

**PLANNING AND MODELING OF  
RESIDENTIAL BUILDING BY USING REVIT  
BIM**

*A Major Project Report*

*Submitted to the Rajasthan Technical University*

*in partial fulfillment of requirements for the award of degree*

*Bachelor of Technology*

*in*

*Civil Engineering*

*by*

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UDAIPUR, RAJASTHAN**

**APRIL 2023**

## **DECLARATION**

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I Chandan Shah hereby declare that the major project report **Planning and Modeling of Residential Building by using Revit BIM**, submitted for partial fulfillment of the requirements for the award of degree of Bachelor of Technology of the Rajasthan Technical University, Kota, Rajasthan is a bonafide work done by me under supervision of Mr. Jitendra Choubisa.

This submission represents my ideas in my own words and where ideas or words of others have been included; I have adequately and accurately cited and referenced the original sources.

I also declare that I have adhered to ethics of academic honesty and integrity and have not misrepresented or fabricated any data or idea or fact or source in my submission. I understand that any violation of the above will be a cause for disciplinary action by the institute and/or the University and can also evoke penal action from the sources which have thus not been properly cited or from whom proper permission has not been obtained. This report has not been previously formed the basis for the award of any degree, diploma or similar title of any other University.

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## ABSTRACT

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The building can be designed by using Autodesk Revit Software. Autodesk Revit is Building Information Modeling (BIM) software for landscape architects, landscape architects, structural engineers, MEP engineers and contractors. The software allows users to design a building and its components in 3D annotate the model with 2D drafting elements and access building information from the building model's database. The Residential building has two flats. Our structure has ground floor and five floors. Staircase can be placed in between two flats. The software which integrates with BIM workflows, is available only in architecture, engineering & construction collection.

## ACKNOWLEDGEMENT

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I take this opportunity to express my deepest sense of gratitude and sincere thanks to everyone who helped me to complete this work successfully. I express my sincere thanks to **Rakesh Yadav**, Head of Department, Civil Engineering, Techno India NJR Institute of Technology Udaipur for providing me with all the necessary facilities and support.

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**CHANDAN SHAH**



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## *Chapter 1*

# *Introduction*

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### **1.1. GENERAL**

The Revit Architecture software will give the plan view, 3d model with excellent elevation, detailing diagrams, schedules for each structural elements, and with rendering we can have realistic view with high efficiency, building information modeling (BIM) gives the information about project design, its different views, scope, quantities, and phases when you need it. In the Revit model, every project we did will give the 2d, 3d, section views, elevations with detailing and schedules, quantities also it will provide us. Revit Architecture collects information about each structural element's material its visualization realistic in nature and its design such as thickness height and in schedule it will give no of data such as cost type of family, no. of brick, no of doors, no. of windows etc. across all other representations of the project. In Revit we can have these all 2D, 3D, and sectional views, elevations and detailing drawing etc. in one complete sheet. From the outset, Revit was intended to allow architects and other building professionals to design and document a building by creating a parametric three-dimensional model that included both the geometry and non-geometric design and construction information, which is also known as Building Information Modeling or BIM (1975 Eastman C.). At the time, several other software packages—such as ArchiCAD and Reflex—provided a three-dimensional virtual building model, and let the user control individual components via parameters (parametric components). Two key differences in Revit were that users created parametric components in a graphical "family editor" rather than a programming language, and the model captured all relationships between components, views, and annotations so that a change to any element automatically propagated to keep the model consistent.



## 1.2. OBJECTIVES OF THE PROJECT

The main objectives of this project are:

- ⊗ Learning possibilities and techniques of Revit software.
- ⊗ Creating a residential house model using Revit software in order to study Software capabilities and difficulty.
- ⊗ Rendering of software is done by enscape.

## 1.3. ROLE OF SOFTWARES

### 01. Role of Autodesk Revit

Autodesk Revit is building information modeling software tool for architects, landscape architects, structural engineers, mechanical, electrical, and plumbing (MEP) engineers, designers and contractors. The original software was developed by Charles River Software, founded in 1997, renamed Revit Technology Corporation in 2000, and acquired by Autodesk in 2002. The software allows users to design a building and structure and its components in 3D, annotate the model with 2D drafting elements, and access building information from the building model's database.[1] Revit is 4D building information modeling application capable with tools to plan and track various stages in the building's lifecycle, from concept to construction and later maintenance and/or demolition.

## 02.Role of Enscape

Enscape is a commercial real-time rendering and virtual reality plugin. It is mainly used in the architecture, engineering, and construction fields and is developed and maintained by Enscape gmbh, founded in 2013 and based in Karlsruhe, Germany with an office in New York, United States. In 2022, Enscape's developer Enscape gmbh merged WI The main focus of Enscape lies in the calculation of realistic visualizations of architecture with low operating complexity. A real-time method is applied to achieve higher iteration speeds at the planning project by reducing waiting times. The respective CAD model is used, for example, to derive a virtual reality simulation.

Enscape uses openly 4.4[3] and Vulkan and provides photorealistic representations of the underlying CAD models. With the help of a path-tracing procedure[4] and physically based material models, the global illumination[4] can be visualized realistically.th Chaos, developer of competing rendering software V-Ray.[2]

## *Chapter 2*

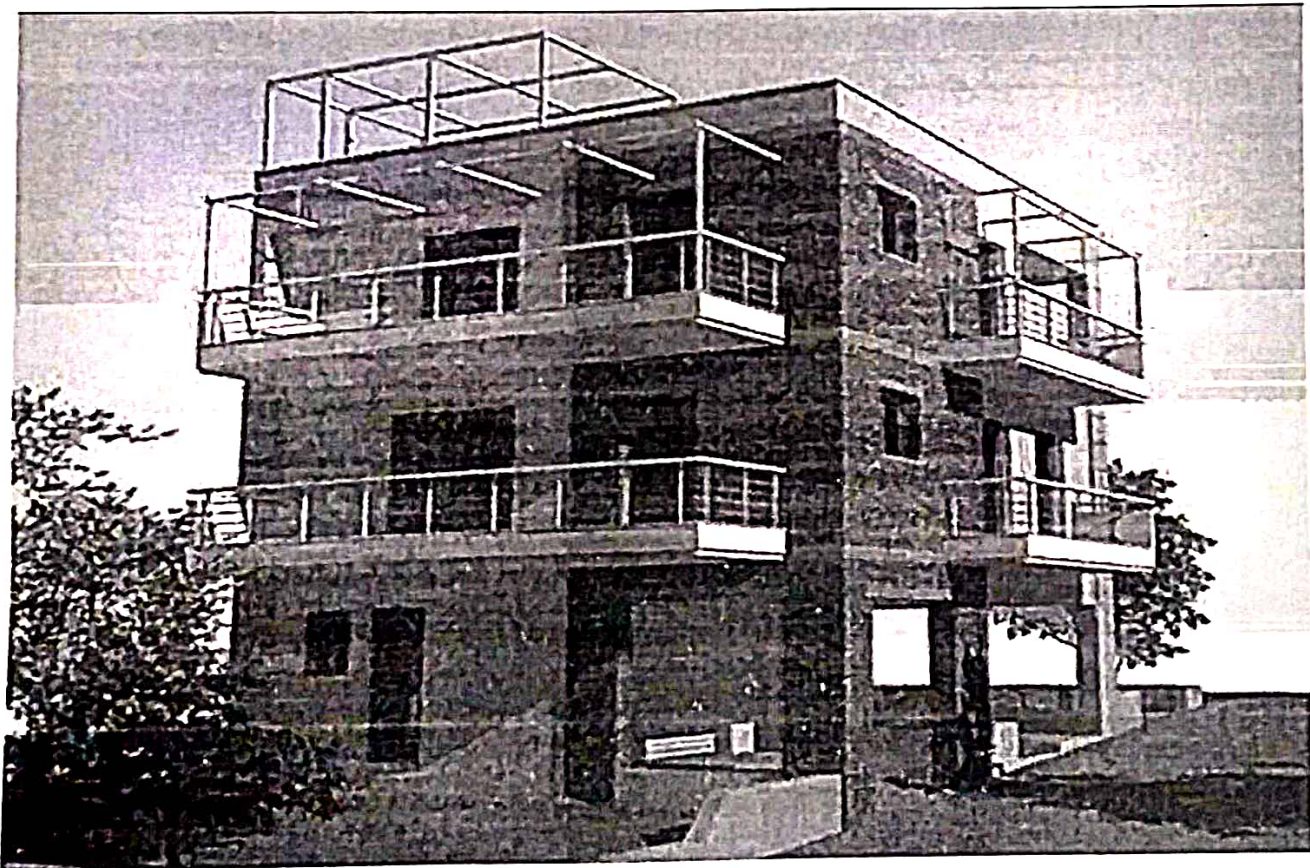
### *Literature Review*

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#### **2.1. Residential Building**

A residential building is one or more family dwellings, lodging or boarding houses, hostels, dormitories, apartment houses, flats, and private garages in which sleeping accommodation is provided for conventional residential purposes, with or without kitchen or dining facilities.

