly ash bricks are a good idea for this.

3. Check 90 degree and straightness of the wall at all levels .A good workmanship will give better quality of construction and final finish.



2. Floor Slabs

Floor defines the different levels your building consists of and here we walk around and place our furniture .Floor space index (FSI) is what determines the legal area which you can build. It is on this which your ground coverage is decided on. FSI depends and varies according to the city and population of a place.

Floor area FSI =Total area of all floors (this includes carpet area +walls+ balcony) divided by the total plot area.

Set-backs and height has to be considered depending upon the road width of the plot. Ground coverage and parking need to be considered when planning your building.

Carpet area-This is the actual area which we use in a dwelling (usually 70%of BUA)

Built up area (BUA)-this includes carpet area, balcony and wall area

Super built up area-This includes BUA and common area. Some may also include amenities like pool, garden and club house. More the amenities more the super built up area. Builders generally charge on SBUA.

Fire and lift areas to consider only once for FSI calculations.

Atrium porch at the entrance should not to be considered if cantilevered. If it has pillars then it has to be considered in the FSI.

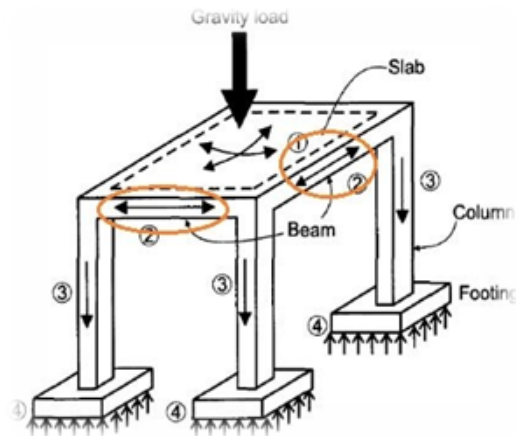
Plinth area can be 10-20% more than carpet area

Mistakes to be avoided based on Vastu during construction

1. Always try keeping the slope of the site towards north-east, meaning south-west to be higher than north-east at all level

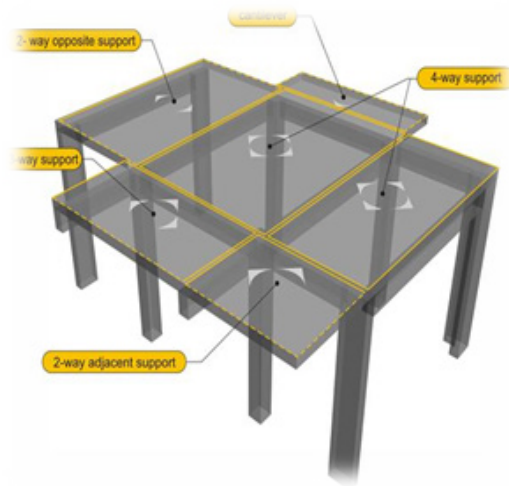
3. Roof Slabs & Beams

Beam is that which transfers the loads, stresses and movements of the structure to the columns which distribute it to the sub structure.



Roof is that which keeps out the elements of nature and protects the inhabitants from them. As it is exposed to the environment it has to be protected from water problems, so acrylic polymer-based water-proofing or polyurethane based waterproofing needs to be applied. This acts as a layer

above the concrete to protect it. It can be coated with reflective paints to cool the temperatures indoors.



