



Internship Report on Building Planning and Structural Detailing

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Submitted By

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Abstract

After completing B.Tech in Civil Engineering it is important to acquire skills related to industry to understand latest technologies which are implemented in Civil Engineering industry to be as a competent person. In this Internship program entitled “Building Planning and Structural Detailing” it is discussed and practiced topics related to building planning, structural detailing and material estimation. In the Building planning understood planning of a building as per Andhrapradesh Building regulations 2016 and as per Vastu. In the structural detailing it is understood various building elements, functions of each building element, structural detailing as per IS code. Further the detailing is carried out using CAD software. Quantities of concrete and steel estimation is discussed. The learnt concepts are practiced on a sample building. At the end of program visited a construction site to observe and understand the work flow in actual construction site.

Outline

- What are building bylaws
- Andhra Pradesh building regulations(2017)
- Autocad commands
- Vastu theory
- Building planning using vastu and building regulations
- Building structural elements
- Detailing of elements
 - Footing
 - Column
 - Beam
 - Slab
 - Stair case

Building planning regulations and By-laws:

What are building by-laws:

- The rules and regulations framed by town planning authorities covering the requirements of building, ensuring safety of the public through open spaces, minimum size of rooms and height and area limitations are known as building by laws.
- Rules and regulations which largely regulate the building activity should be formulated to get disciplined growth of building and the better planned development of towns and cities.

Objective:

- Pre-planning of building activity
- Allow orderly growth and prevent haphazard development
- They provide health, safety and comfort to people who live in buildings
- Provide proper utilization of space to achieve maximum efficiency in planning

Scope of building by-laws:

☐ Aspects of different types of building in building by-laws

- Building frontage line
- Minimum plot size
- Built up area of building
- Height of building
- Provision of safety, water supply, drainage, proper light and ventilation
- Requirement for off street parking space
- Size of structural elements

Applicability of building by-laws:

- New construction
- Additional and alterations to a building
- Changing of occupancy of building
- Development of land is undertaken
- In demolition

Andhra Pradesh building regulations(2017)

- a. Buildings
- b. Setbacks
- c. Minimum requirements of room sizes

a. Buildings

Building

(a) A structure constructed with any materials whatsoever for any purpose, whether used for human habitation or not, and includes:-

- (i) Foundation, plinth, walls, floors, chimneys, plumbing and building services, fixed platforms etc.
- (ii) Verandahs, balconies, cornices, projections etc.
- (iii) Parts of a building or anything affixed thereto
- (iv) Any wall enclosing or intended to enclose any land or space, sign and outdoor display structures etc.
- (v) Tanks constructed or fixed for storage of chemicals or chemicals in liquid form and for storage of water, effluent, swimming pool, ponds etc.
- (vi) All types of buildings shall be considered to be "buildings", except tents, shamianas and tarpaulin shelters erected temporarily for temporary purposes and ceremonial occasions.

(b) Assembly Buildings

A building or part thereof, where groups of people congregate or gather for amusement, recreation, social, religious, patriotic, civil, travel and similar purposes and these includes buildings of drama and Cinema theatres, drive-in-theatres, assembly halls, City halls, town halls, auditoria, kalyanamandapams, places of worship and road, railways, air, sea or other public transportation stations.

(c) Business Buildings

Includes any building or part thereof used principally for transaction of business and/or keeping of accounts and records therefore including offices, banks, professional establishments, court houses etc., if their principal function is transaction of business and/or keeping of books and records.

(d) Detached building

Includes a building with walls and roofs independent of any other building and with open spaces on all sides within the same plot.

(e) Educational Buildings

Includes a building exclusively used for a school or college involving assembly for instruction, education or recreation incidental to educational use, and including a building for such other uses as research institution.

(f) Existing Building

A building or structure existing authorisedly with the approval of the Authority before the commencement of these Rules.

(g) Hazardous Buildings

Includes a building or part thereof used for:

- (i) Storage, handling, manufacture or processing of radioactive substances or of highly combustible or explosive materials or of products which are liable to burn with extreme rapidity and/or producing poisonous fumes or explosive emanations;
- (ii) Storage, handling, manufacture or processing of which involves highly corrosive, toxic or noxious alkalis, acids, or other liquids, gases or chemicals producing flames, fumes and explosive mixtures etc., or which result in division of matter into fine particles capable of spontaneous ignition.

(h) High Rise Building

High Rise Building means a building with 18 meters and above (including stilt floor) in height. However, chimneys, cooling towers, boiler rooms/ lift machine rooms, cold storage and other non-working areas in case of industrial buildings and water tanks and architectural features in respect of other buildings may be permitted as a non-High rise Building.

(i) Industrial Buildings

Includes a building or part thereof wherein products or material are fabricated, assembled or processed, such as assembly plants, laboratories, power plants, refineries, gas plants, mills, dairies and factories etc.

(j) Institutional Buildings

Includes a building constructed by Government, semi-Government organizations or Registered Trusts and used for medical or other treatment, or for an auditorium or complex for cultural and allied activities or for an hospice, care of persons suffering from physical or mental illness, handicap, disease or infirmity, care of orphans, abandoned women, children and infants, convalescents, destitute or aged persons and for penal or correctional detention with restricted library of the inmates ordinarily providing sleeping accommodation and including dharamshalas, hospitals, sanatoria, custodial and penal institutions such as jails, prisons, mental hospitals, houses of correction, detention and reformatories etc.

(k) Mercantile/Commercial Building

Includes a building or part thereof used as shops, stores or markets for display and sale of wholesale or retail goods or merchandise, including office, storage and service facilities incidental thereto and located in the same building.