Individual and multi-family dwellings are built and sold in the residential construction industry. The market is divided into single-family homes, manufactured homes, duplexes, quad lexes, apartments, and condominiums. Mobile homes and pre-built houses are two types of manufactured housing. The size and scope of the operations are the main differences in the business.



**FIG. 1 RESIDENTIAL BUILDING**



## 2.2. Types of Residential Buildings

### 1. SINGLE-FAMILY HOME

Residences built on a single land with no shared walls are known as single-family homes. A garage, whether attached or detached, is sometimes present.

Single-family homes typically have greater privacy and space than other types of residences, as well as private front and back yards. You are free to express yourself with any style of home design because you do not share the land with anybody else.

This style of home necessitates a lot more maintenance, and the homeowner is responsible for all of the costs. You share the costs of yard upkeep, plumbing, roofing, and building amenities in condos and town homes.





## 2. CONDOMINIUMS

Condominiums are individual units that are part of a bigger complex or community. Condos usually share a wall or two with other apartments and are subject to homeowners' associations, which charge monthly or yearly dues. They're popular in high-density metropolitan areas with lots of restaurants and businesses.

The homeowner bears only a little amount of duty for maintenance and upkeep. For example, if your roof leaks, you can split the cost with other residents rather of paying for the entire repair. Furthermore, some condos provide amenities such as gyms, lounge rooms, pools, and other features that you would not be able to buy or fit into a single-family house.

Condominium homeowners' associations frequently place restrictions on the types of remodelling you can perform, as well as pet and rental restrictions. Hoes want consistency and safety; you don't want one homeowner replacing doors and windows that aren't up to code or installed safely!

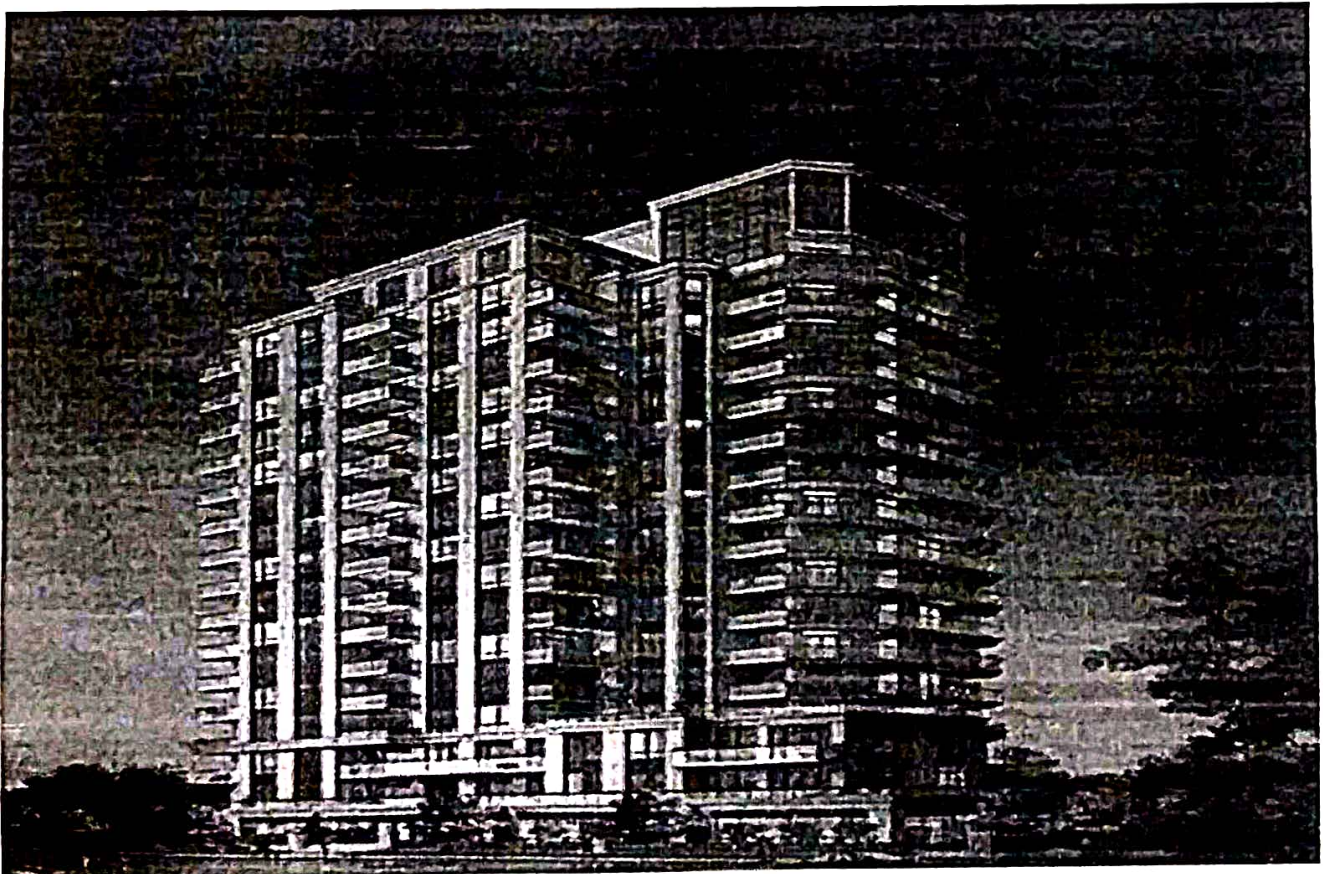


FIG. 3 CONDOMINIUMS



### 3. TOWNHOUSE

A townhouse is a cross between a condominium and a single-family residence. They're usually multi-story buildings with one or two common walls and a small yard or deck. They're bigger than a condo but not as big as a single-family home.

A town home often provides greater privacy than a condo. Some have homeowners associations (HOAs) or joint maintenance agreements (JMAs) to share upkeep costs. They are usually less expensive than a single-family home. Town homes don't normally come with common amenities like a gym or a pool, but they aren't as private as a single-family house either.



FIG. 4 TOWNHOUSE

### 4. CO-OP

Cooperatives, often known as co-ops, are a unique manner of owning a piece of property in a common facility. You own the area within your unit in a condo, but everyone in a co-



op owns the building as a whole. Because of the shared obligation, becoming a member of the community generally necessitates an interview procedure.

Because co-op owners frequently handle upkeep as a group, their HOA dues are usually lower. They are also less expensive than equivalent condominiums. You and your neighbours share financial responsibility for the entire building, which means that if someone fails to pay their co-op mortgage, the bank may foreclose on the entire building.

A co-op loan is harder to obtain than a condo loan; most require a larger down payment, and some banks will not support it.