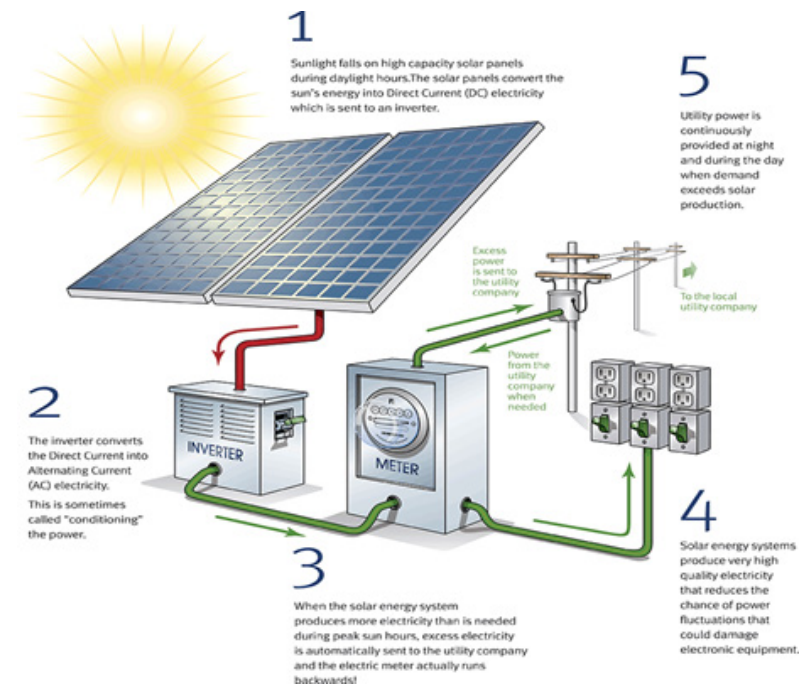
We can also lay china mosaic or ceramic tiling as it is directly exposed to the sun's heat and acts as the largest surface exposed to the sun at all times.

It is very important to have a strong scaffolding during the laying of slab.

Precision in slope is to be maintained when you lay your slab so as to have a first class construction and finish; and save on plastering

cost. Also your electrical drawing should be ready at this stage, so that they can lay the pipes in the flooring before laying the slab.

Provision for solar heater and solar electrical panels need to be done on the roof beforehand. As India is in the tropical belt, looking at the temperature variations of your place you should install solar geyser for hot water and solar electrical panels for electricity generation for your homes. This makes you to contribute to the green revolution world-wide.



Mistakes to be avoided based on Vastu during construction

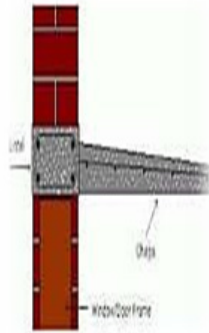
1. South-west part of the building to be the highest and water tank to be placed there always
2. All slabs sloping towards north-east.

4. Lintel and Chajja

The area above any opening needs to have a lintel to support the above masonry. It is an important element to prevent cracking of masonry at the joints of door and window. RCC or stone can be used for lintel and chajja.

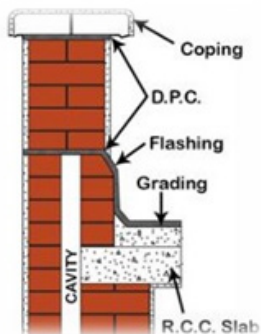


Chajja is the cantilever over window openings to prevent the rains and direct sunlight from entering the building. It is important to provide a slope and drip mould for the flow of water. Water proofing over chajja and at the joint of chajja and wall is of utmost importance.



5. Parapet

The external load bearing walls are extended above the roof slab to keep water from dripping over the edges of the building during rain. This is termed as the parapet. It also provides safety if the roof is used for some other purpose. The top portion of the parapet should be water proofed. If possible then laying a tile or stone is preferred to prevent penetration of water from parapet.