(l) Mixed use building

A building partly used for non-residential activities except industrial purpose and partly for residential purpose.

(m)Office Building (Premises) Includes a building or premises or part thereof whose sole or principal use is for an office or for office purposes or clerical work. Office purposes include the purpose of administration, clerical work, handling money, telephone, and computer operation; and clerical work includes writing, book-keeping, sorting papers, typing, filling, duplicating, punching cards or tapes machine calculations, drawing of matter for publication and editorial preparation of matter for publication.

(n)Public Building

Public Building means a building used or intended to be used either ordinarily or occasionally as a place of public worship, dharamasala, college, school, theatre, cinema, public concert room, public hall, public bath, hospital, latrine, room, shop or any other place of public assembly.

(o)Residential Building

Residential Building includes a building in which sleeping and living accommodation is provided for normal residential purposes, with cooking facilities and includes one or more family dwellings, apartment houses, flats and private garages of such buildings.

(p)Semi-detached Building

Semi-detached Building means a building detached on the three sides with open spaces as specified.

(q)Storage Building

A building or part thereof used primarily for storage or shelter of goods, wares, merchandise and includes a building used as a warehouse, cold storage, freight depot, transit shed, store house, public garage, hanger, truck terminal, grain elevator, barn and stables.

(r) Unsafe Building

Includes a building which:

- (i) is structurally unsafe, or
- (ii) is unsanitary, or
- (iii) is not provided with adequate means of ingress or egress or
- (iv) constitutes a fire hazard or
- (v) is dangerous to human life or
- (vi) in relation to its existing use, constitutes a hazard to safety or health or public welfare by maintenance, dilapidation or abandonment

Note: All unsafe buildings/structures will be required to be restored by repairs, demolition or dealing with as otherwise directed by the Authority.

(s)Whole Sale Building/Establishment

An establishment wholly or partly engaged in wholesale trade and

manufacture wholesale outlets, including related storage facilities, warehouses and establishments engaged in truck transport, including truck transport booking agencies.

b. Setbacks

TABLE – 17
Minimum Setbacks and Height Permissible

Sl. No.	Plot Size (in Sqm) Above – Up to	Parking provision	Height (in m) Permissible Up to	Building Line or Minimum Front Setback to be left (in m)					Minimum setbacks on remaining sides (in m)
				Abutting Road Width					
				Up to 12 m	Above 12m & up to 18m	Above 18m & up to 24 m	Above 24m & up to 30m	Above 30m	
(A)	(B)	(C)	(D)	(E)	(F)	(G)	(H)	(I)	(J)
1	Less than 50		7	1.5	1.5	3	3	3	-
2	50-100	-	7	1.5	1.5	3	3	3	-
			10	1.5	1.5	3	3	3	0.5
3	100 - 200	Stilt floor	10	1.5	1.5	3	3	3	1.0
4	200 - 300	Stilt floor	7	2	3	3	4	5	1.0
			10	2	3	3	5	6	1.5
5	300 - 400	Stilt floor	7	3	4	5	6	7.5	1.5
			12	3	4	5	6	7.5	2.0
6	400 - 500	Stilt floor	7	3	4	5	6	7.5	2.0
			12	3	4	5	6	7.5	2.5
7	* 500 - 750	Stilt floor	7	3	4	5	6	7.5	2.5
			12	3	4	5	6	7.5	3.0
			15	3	4	5	6	7.5	3.5
8	750 - 1000	Stilt + One Cellar floor	7	3	4	5	6	7.5	3.0
			12	3	4	5	6	7.5	3.5
			15	3	4	5	6	7.5	4.0
9	1000 - 1500	Stilt + 2 Cellar	7	3	4	5	6	7.5	3.5
			12	3	4	5	6	7.5	4.0
			15	3	4	5	6	7.5	5.0

C. Minimum requirements of room sizes

TABLE - 5
Minimum Size, Width and Height of different components of residential premises

S. No .	Component s of Building	Minimum Requirement for a Dwelling Unit up to 50sq.m			Minimum Requirement for a Dwelling Unit above 50sq.m		
		Area (sq. m)	Width (m)	Height (m)	Area (sq. m)	Width (m)	Height (m)
(A)	(B)	(C)	(D)	(E)	(F)	(G)	(H)
1	Habitable Rooms	7.5	2.1	2.75	9.5	2.4	2.75
2	Kitchen	3.3	1.8	2.75	4.5	1.8	2.75
3	Pantry	-	-	-	3.0	1.4	2.75
4	Kitchen with Dining area	7.5	2.1	2.75	7.5	2.1	2.75
5	Bathroom	1.2	1.0	2.2	1.8	1.2	2.2
6	WC	1.0	0.9	2.2	1.2	0.9	2.2
7	Combined Bath & WC	1.8	1.0	2.2	2.8	1.2	2.2
8	Door ways (Habitable rooms)	-	0.9	2.1	-	0.9	2.1
	(Kitchen, Bath, WC)	-	0.75	2.0	-	0.75	2.0
9	Staircases	-	1.0	-	-	1.0	-
10	Garage	Two-wheeler garage: 1 x 2 m			18.0	3.0	2.4
11	Store room	Area and width of the store has no restriction, however Minimum Height has to be 2.20mt. If the area of the store is 9.5sqm and above, the light and ventilation clause shall also apply.					
12	Projections	Permitted within the plot boundary, up to 0.75 m width. No portions of any projection whatsoever shall project outside the plot boundary.					