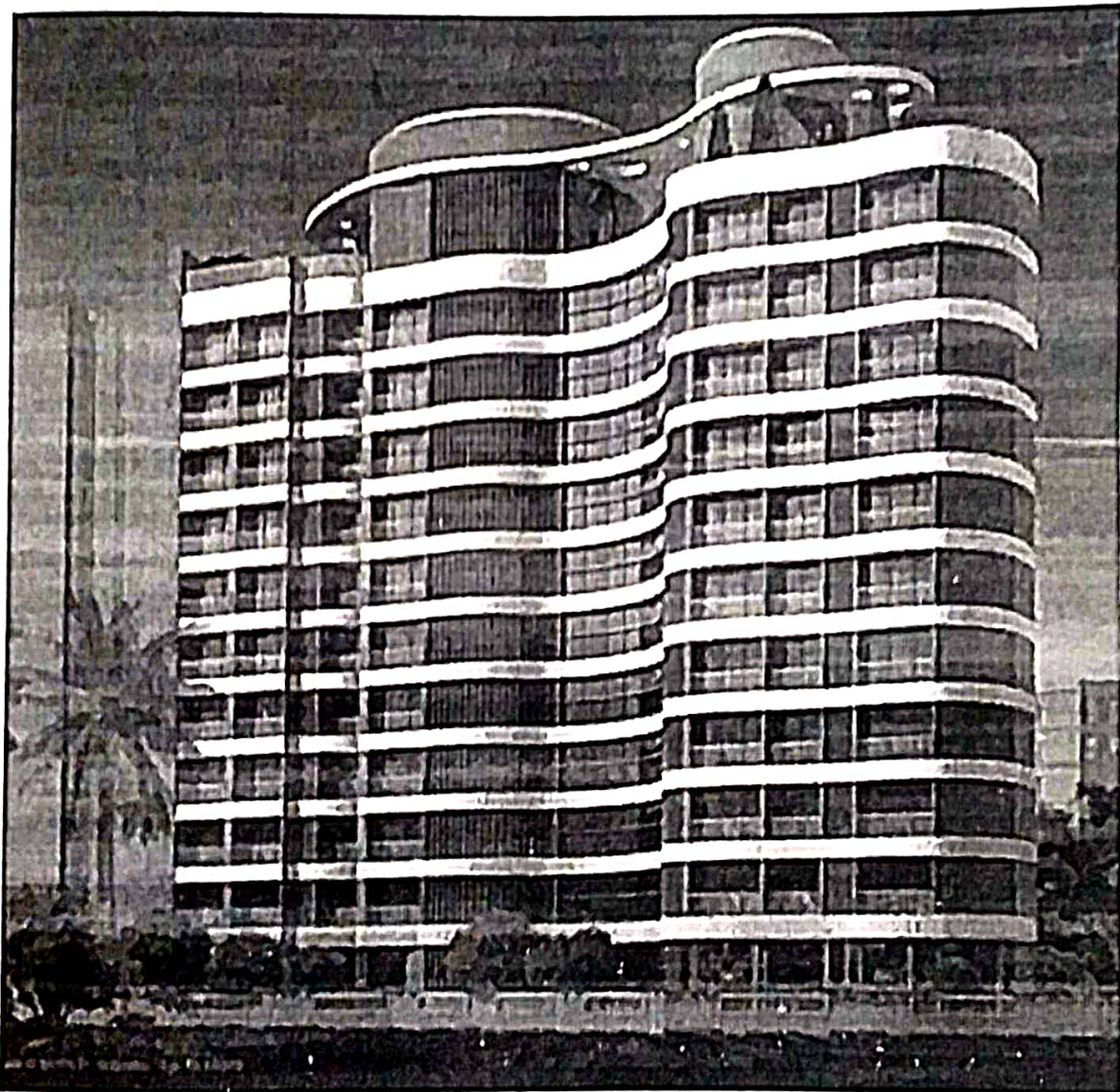


FIG. 5 CO-OP



## 5. MULTI-FAMILY HOME

Multi-family dwellings are the least prevalent type of residential structure. They are primarily single-family homes that have been divided into two or more units. They can be row house-style or multi-story, with sizes ranging from a duplex to a four-plexus; anything with more than four units is deemed commercial.

Some multi-family homes have separate entrances for each apartment, while others have a shared main entry. The difference between multi-family apartments and condos is that the units cannot be acquired separately; there is only one owner for the entire building.

Multi-family homes are perfect for those looking for an investment property: many people choose to live in one unit while renting out the others for income, or just rent out all of them.

They are also an excellent choice for multi-generational households because they allow family members to reside in the same building yet each have their own unit. Multi-family dwellings are a cross between a single-family home and a condominium. The units are typically smaller and less private than single-family residences.



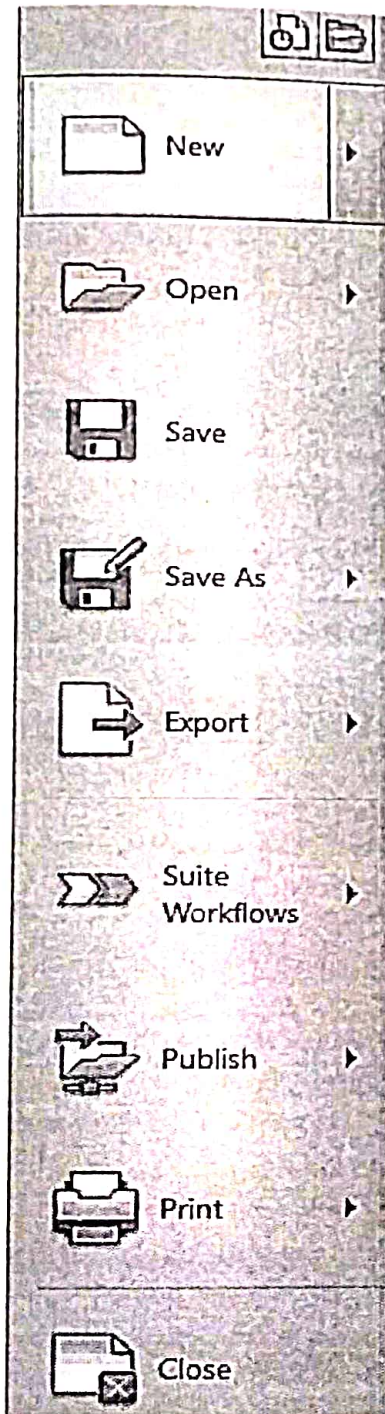
FIG. 6 MULTI FAMILY HOME

## 2.3. METHODOLOGY

### A. MODELLING

☒ Residential building

☒ Creating a Project



Creates a Revit file.



#### **Project**

Creates a Revit project file.



#### **Family**

Creates a set of custom components to use in projects.



#### **Conceptual Mass**

Opens a template for creating a conceptual massing model.



#### **Title Block**

Opens a template for creating a Title Block family.



#### **Annotation Symbol**

Creates a tag or symbol to identify elements in the project.

FIG. 7 CREATING A PROJECT



## & Adding Walls

### Wall: Architectural (WA)

Creates a non-structural wall in the building model.

Use the Type Selector to specify the type of wall to create, or use the default type to create a generic wall and specify a different wall type later.

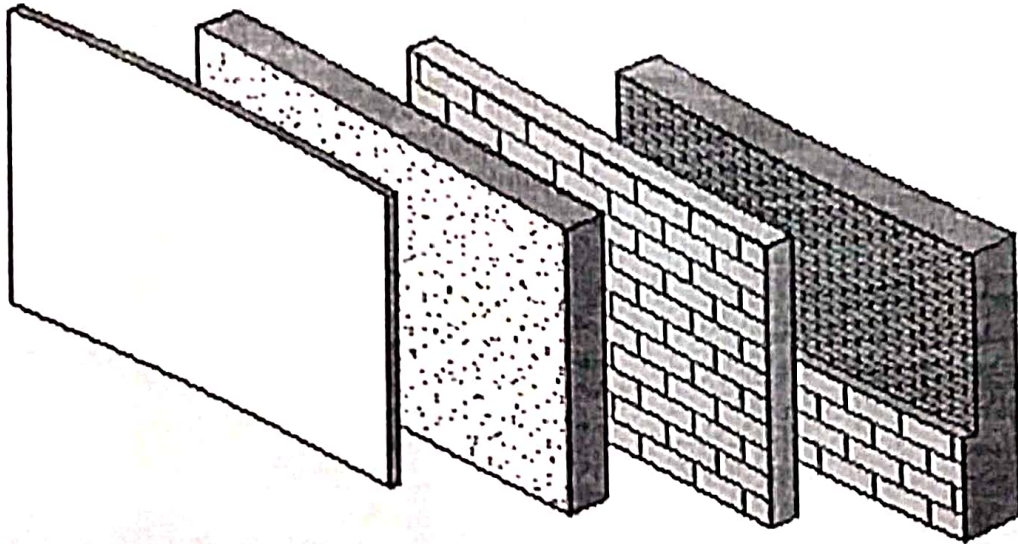


FIG. 8 ADDING WALLS

## & Adding a Curtain Wall

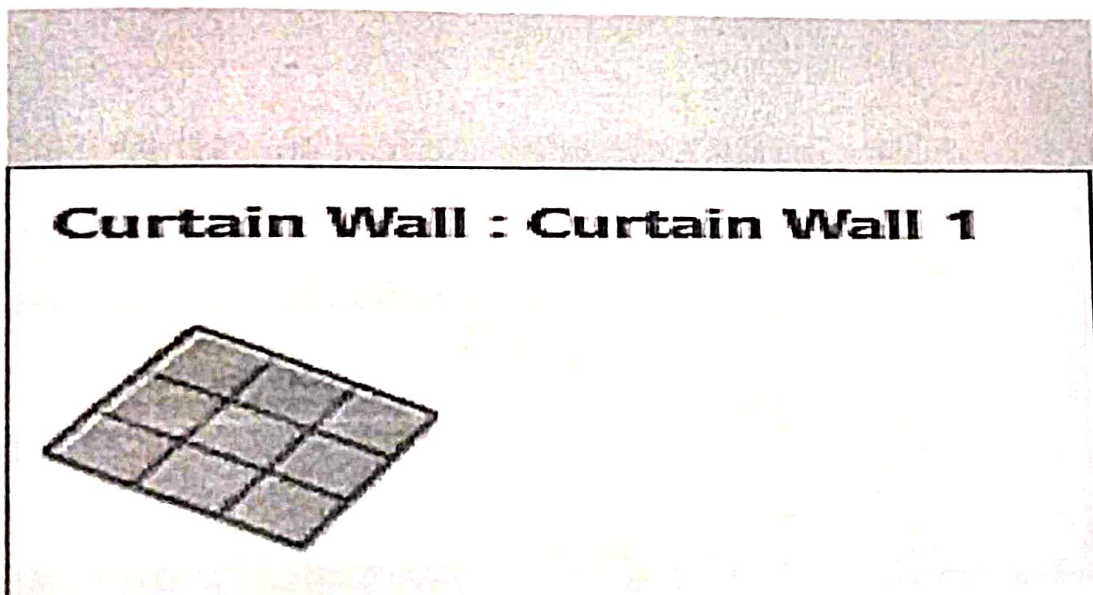


FIG. 9 ADDING A CURTAIN WALL



## ⌘ Adding Doors

### Door (DR)

Adds doors to the building model.