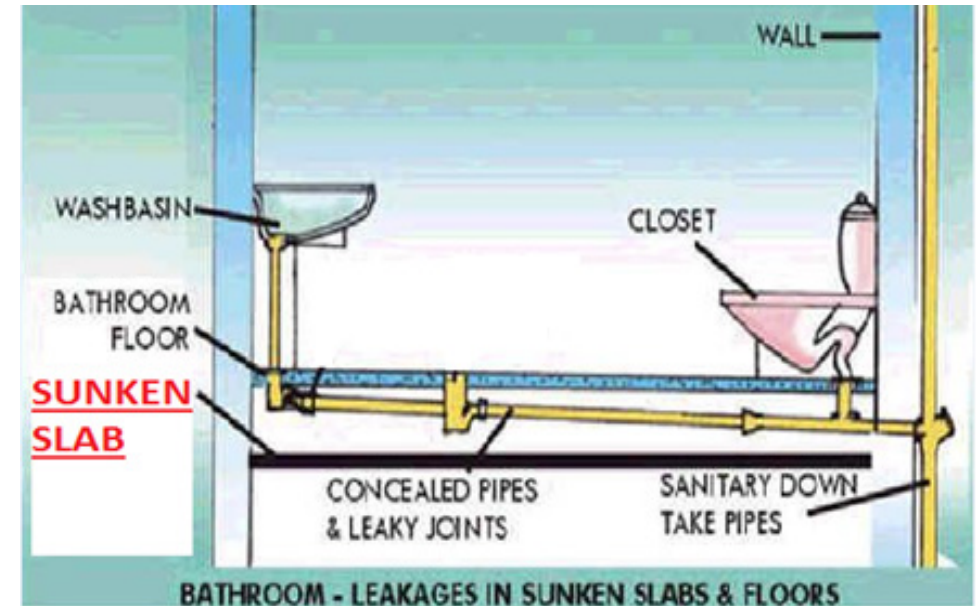
The junction of the roof slab and parapet should be treated with proper vata (slope at edge) to take care of water flow issues.

Mistakes to be avoided based on Vastu during construction

1. Check the 90 degree at this level too and slope of parapet coping should also be towards north-east.

6. Sunken Slabs

An additional slab is laid at the toilet area which is 9" below the actual floor slab to take care of all the plumbing pipes and slope. This is later filled with light weight broken ACC blocks, CLC (cellular light weight concrete) rubble, coal lumps, broken red clay bricks and inverted earthen pots up to floor level. Water proofing is done at the sunken portion of the slab.



Mistakes to be avoided based on Vastu during construction

1. Have the water closet facing north –south always. Facing north when using the seat.
2. Mirror on the basin is to be placed in the north or east wall of the bathroom
3. Slope of the bathroom should be towards north-east and giving proper slope is a must to avoid leakage problems.

7. Staircase

Staircase is the sculpture of the building; it is the part which shows movement in the building. It gives character and language to the built form. It requires lot of detailing and proper anthropometrics.



Riser height 7" upto 5", (this is the height of each step)

Width of tread 11" upto 10", (this is the width of each step)

Width of stair 3' minimum (this helps for movement of material)

Clearance height and landing height lead to the comfort of the user.

Handrail height 34" upto 38" and type of handrail as per the usage needs to be considered.

For handicapped the heights will vary.