Notes:

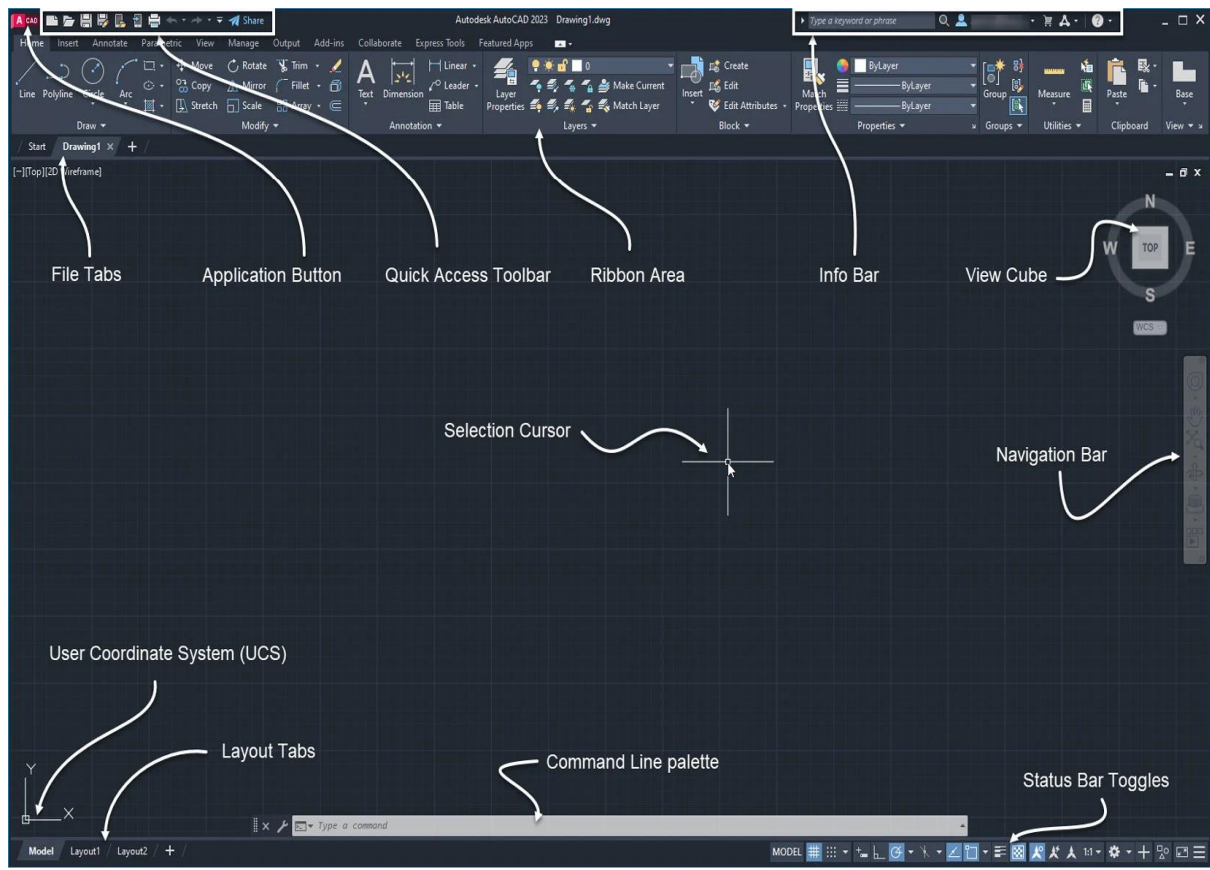
AutoCAD Introduction and User Interface

AutoCAD is a widely-used computer-aided design (CAD) software application developed by Autodesk. It has played a pivotal role in various industries such as architecture, engineering, construction, manufacturing, and more. AutoCAD provides a powerful platform for designing and drafting 2D and 3D models, creating technical drawings, and assisting in various design-related tasks. To understand how to use AutoCAD effectively, it's crucial to become familiar with its user interface.

****User Interface Overview:****

1. ****Application Menu:**** The AutoCAD application menu is located at the upper-left corner of the interface. It provides access to various file-related functions such as creating new drawings, opening existing ones, saving, and printing. It also includes options for customization, settings, and help.
2. ****Quick Access Toolbar:**** Below the application menu, you'll find the Quick Access Toolbar. This is a customizable toolbar where you can place frequently used tools and commands for easy access.
3. ****Ribbon:**** The Ribbon is a central element of the AutoCAD user interface. It contains various tabs, each with multiple panels that group related commands and tools. The Ribbon makes it intuitive to navigate and find the specific tools you need for your design tasks.
4. ****Drawing Area:**** The large, central area of the interface is your drawing canvas. This is where you create and manipulate your drawings. AutoCAD supports both 2D and 3D drawing environments, and you can easily switch between them.
5. ****Command Line:**** At the bottom of the screen, you'll find the Command Line. This is where you can input text commands, and it provides feedback on your actions and prompts for further input. While many users rely on the graphical interface, the Command Line is a powerful tool for experienced AutoCAD users.
6. ****Tool Palettes:**** On the left side of the screen, you can access tool palettes that contain blocks, hatches, and other design elements. These palettes are highly customizable and can streamline your workflow by providing easy access to reusable content.
7. ****Properties Palette:**** The Properties Palette displays information about the selected object, such as its layer, color, and other attributes. You can also use it to modify these properties.
8. ****Navigation Bar:**** The Navigation Bar offers various tools for zooming, panning, and navigating your drawing, making it easier to work with large or complex designs.
9. ****Layout Tabs:**** AutoCAD allows you to work on multiple layouts within a single drawing file. You can switch between layout tabs to create multiple views of your design, each with its own set of viewports and scale settings.