Use the Type Selector to specify the type of door to add, or load the desired door family into the project.

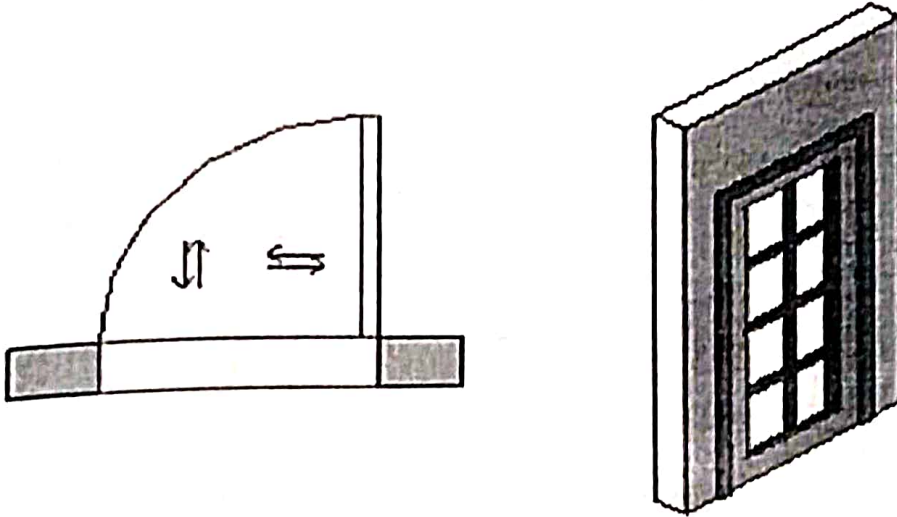


FIG. 10 ADDING DOORS

## ⌘ Adding windows

### Window (WN)

Adds windows to the building model.

Use the Type Selector to specify the type of window to add, or load the desired window family into the project.

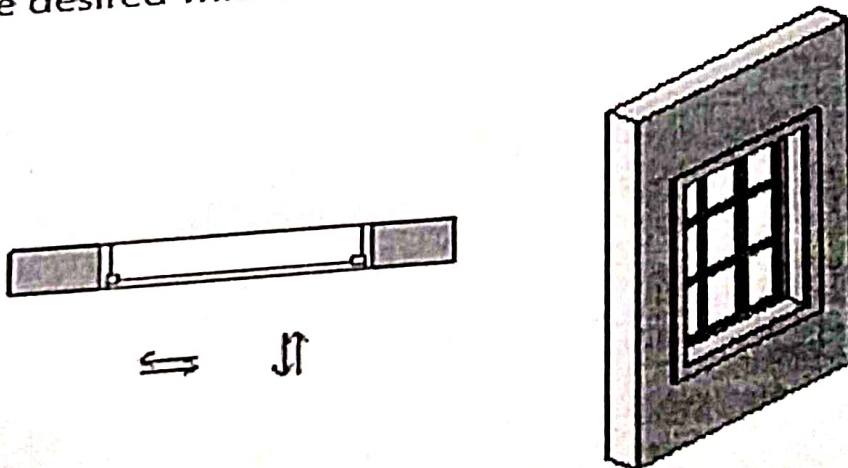


FIG. 11 ADDING WINDOWS

## Adding Components

### Place a Component (CM)

Places an element in the building model, based on a selected element type.

Use the drop-down list to select the element type. (If the desired type is not listed, use the Load Family tool to load it into the project.)

Then click in the drawing area to place elements of that type in the building model.

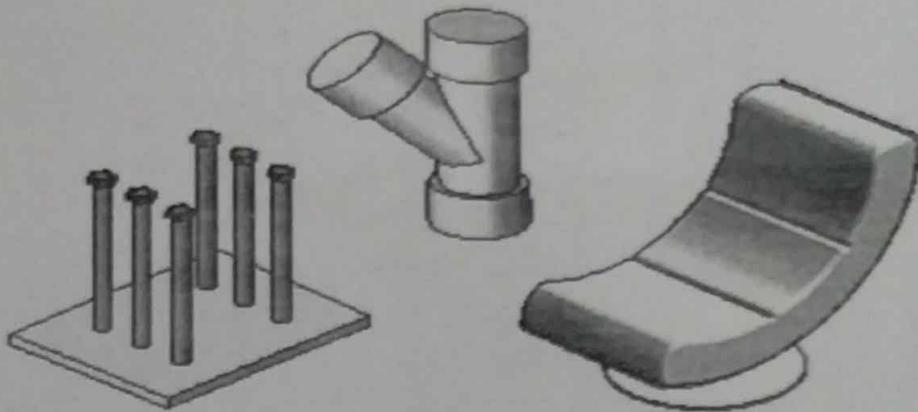


FIG. 12 ADDING COMPONENTS

## Adding Floors

### Floor

Creates a floor for the current level of the building model.

To align the floor with existing walls, use the Pick Walls tool. Or to sketch the floor boundaries, draw lines or pick existing lines in the model.

The floor is offset downward from the level on which it is created.

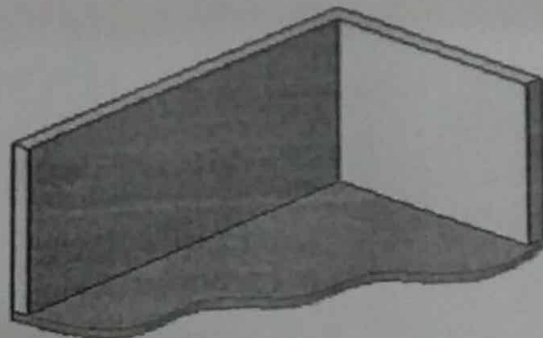


FIG. 13 ADDING FLOORS

## ↳ Adding Stairs

### Stair

Adds a stair to the building model by creating common run, landing, and support components.

To add stairs, open a plan view or a 3D view.

The number of treads for a stair run is based on the distance between floors and the maximum riser height defined in the stair type properties.

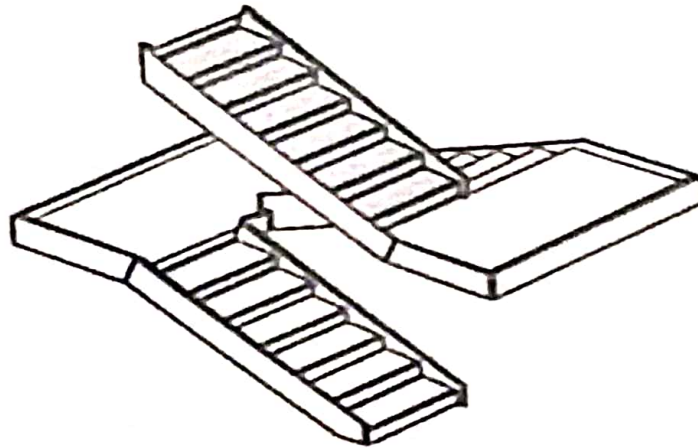


FIG. 14 ADDING STAIRS

## ↳ Adding Ceiling

### Ceiling

Creates a ceiling at a specified distance above the level in which it resides.

For example, if you sketch a ceiling in the floor plan view for Level 1, the ceiling is created a specified distance above Level 1.

To see the ceiling, open the Reflected Ceiling Plan (RCP) view for the corresponding level.