Mistakes to be avoided based on Vastu during construction

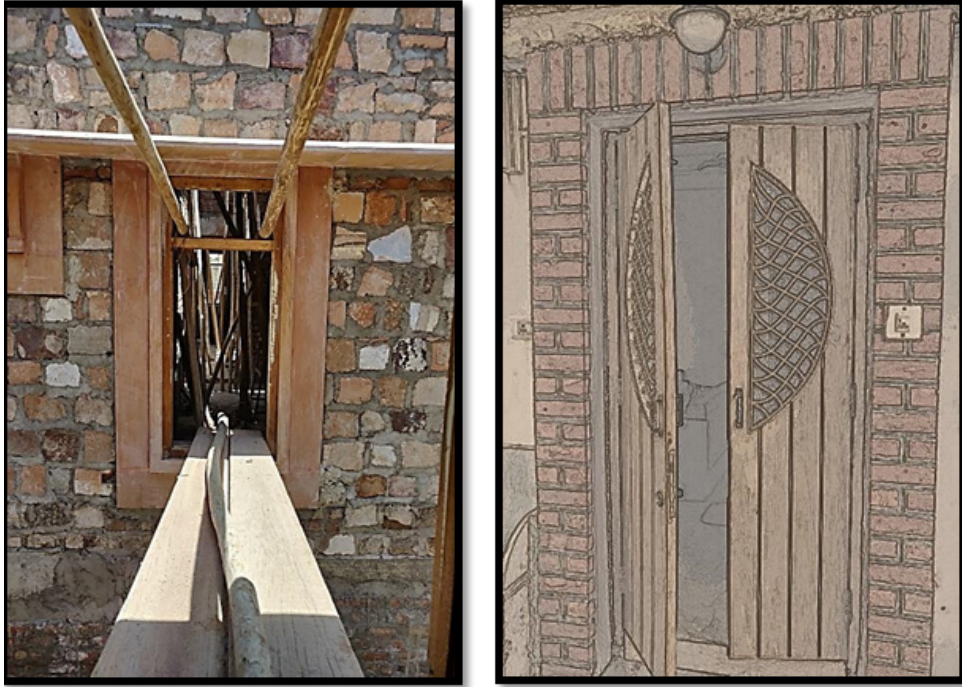
1. Staircase or ramp should function clockwise when you are climbing them.



Staircase sculptor in Jodhpur stone on single beam.



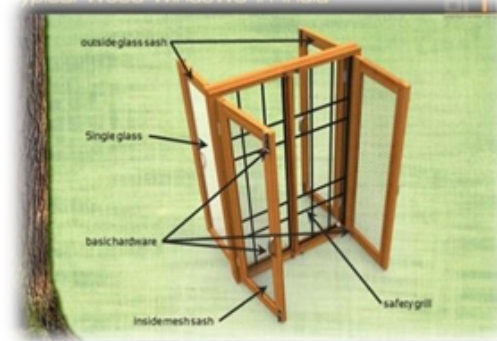
Openings that relate the inside built space to the outside open space



8. The Doors, Windows and Other Openings

Main door should be the widest door in the house .It would be ideal to have stone cladding around the frame so as to prevent cracks at edges and get a perfect alignment for the door and window. Door provides access into and out of the building, the door is held together with a door frame.

Window has a window frame which keeps it together. It also has grill for security purposes and mesh to protect from insects. Either glass panes or wooden panes are used to take care of the sun and rain.



Mistakes to be avoided based on Vastu during construction

1. Always have bigger openings in the north and east.
2. Main door to be the bigger than other doors and should ideally be aesthetically pleasing.

Alignment of door and windows needs to consider air flow and sunlight; planning accordingly will make the place perfect for living. Fabrication of grill comes at this stage too. If we wish to install automatic systems for windows, doors or for curtains then it should be planned at this stage.



9. Overhead Watertanks

Capacity of the tank is decided after looking at the usage of the building .We need to consider which type of tank (material) as it is exposed to climatological conditions the most. This plays a crucial role on the life of the tank and might save huge maintenance costs later. Use of sensors (semi - automatic or automatic) plays a major role in saving the overflow from the tanks. If there is no water in the underground tank it saves the motor from damage.

Mistakes to be avoided based on Vastu during construction

1. Always have the over-head water tank on the southwest portion of the building.

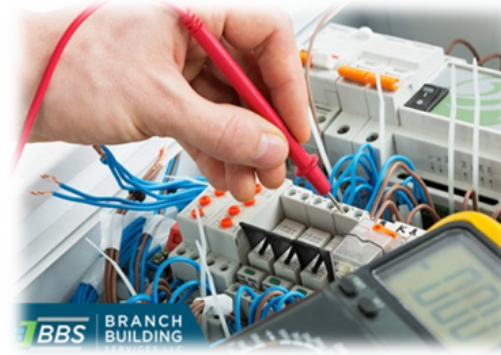
Mechanical, Electrical and Plumbing

MEP plays a very important role in designing, planning, and execution of the project. A good mechanical design will take care of the HVAC (heating , ventilation and air conditioning) system and give an energy efficient solution for the project. The comfort of the user depends on these three systems.