10. **Status Bar:** The Status Bar, located at the bottom of the interface, provides essential information, including drawing coordinates, snap and grid settings, and the current workspace. It also features toggles for various drawing aids like Ortho and Osnap.



Auto cad commands

1. Line (L):

With line, we can create a series of contiguous line segments. Each segment is a line object that can be edited separately.

2. Ploy line (PL):

A 2D polyline is a connected sequence of segments created as a single planar object. You can create straight line segments, arc segments, or a combination of the two.

3. Circle (C):

Creates a circle using center and radius.

4. Scale (SC):

Enlarges or reduces selected objects, keeping the proportions of the object the same after the scaling. To scale an object, specify a basic point and a scale factor. The base point acts as the center of the scaling operations and remains stationary. A scale factor greater than one enlarges the object. A scale factor between zero and one shrinks the object.

5. Rotate (RO):

Rotates object around a base point. You can rotate selected object around a base point to an absolute angle.

6. Fillet (F):

Rounds and fillets the edges of the object. An arc is created that is tangent to both of the selected line. The lines are trimmed to the ends of the arc.

7. Copy (CO):

Copies objects a specified distance in a specified direction. With the copy mode system variable, you can control whether multiple copies are created automatically.

8. Rectangle (REC):

Creates a rectangular polyline from the specified rectangle parameters (length, width, rotation) and type of corners.

9. Trim (TR):

To trim objects select the objects to be trimmed individually, press the drag to start a free hand selection part or pick to empty location to specify a crossing fence. All objects automatically acts as cutting edges. Selected object that cannot be trimmed are deleted instead.

10. Move (M):

Moves object a specified distance in a specified direction. Use coordinates, grid snaps, object snaps and other tool to move objects with precision.

11. Hatch(H):

Fills an enclosed area or selected objects with a hatch pattern or fill. Choose for several methods to specify the boundaries of a hatch. Specify a points in an area that is enclosed by objects. Select object that enclose an area. Specify boundary points using the hatch draw option. Drag a hatch pattern into an enclosed area from a tool palette or Design center.

12. Mirror(MI):

Creates a mirrored copy of selected objects. You can create objects that represents half of a drawing, select them, and mirror them across a specified line to create the other half.

13. Array (AR):

Distributes object copies into any combination of rows, columns and levels. Creates an array of rows and columns of copies of the selected object.

14. Multiple line text(T):

Creates a multi text object. You can several paragraphs of text as a single multi line text object. With the built-in editor you can format the text appearance, columns and boundaries.

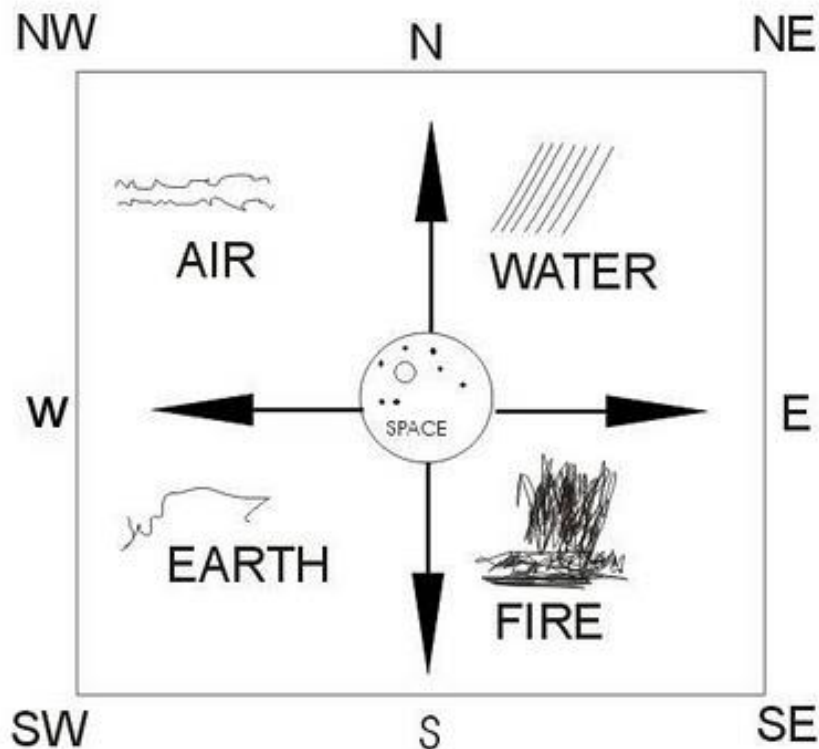
15. Offset (O):

You can offset an object at specify distance or through a point. After you offset object you can trim and extend them as an efficient method to create drawings containing many parallel lines and curves.

16. Explode:

Explodes a compound object when you want to modify its components separately. Objects that can be exploded include blocks, polyline, and regions among others.

VASTU



Vastu Shastra, often known as Vastu, is an old Indian architectural and design concept that offers recommendations for producing aesthetically pleasing and functional living areas. It is predicated on the idea that a home's structure and layout may affect the health, contentment, and prosperity of its people. Here are some essential guidelines and ideas for applying Vastu to a house:

- According to Vastu, it's important to evaluate the orientation of your home.
- The four cardinal directions (north, south, east, and west) are very important, and the main entrance is usually pointed towards one of them.
- It is typically suggested to avoid south-facing entrances since they are seen to be less beneficial.
- The north and east orientations are frequently selected for the entry as they are often regarded auspicious and bring in positive energy.
- The arrangement of the home's rooms and other areas should adhere to Vastu principles.
- In order to promote excellent energy flow, the middle of the house is often kept open and can be utilized for communal rooms or as a courtyard.
- While children's bedrooms might be located in the northwest or west of the home, it is frequently advised that the master bedroom be located in the southwest corner.
- The bathroom and toilet sections are typically put in the northwest or western regions of the home, while the kitchen is ideally positioned in the southeast.