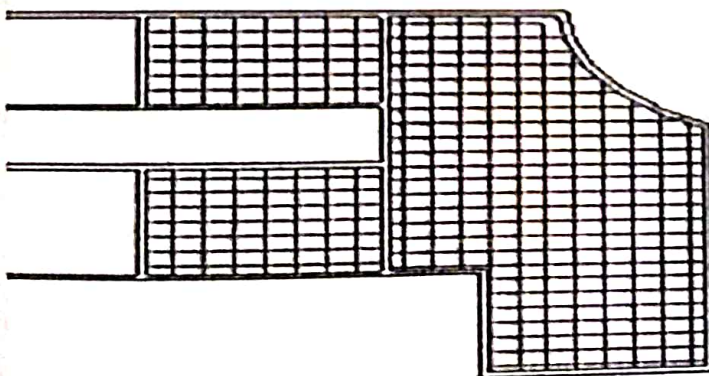


FIG. 15 ADDING CEILING

### Roof by Footprint

Creates a roof using the building footprint to define its boundaries.

To create a roof by footprint, open a floor plan view or a reflected ceiling plan view.

You can specify different slopes and overhangs for the roof when you create it, or use default values and refine them later.

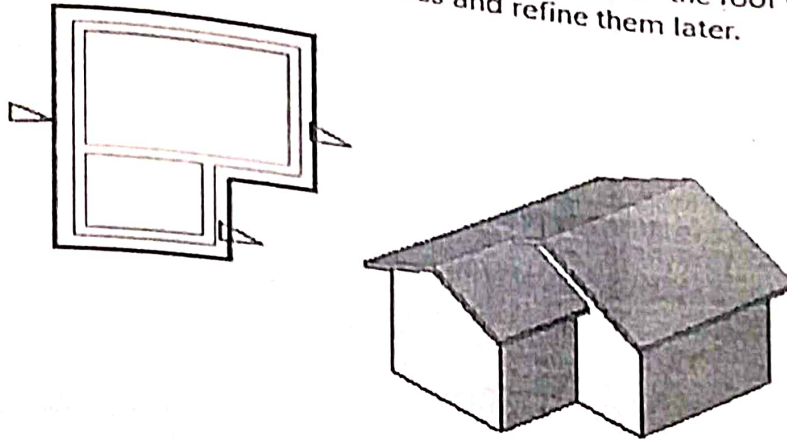


FIG. 16 ADDING A ROOFS

### & Adding Site Components

#### Site Component

Adds site-specific elements, such as trees, parking islands, and fire hydrants.

Use the Type Selector to specify the type of site element to place, or load the desired site family into the project.

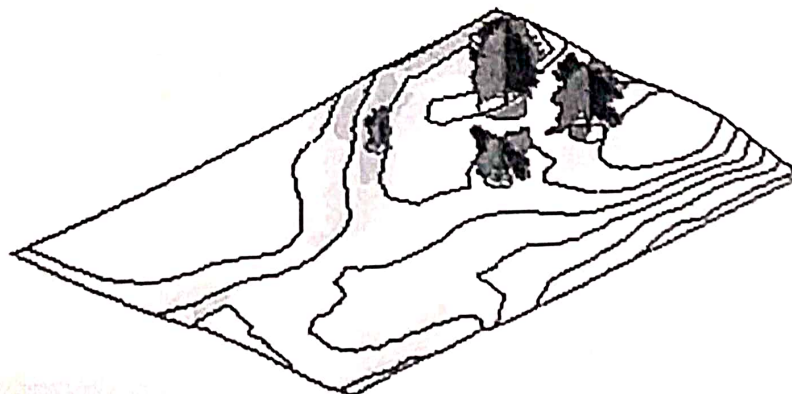


FIG. 17 ADDING SITE COMPONENTS



## 🔗 Add Painting

### Paint (PT)

Applies a material to the face of an element.

For quantity reporting and scheduling, materials that are applied with the Paint tool are distinguishable from those that are used as the body material of host object elements.

To remove paint from an element, use the Remove Paint tool.

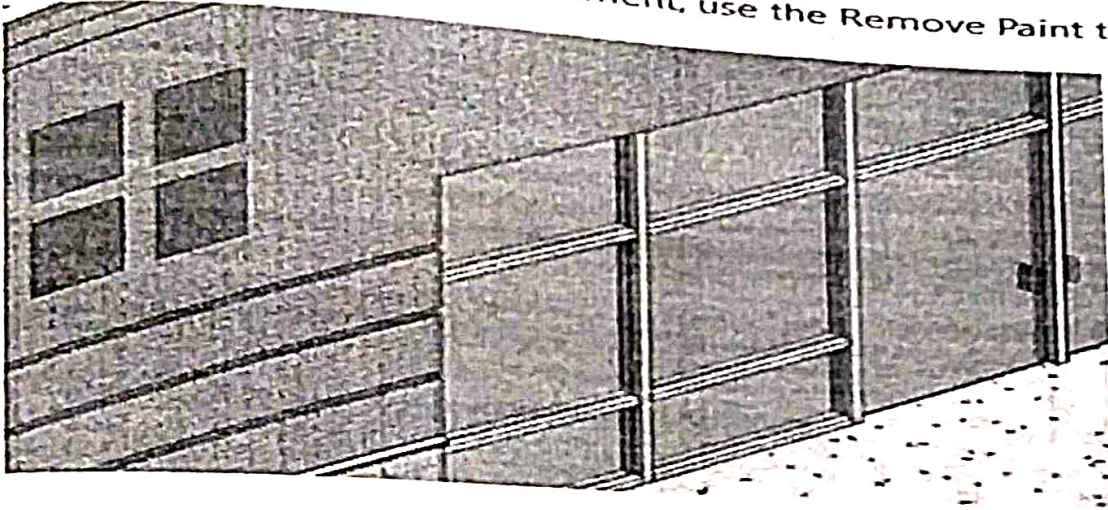


FIG. 18 ADD PAINT

## 🔗 Camera View

### Camera

Creates a 3D view from the perspective of a camera placed in the view.

Use the Offset and Level options to specify a perspective. You can also edit the Eye Elevation and Target Elevation view properties to change the perspective.

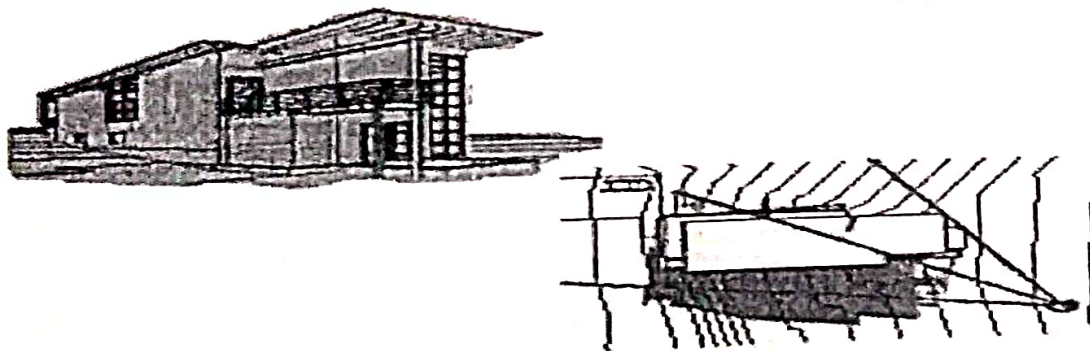


FIG. 19 CAMERA VIEW



## Rendering

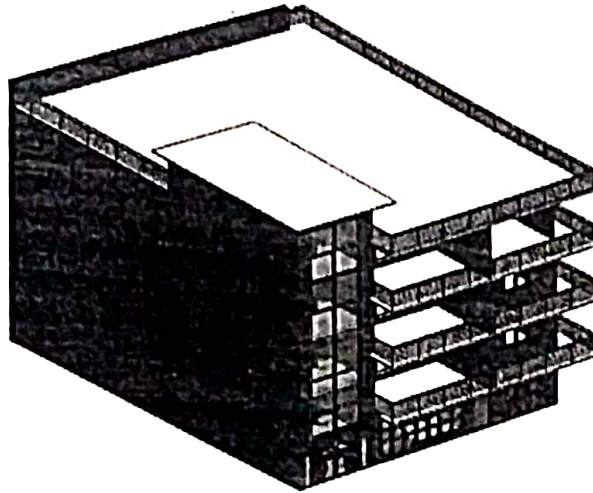
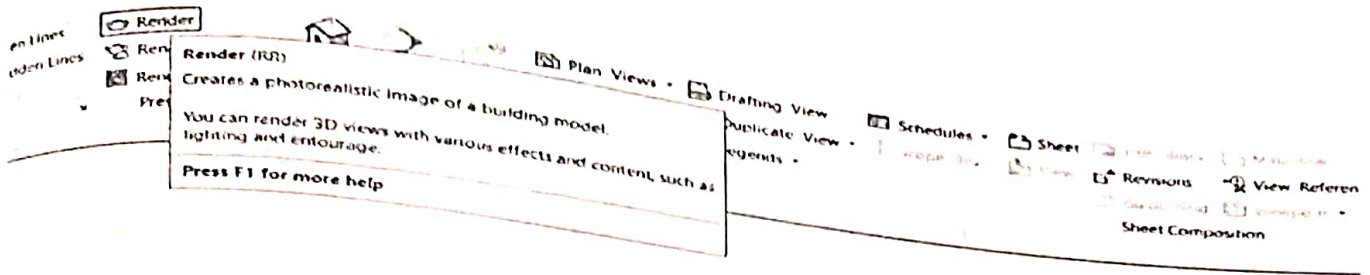