If this is not planned before it leads to unnecessary wastage of money and time.



Electrical designing and planning should also be decided prior to execution of the structure so necessary placements for main meter, main distribution box etc. can be decided. Load calculation needs to be done at this stage so that if three phase connection has to be taken, then necessary planning will need to be done at this stage.



Electrical designing deals with placement of switches to the proper distribution of light in a space depending on the luminous flux (amount of light and brightness) required for individual work space. Proper placement of fans and ventilating devices is essential. Planning for internet connection and placement has to be done along with electrical designing.

Planning of electrical connection for motor pumps, motors, DC generators should also be done. If placing the solar electrical panels, then the necessary provision and placement of motors should be planned.

Earthing is also a very important aspect to be considered with electricity designing.

Electrical stages: First the pipe is laid in the slab, floor and walls, and then wires are pulled out from the pipes followed by switches and fixtures.

Planning of toilet, kitchen, other wet areas, swimming pool and terrace garden plays an important role for Plumbing design.





the drainage and the flow of sewage out from site is also important.

Two very important elements here to take care of:

1. Sealing of all joints in the pipes should be 100% leak proof.
2. Proper slope for water to drain well is essential.



We need to decide which quality of pipe we want to lay, either UPVC or CPVC. If place has extreme temperatures, then preferably use CPVC pipes to prevent leakage from joints.

Mistakes to be avoided based on Vastu during construction

1. As electricity is the fire element, try having maximum switch boards in the south-east portion of the space.
2. Drainage to be made to flow towards north-east, taking care of the underground tank position.
3. Slope of terrace and site to be towards north-east.