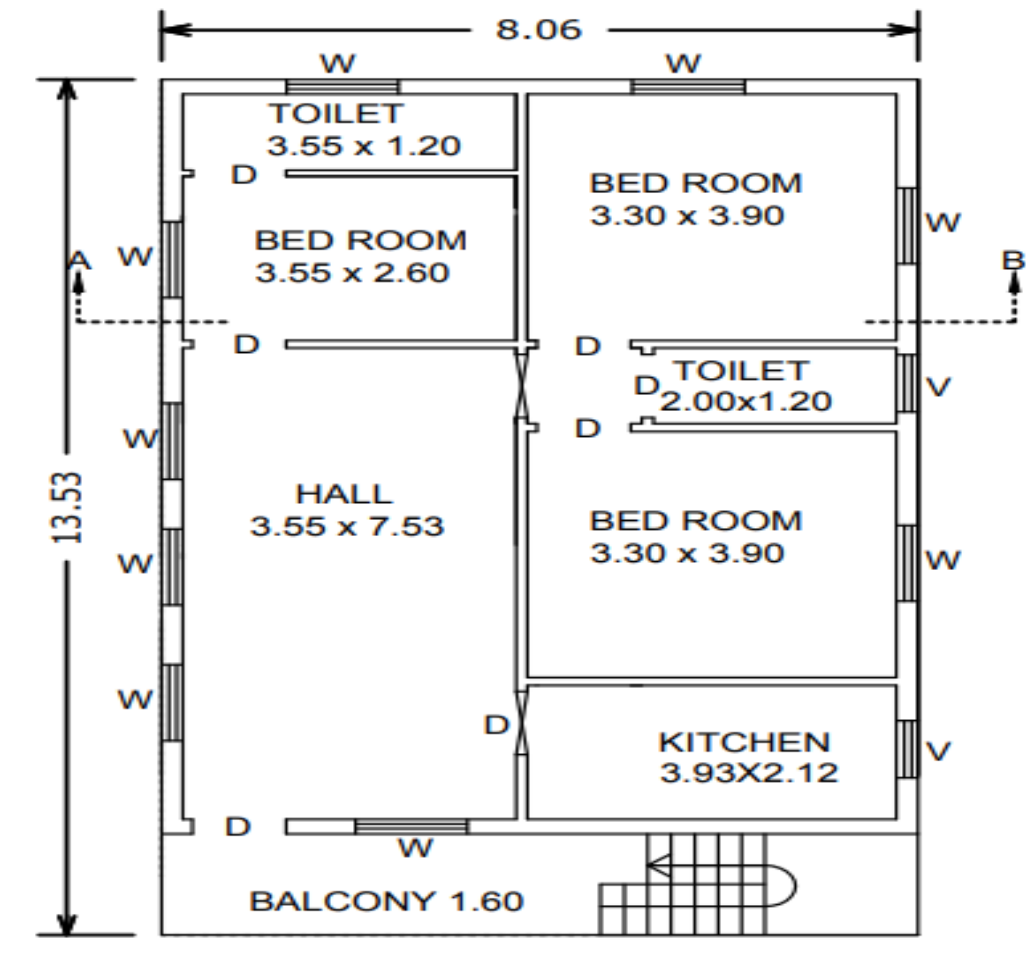
- The main entry must be placed at lower hand. The northeast corner is seen to be a holy space suited for a prayer or meditation room.

Some of the regulations to be followed while constructing a house/building:

- ☐ SOUTH-WEST; NAIRUTHI : Master bedroom
- ☐ NORTH-WEST; VAYUYAM : Toilets
- ☐ SOUTH-EAST; AGNEYAM : Kitchens
- ☐ NORTH-EAST; ISHANYAM : bore wells

- ☐ NORTH-EAST; ISHANYAM = WATER
- ☐ SOUTH-EAST; AGNEYAM = FIRE
- ☐ SOUTH-WEST; NAIRUTHI = EARTH
- ☐ NORTH-WEST; VAYUYAM = AIR

Building planning using vastu and building regulations:



Building structural elements

structural elements for buildings

The essential parts of a building or other structure that give stability, support, and the capacity to sustain a variety of loads, such as gravity, wind, seismic pressures, and live loads, are known as structural elements. These components are built and developed to guarantee the longevity and safety of the construction. Here are some crucial structural components that are frequently included in buildings:

- Footings
- Columns
- Beams
- Slabs
- Stair case

The safety of a structure depend on how these structural components are designed and built. Building rules and regulations that are particular to the site and kind of construction must be followed. In order to ensure that these components are built to endure the loads they will experience during the life of the building, structural engineers are essential. In addition, a building's structural elements' resilience and safety are greatly influenced by the materials used, the construction process, and maintenance procedures.