FIG. 20 RENDERING

## Walkthrough

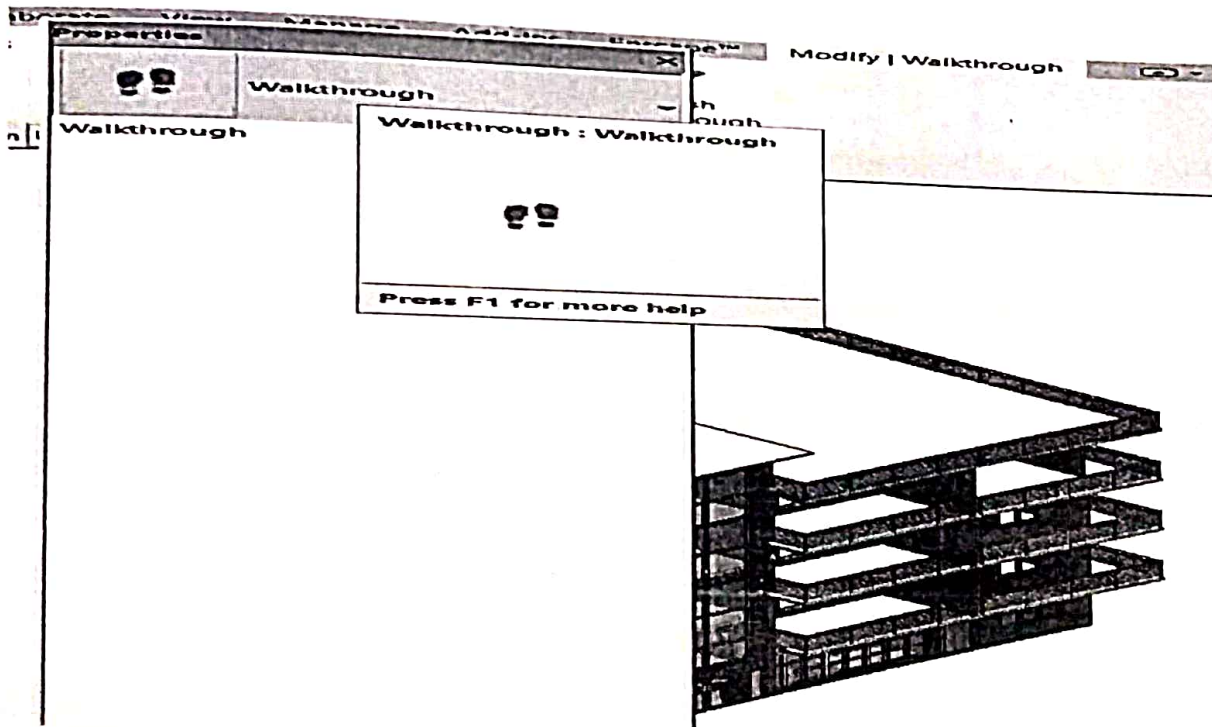


FIG. 21 WALKTHROUGH

### 3.1. DIMENSION OF PLAN

1. Size of plan : 40' x 42'
2. Hall size: 22'4.5" x 14'
3. Guest room size: 13' x 12'6"
4. Bedroom 1 size: 12'11" x 12'10.5"
5. Bedroom 2 size: 13'7.5" x 12'10.5"
6. Bedroom 3 size: 9'7.5" x 7'9"
7. Kitchen size: 9'4.5" x 8'
8. Washroom size : 4'6" x 7'9"
9. Washroom size : 5'3" x 7'6"

This is 4 story residential building with proper architectural concepts. In each floor there are 3 bedrooms, 1 kitchen,, 2 washrooms and 1 guest room.

All the dimensions of construction work is mentioned above and in detail plan.

### 3.2. FLOOR PLAN

1. Floor plan is a technical scale drawing that illustrates property House/Building layout from above. Depending on your needs, floor plans can include a variety of things.
2. A good floor plan has many benefits, the main ones are competitiveness in a demanding market, saving time and money, and turning your vision into reality.
3. Two main types of floor plans are 2D and 3D diagrams. There are other plans that are similar to floor plans.
4. Floor plan is also called Building plan.

Every **simple floor plan** will illustrate:

1. Walls
2. Windows
3. Stairs
4. Doors
5. Room layouts

**Detailed floor plans** will also include:

1. HVAC (heating, ventilation, and air conditioning)
2. Plumbing and electrical systems
3. Additional features (Everything that you need for interior planning can be included in a floor plan. From build-in appliances to plant placement on your terrace.)

Depending on your needs and wishes, the floor plan will include everything that is necessary. If you are uncertain if you will be able to interpret everything that is illustrated on a floor plan, check out our article on reading and understanding elements of a house plan.



# 1. 1<sup>ST</sup> LEVEL PLAN

In this plan, there are 3 bedrooms, 1 kitchen, 1 guest room and 2 wash rooms are designed. There are one staircase also designed at the entrance. There are enough windows are planned.

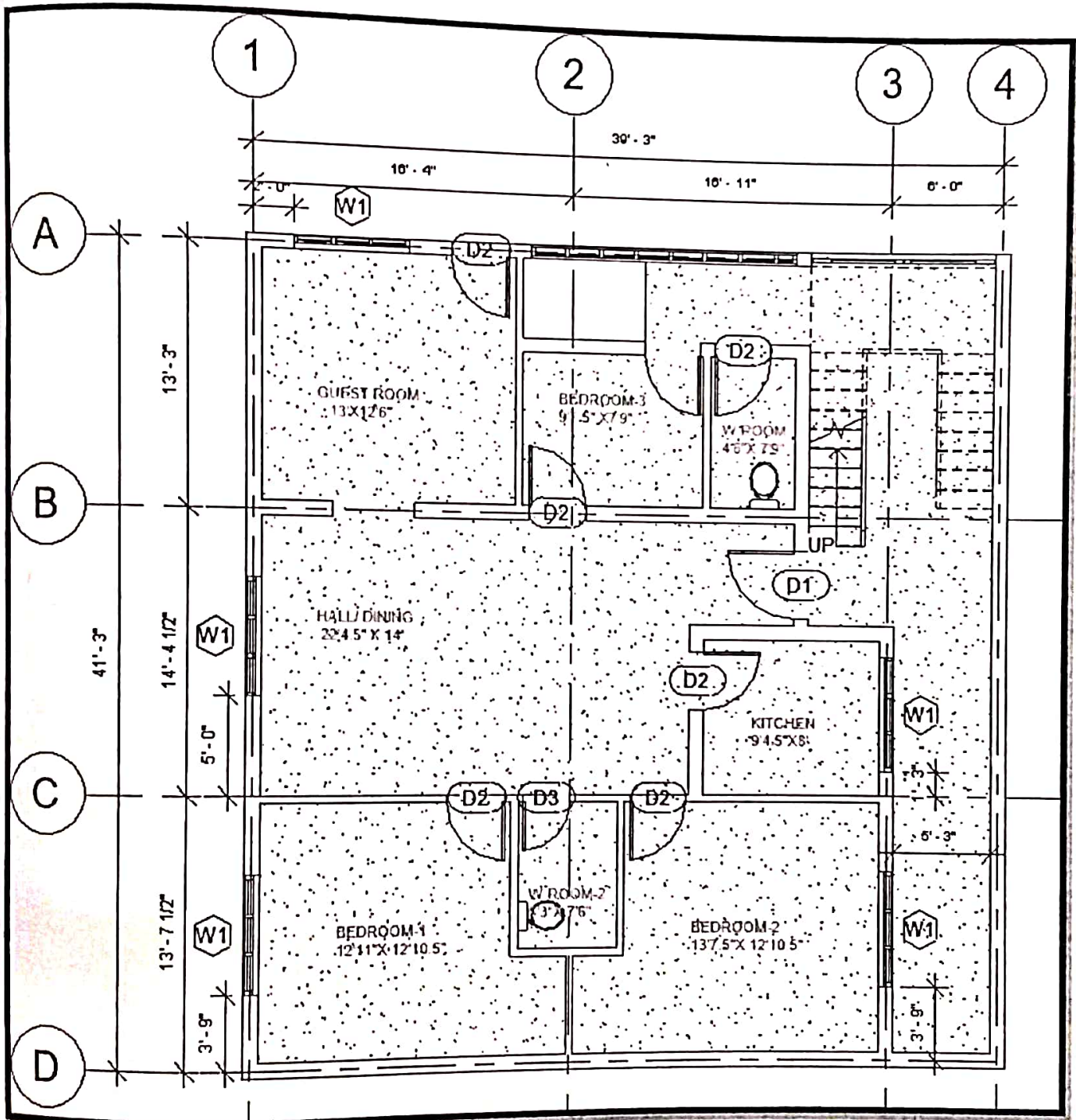


FIG. 22 1<sup>ST</sup> LEVEL PLAN

## 2. 2<sup>ND</sup> LEVEL PLAN

This is also similar to 1<sup>st</sup> level plan. But in addition, there are wide balconies also designed.