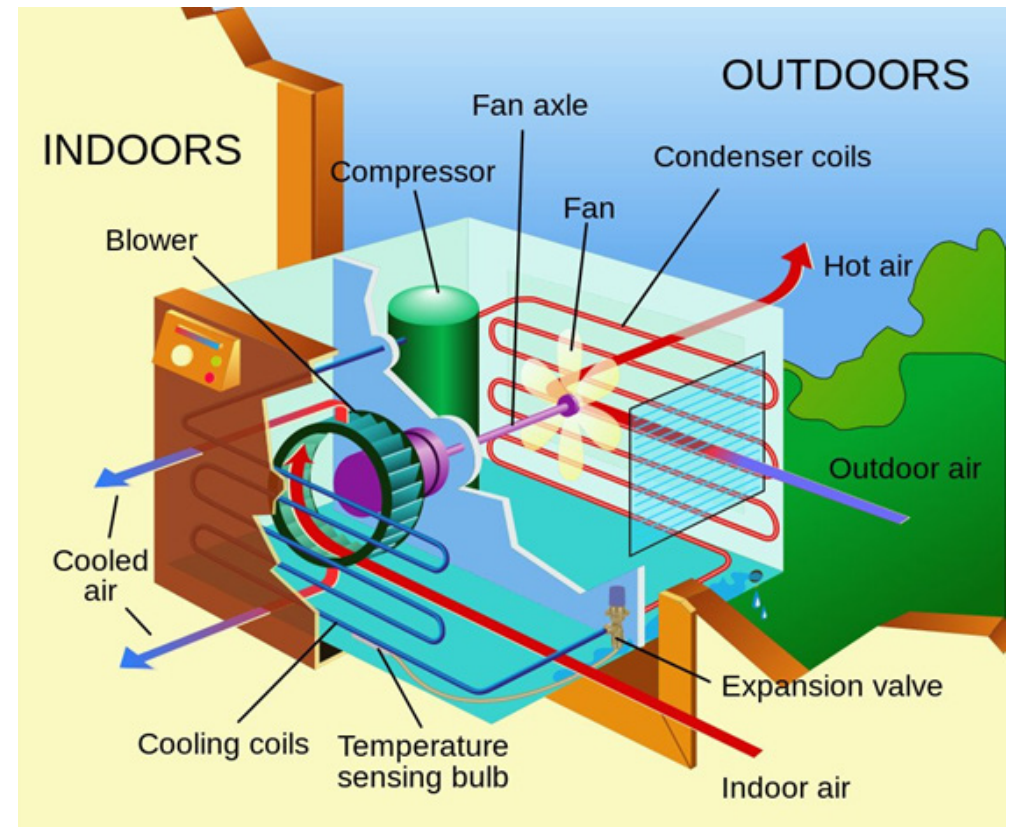


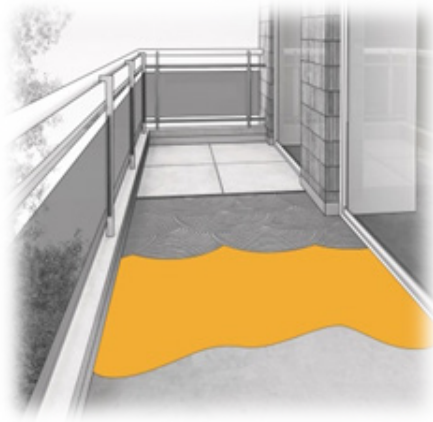
Diagram of Air conditioning functioning

Water proofing

The average mentality of a person will be why to spend on this so much. We would prefer to spend on interior finishes and products but this waterproofing will protect your costly interior finishes and product which will make it HIGHLY ESSENTIAL.

Water proofing is a very important criterion for a good, durable strength and life of the structure. Water plays a major role in eroding the structure, if proper precautions are not taken during

construction then it can damage the masonry, painting, plastering, Rcc and any wooden furniture fixed on the wall. We NEED to WATER-PROOF the terrace, balcony, bathroom, toilets, water tanks, swimming pools, basements, terrace, garden area, above plinth beam and external wall.



Water proofing is different at different places:

1. Integral waterproofing is used for external plaster.
2. Flexible, elastomeric compound can be used on terraces with reflective roof coat where the terrace is not tiled, or else we can go for china mosaic on the terrace .On the tiles we should go for another transparent layer of waterproof coating for complete protection. We need to also consider the temperature of the place to decide which chemical can be applied .For coastal areas, swimming pools and terrace garden areas you will need to go for polyurethane based product to give best protection.
3. To prevent receding dampness from foundation we need to apply bituminous compound to protect the super structure.
4. We can use acrylic based product for bathrooms and toilet or can use elastomeric product too.



Good workmanship and maintaining a proper slope in wet areas is of utmost importance to give a foolproof protection to the structure.

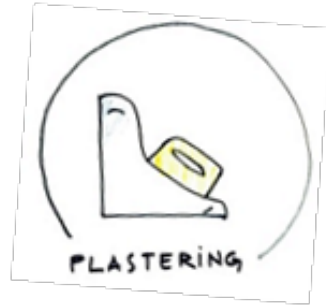


Problems we see when compromised with the water proofing of the structure:

Waterproofing compound should be put in cement mix; this can be a polymer based-product. Another waterproofing compound to be applied from 1metre under the plinth can be a bituminous compound. These are used to prevent the seepage of water from the ground which otherwise would appear as dampness on internal walls. To increase the life of the structure this plays a major role.

Plastering

Internal Plaster is mixture of cement and sand. In external plaster, integral waterproofing compound needs to be added too. This provides a smooth surface to the masonry and protects the masonry from atmospheric influences. This smooth surface makes it easy to prepare the surface for painting.