Detailing of elements

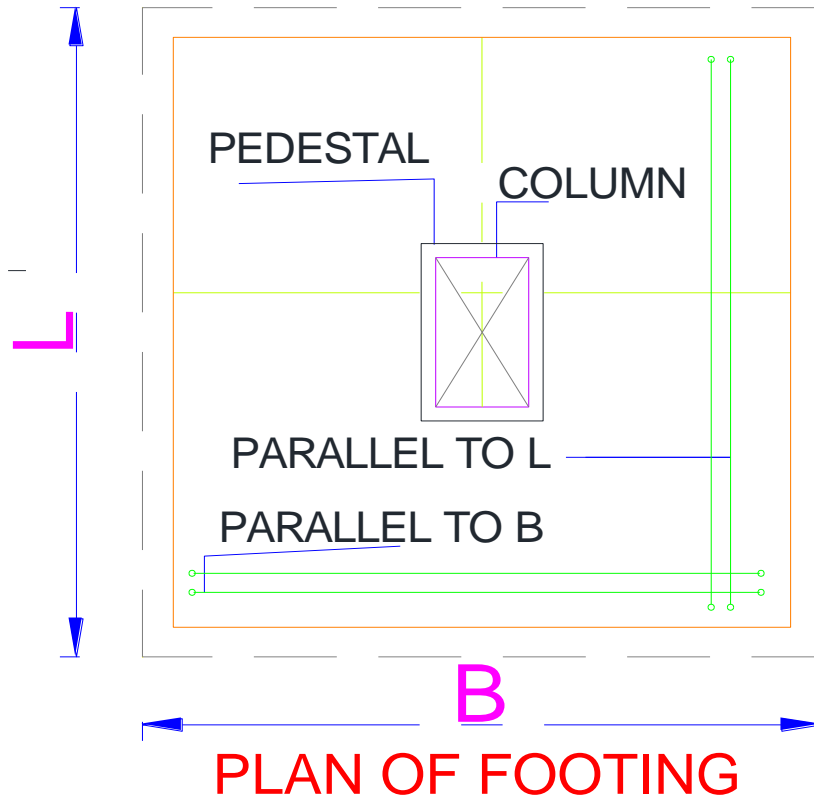
1. Footings:

Purpose : Footings are the structural elements that serve as the base for columns and walls, distributing the load they bear to the soil below. They are designed to prevent excessive settlement and ensure the stability of a structure.

Types : Footings can be classified into two main types: shallow footings and deep footings. Shallow footings, like spread footings, are situated close to the ground's surface and are used when the soil can adequately support the building load. Deep footings, such as piles or caissons, are used when the load needs to be transferred to deeper, more stable soil layers or bedrock.

Design Considerations : The design of footings takes into account the building weight, the type of soil, and local building codes. They can be

rectangular, square, or even circular in shape, depending on the load and architectural requirements. Reinforcement bars (rebar) are often used to provide additional strength and prevent cracking.



Let footing is of square

L= Length of footing

B= Width of footing

T= Thickness of footing

Volume of concrete required = $L \times B \times T$

No of rods parallel to B = $L/sp + 1$

No of rods parallel to L = $B/sp + 1$

SCHEDULE OF FOOTINGS

TYPE	DIMENSIONS				REINFORCEMENT	
	L	B	D1	D2	Parallel to L	Parallel to B
F1	7'	7'	1'	2'6"	# 10 @4" c/c	# 10 @4" c/c
F2	5'	5'	1'	2'6"	# 10 @4" c/c	# 10 @4" c/c

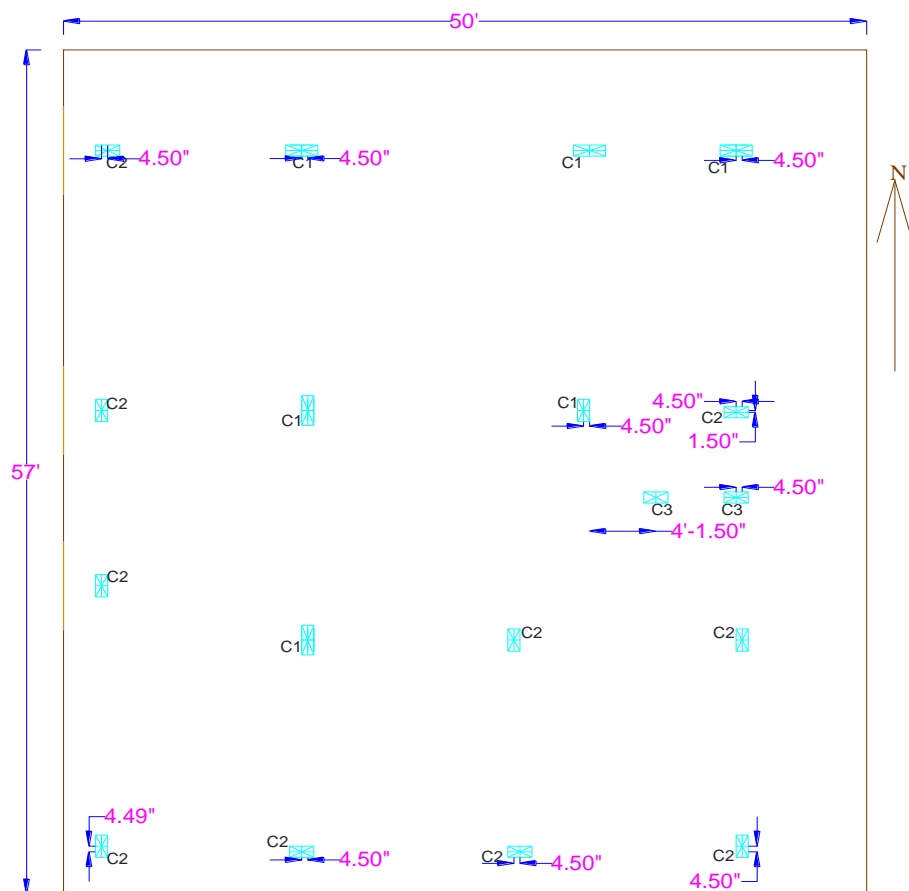
2. Columns

Purpose: Columns are vertical structural elements that support the weight of the structure above them and transfer it to the footings. They are critical in providing vertical stability and creating spaces within a building.