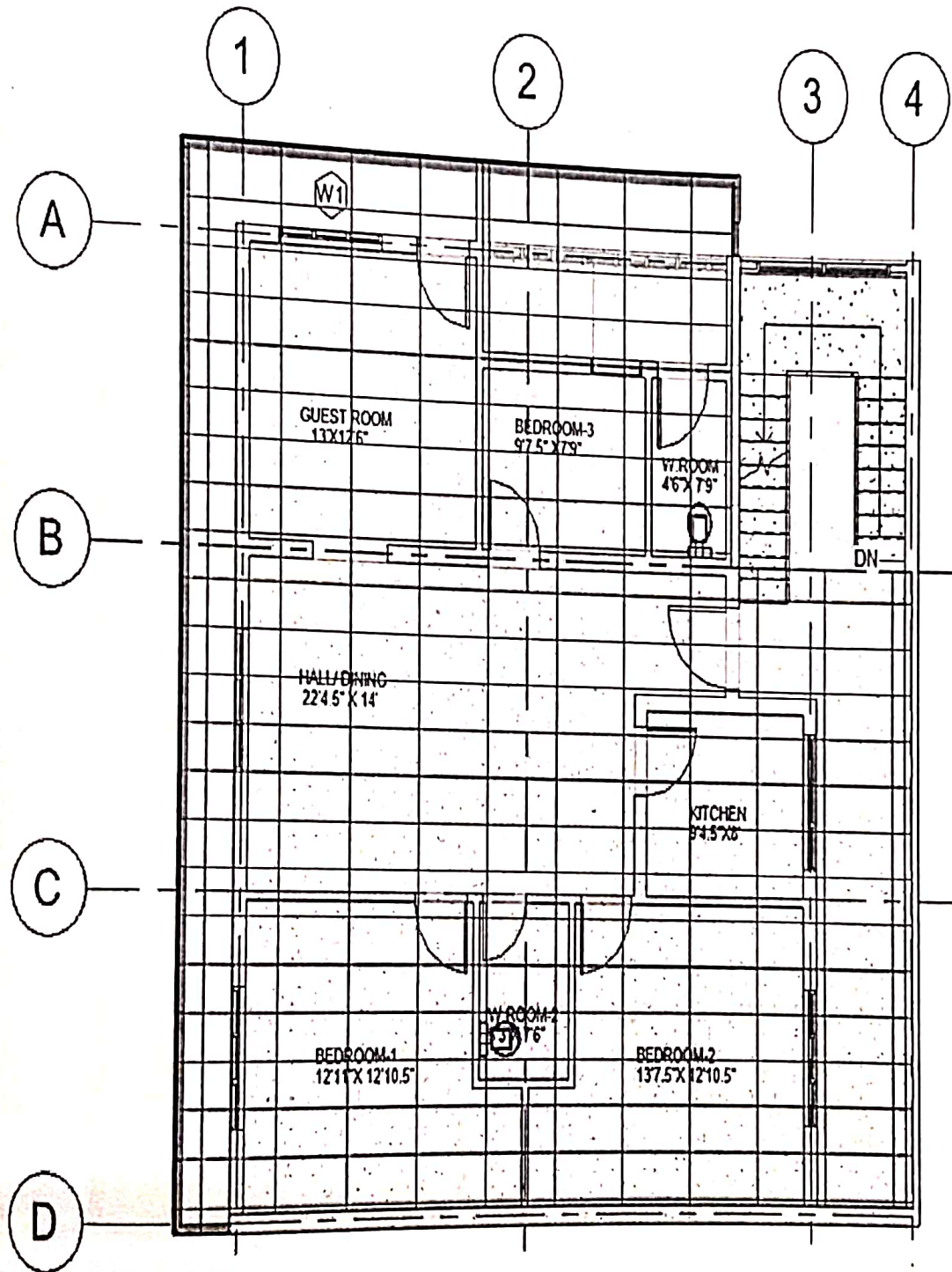


FIG. 23 2<sup>nd</sup> LEVEL PLAN

### 3. 3<sup>RD</sup> LEVEL PLAN

This is also similar to 1<sup>st</sup> level plan. But in addition, there are wide balconies also designed.

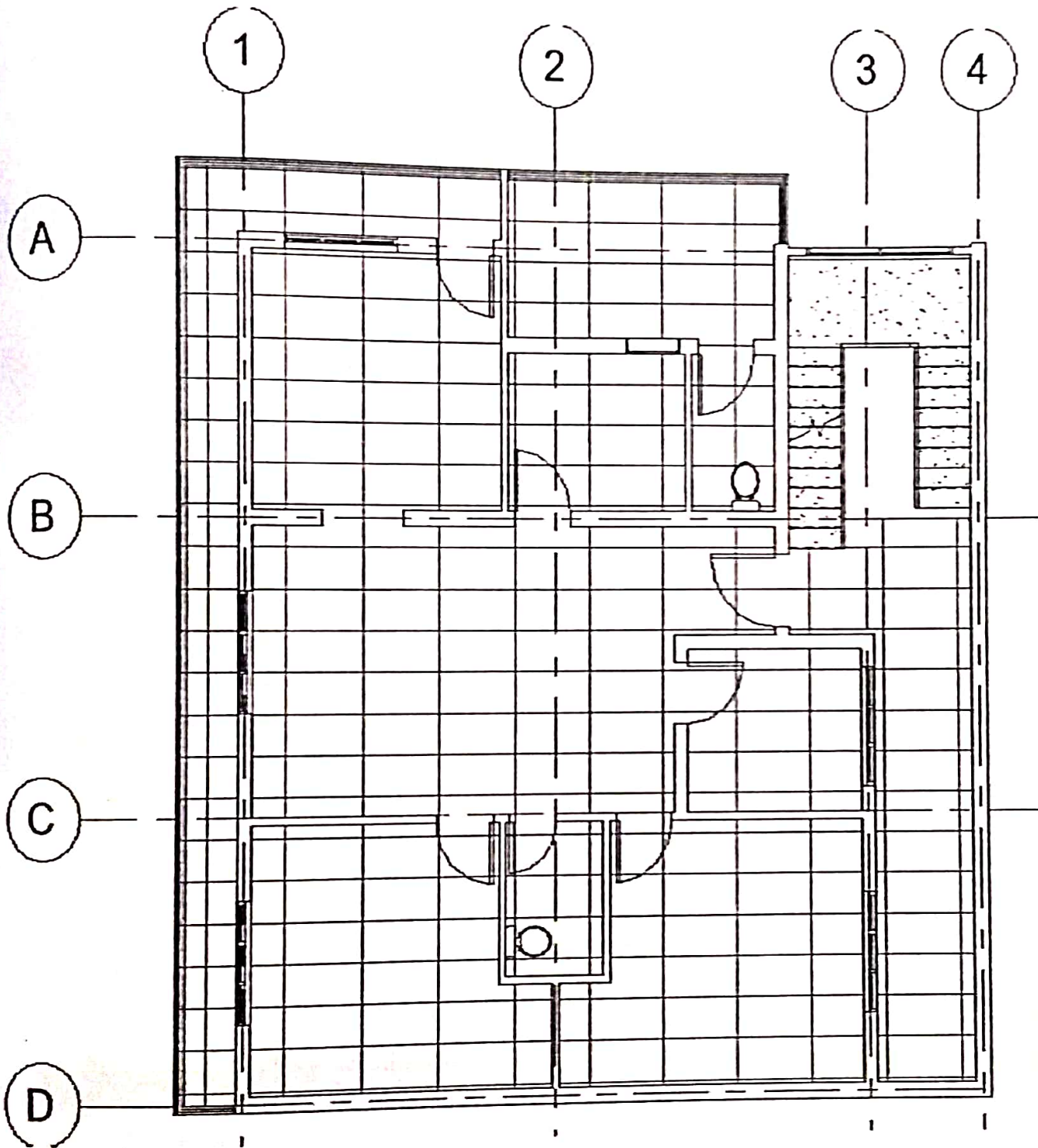


FIG. 24 3rd LEVEL PLAN



#### 4. 4<sup>TH</sup> LEVEL PLAN

This is also similar to 1<sup>ST</sup> level plan. But in addition, there are wide balconies also designed.