Use of fly ash bricks considerably reduces the use of material (cement, sand, etc.) in plaster and the finishing we get is also commendable. It is very important to finish laying all the plumbing and electrical pipes in the walls before plastering to prevent the cracks. If the pipes are laid after plastering, then when plastering is done again it may lead to cracks on walls. Proper curing is required for 7 days after plastering to prevent cracks from developing on walls.

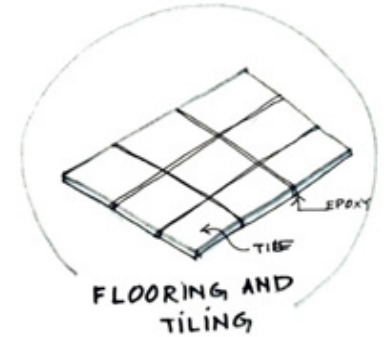


Mistakes to be avoided based on Vastu during construction

1. Check the plum line and make sure you have a perfect vertical finish of the plaster.

Flooring

Floor is that which supports the live load and it's the surface that undergoes the most wear and tear due to movement of material and humans. Selecting the right material is very important for a longer life and better maintenance.



Flooring changes the perception and ambience of the room, it plays a vital role in deciding on the interior finishes and colour of the spaces. Market is loaded with different materials from tiles, stone, wooden, concrete, epoxy etc., having different hardness and finishes to suit every requirement.

Nowadays, tiles are even laid by epoxy based chemicals making the work faster and much more accurate. This has made easy renovation possible as tiles can be laid on existing old floors. Using of spacers and epoxy grouting gives better life and workmanship for the tiles available in the market.



Mistakes to be avoided based on Vastu during construction

1. Slope to be maintained in north-east direction at all times.
2. Tile-laying should start from the south-west of the building

Wall Putty Application

Putty provides a smooth surface for the final paint coat which is applied to the surface. It takes care of the imperfections and minor cracks and undulations of the surface giving it a smooth texture.



Putty protects the surface from flaking and makes it abrasion resistant and water resistant. It also increases the life of the paint applied.

Wall putty is cement based having flexibility. After two coats of wall putty we need to apply primer to give more coverage. (less use of expensive paint)

Some people prefer to go for pop punning on walls to get a perfect vertical finish of the wall. Painting can be done directly on this surface.

Pop is a type of gypsum powder so where there is dampness it is unadvisable. This forms a separate layer over plastered surface as it is not cementitious but surely pop finish gives better quality than putty.



Painting

Paints are pigmented fluid material used to adorn walls, wooden surfaces and metal. Paints and textures change the look and beauty of the space and provides a character to the space.



In the market you are loaded with many brands many finishes and textures but the basic is with that paint is divided into two categories :

1. Emulsions - Water based
2. Acrylic enamel-oil based

Paint is applied using a spray, roller or brush over a coat of primer. Use of primer reduces the consumption of paint. Switch board plates to be put only after final painting is done.

If repainting any surface then take proper care to tape all furniture and electrical boards so as to prevent messing it up.

Site Cleaning

One of the most important aspects to take into account during construction is to keep the site clean of any unwanted stuff.

A hygiene and clean environment gives positivity and provides a quicker and hassle free execution of work.

So this completes the construction stage. Stay tuned for my second booklet, in which I will give an insight about the interior stages involved in a building.

Disclaimer

All content provided by this book is for information purpose only and not typically technical. It is therefore important to take guidance and support of an Architect, Structural engineer, Landscape architect , Electrical contractor, Surveyor, Interior designer and the like who will assist you with proper guidance in your construction journey.

The author makes no representation as to the accuracy or completeness of any information in this book. This is a personal book of experience compiled for knowledge and guidance. The author is not liable for any losses, injury or damages caused by the use of this information.

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To unlock the mystery of
construction for a common man.

This booklet includes everything from the substructure, to the superstructure and the overall construction phase of any building. This will help anyone who is trying to embark on a construction project while keeping in mind important details like Vastu and other pains that are often skipped by people while designing and constructing.