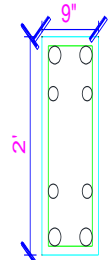
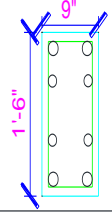
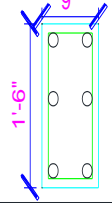
Materials: Columns can be constructed from various materials, including concrete, steel, wood, or composite materials. The choice of material depends on factors such as load-bearing capacity, architectural design, and local building codes.

Shapes : Columns come in different shapes, including rectangular, square, circular, and more elaborate architectural shapes. The shape can also be decorative, aligning with the building design.

Reinforcement: Concrete columns are typically reinforced with steel bars to enhance their load-bearing capacity and resistance to bending.



GROUND FLOOR COLUMN REINFORCEMENT SCHEDULE

GROUP NAME	SIZE	REINFORCEMENT		COLUMN NOS	STIRRUPS
		DIA	NOS		
C1		20 16	4 4	6	<div></div> #8MM@8"C/C
C2		16	8	11	<div></div> #8MM@8"C/C
C3		16 12	4 2	2	<div></div> #8MM@8"C/C

3. Beam:

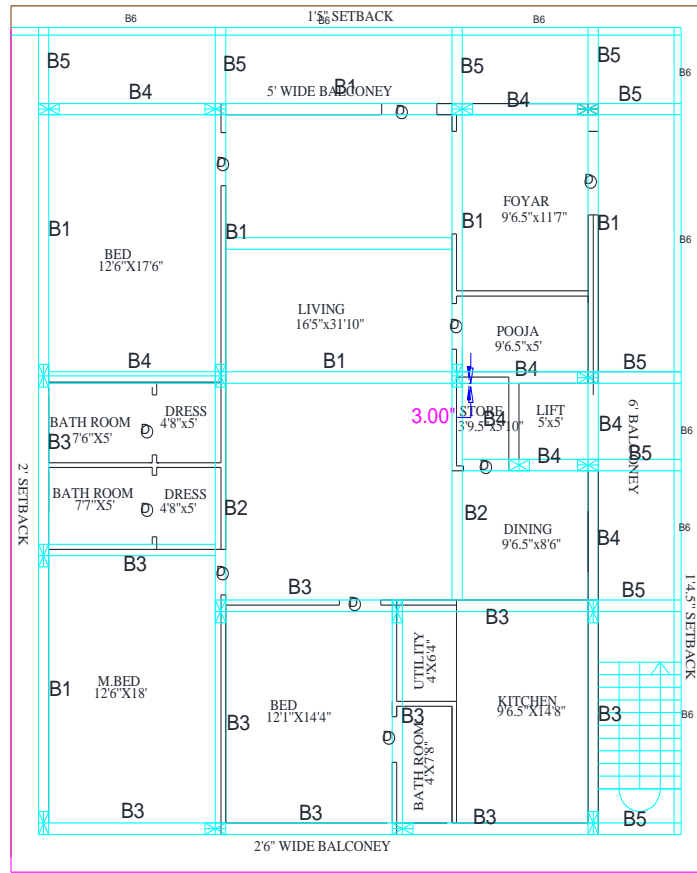
Purpose: Beams are horizontal or inclined structural members that span between columns, walls, or other vertical supports. They distribute the loads from above, including the weight of the floors, walls, and roof, to the vertical supports (columns and walls).

Materials: Beams are commonly made of concrete, steel, or wood, depending on the specific requirements of the building. Steel beams, for example, are often used for large spans where strength and minimal deflection are crucial.

Types: There are different types of beams, such as simply supported beams, cantilever beams, and continuous beams. Each type is designed to meet specific load and span requirements.

Reinforcement: Like columns, concrete beams are usually reinforced with steel bars to enhance their strength and prevent cracking or bending under loads.

TYPE	SECTION		STIRRUPS
	MID	END	
B1			8MM @ 8"
B2			8MM @ 8"
B3			8MM @ 8"
B4			8MM @ 8"
B5			8MM @ 8"
B6			8MM @ 8"



SECOND FLOOR-PLAN-2

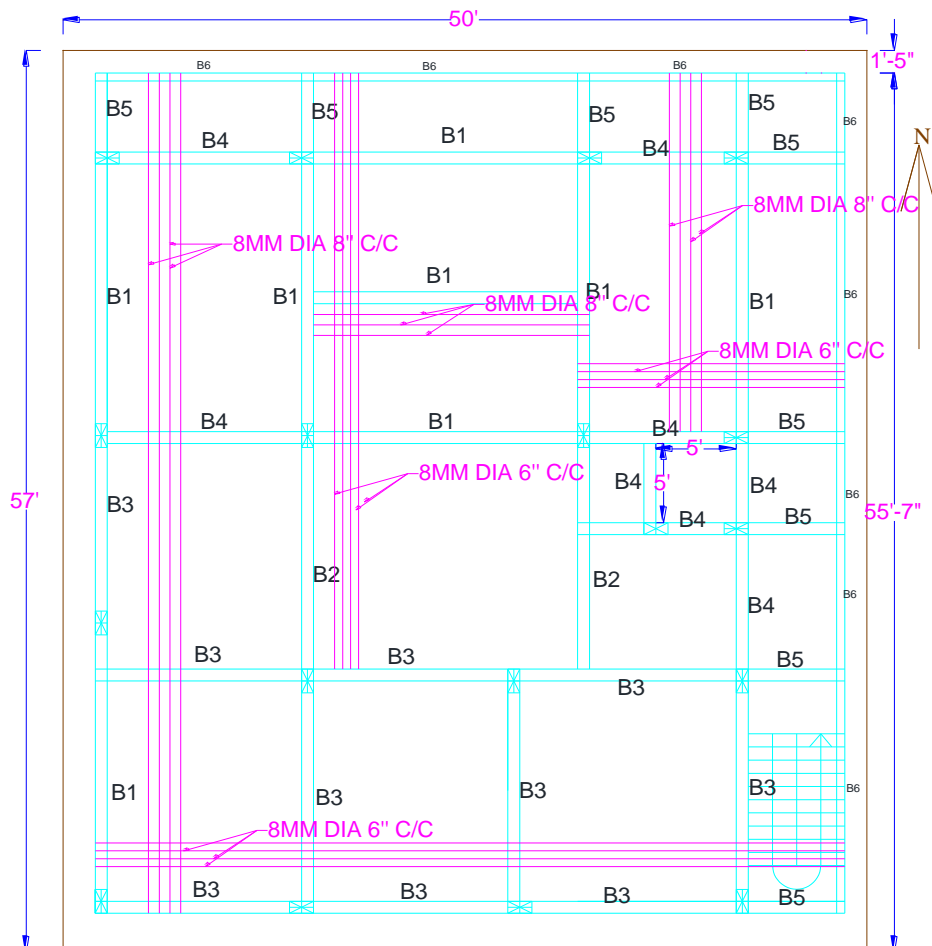
4. Slab:

Purpose: Slabs are horizontal, flat structural elements that form the floors and ceilings of a building. They serve as walking surfaces and separate different levels within a structure.

Materials: Slabs can be constructed from materials like concrete, steel, or wood, depending on factors such as load requirements, fire resistance, and architectural design.

Types: Slabs come in various types, including solid slabs, hollow-core slabs, and ribbed or waffle slabs. The choice depends on the structural and architectural demands.

Reinforcement: Concrete slabs, especially those in suspended or high-load areas, are often reinforced with steel bars to enhance their strength and prevent cracking.



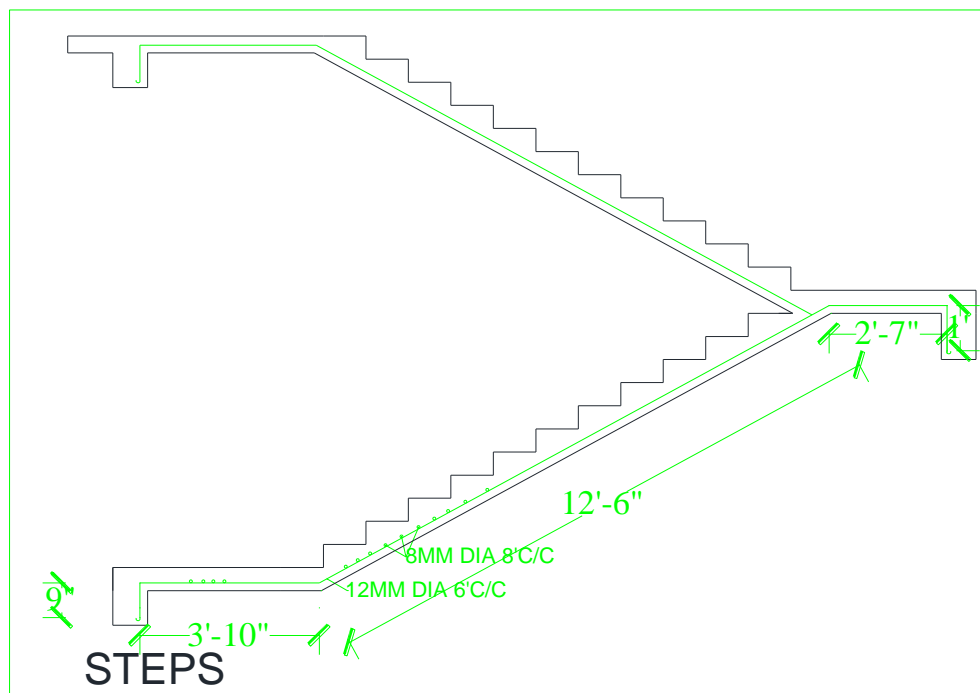
5. Staircase:

Purpose: Staircases provide vertical circulation within a building, allowing people to move between different levels. They serve both functional and architectural purposes and need to be structurally sound to ensure safety.

Materials: Staircases can be made from various materials, including concrete, steel, wood, glass, and even combinations of these materials. The choice depends on the design and load requirements.

Design Considerations: Staircases must be designed with careful attention to dimensions, riser and tread sizes, handrails, and safety features to comply with building codes and to ensure ease of use and safety for occupants.

Structural Elements: A staircase typically consists of steps, landings, and a handrail. The steps bear the load of those using the stairs, while the handrail provides support and safety. **Load-Bearing Capacity** The design of the staircase considers the expected live loads (the weight of people using the stairs) and any additional loads, such as furniture.



These structural elements are fundamental to the stability, safety, and functionality of a building. Their design and construction are integral to the overall structural integrity of a structure and must adhere to building codes and engineering standards.

In order to define our built environment, building planning and structural details are the foundational elements of effective construction. These fields, which are always changing, provide the basis for building safer, more environmentally friendly, and visually beautiful structures. As architects and engineers, our dedication to mastering these disciplines assures that our cities and communities will have a better, more resilient future.

The experience of doing this internship has been satisfying and insightful. In addition to giving me useful information and skills, it has also deepened my understanding of the significance of careful design and structural details in the context of construction. I'm grateful of the advice and assistance I've had from my mentors during my internship, and I have no doubt that the things I've learned here will provide a strong basis for my future career in building design and structural detailing.