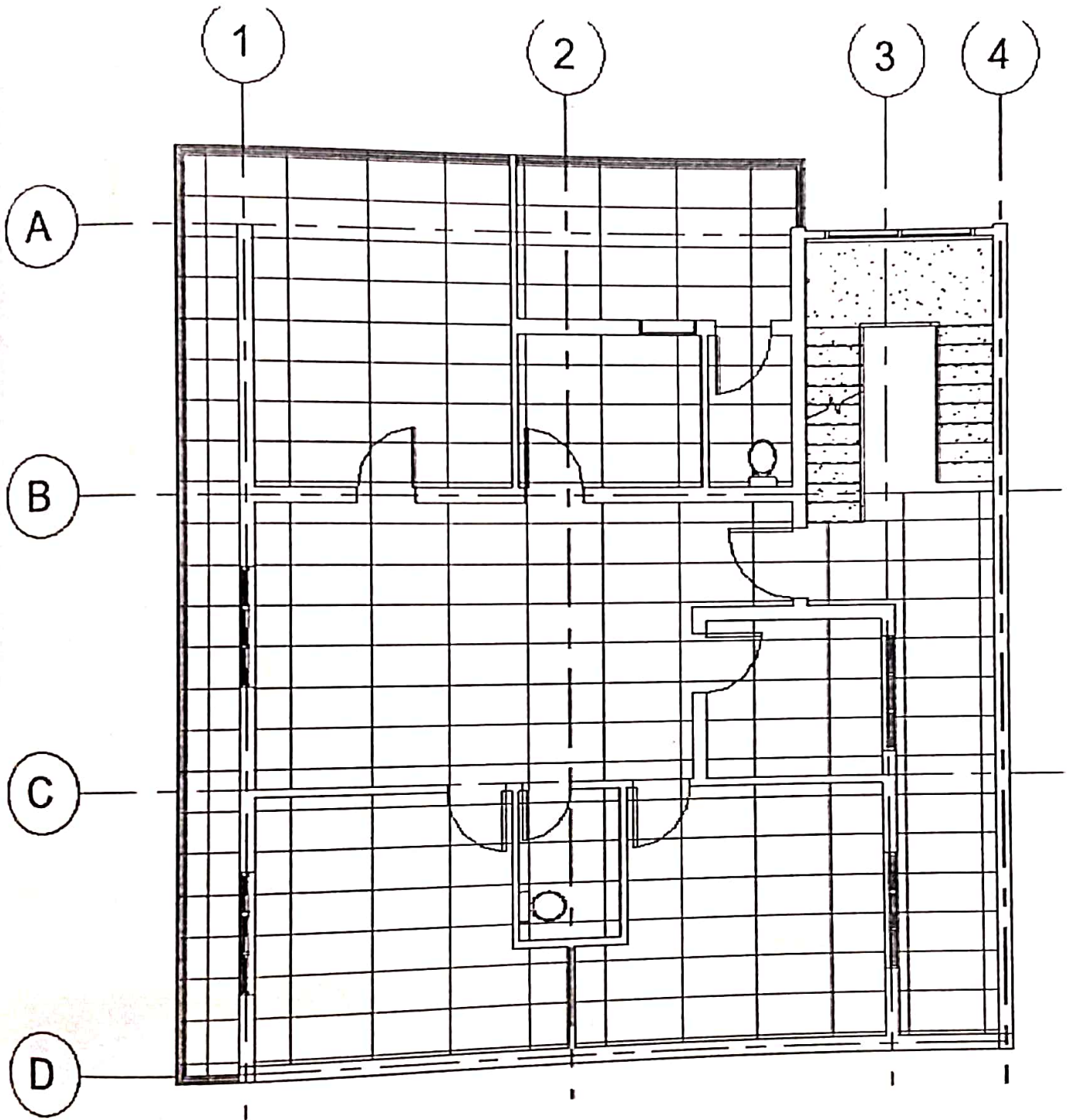


FIG. 25 4<sup>th</sup> LEVEL PLAN

## 5. 5<sup>TH</sup> LEVEL PLAN

This plan shows, the terrace view plan. In this, there are 1 staircase is seen and open terrace are designed.

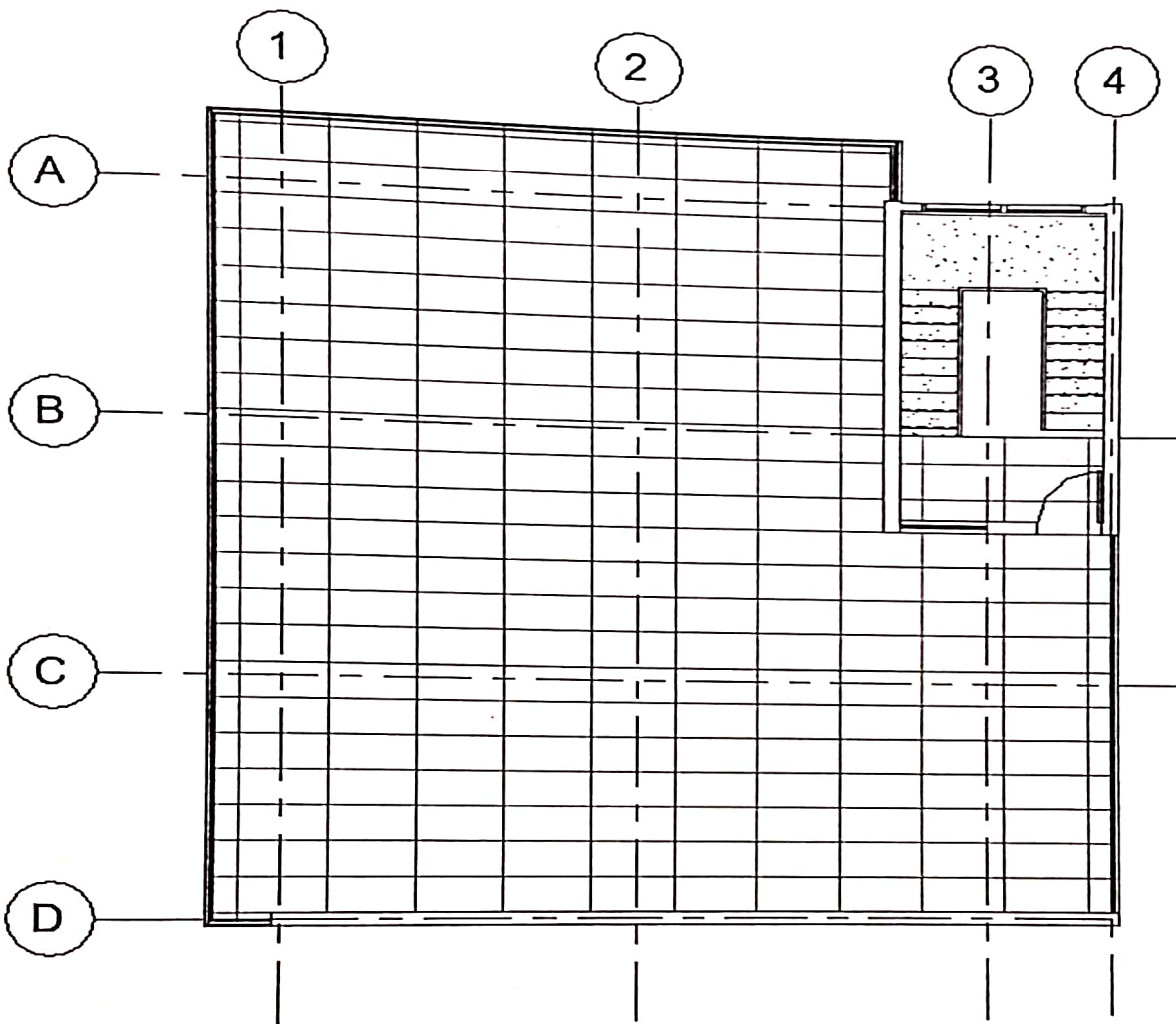


FIG. 26 5<sup>TH</sup> LEVEL PLAN

## 6. 6<sup>TH</sup> LEVEL PLAN

In this plan, 1 mummy is designed.

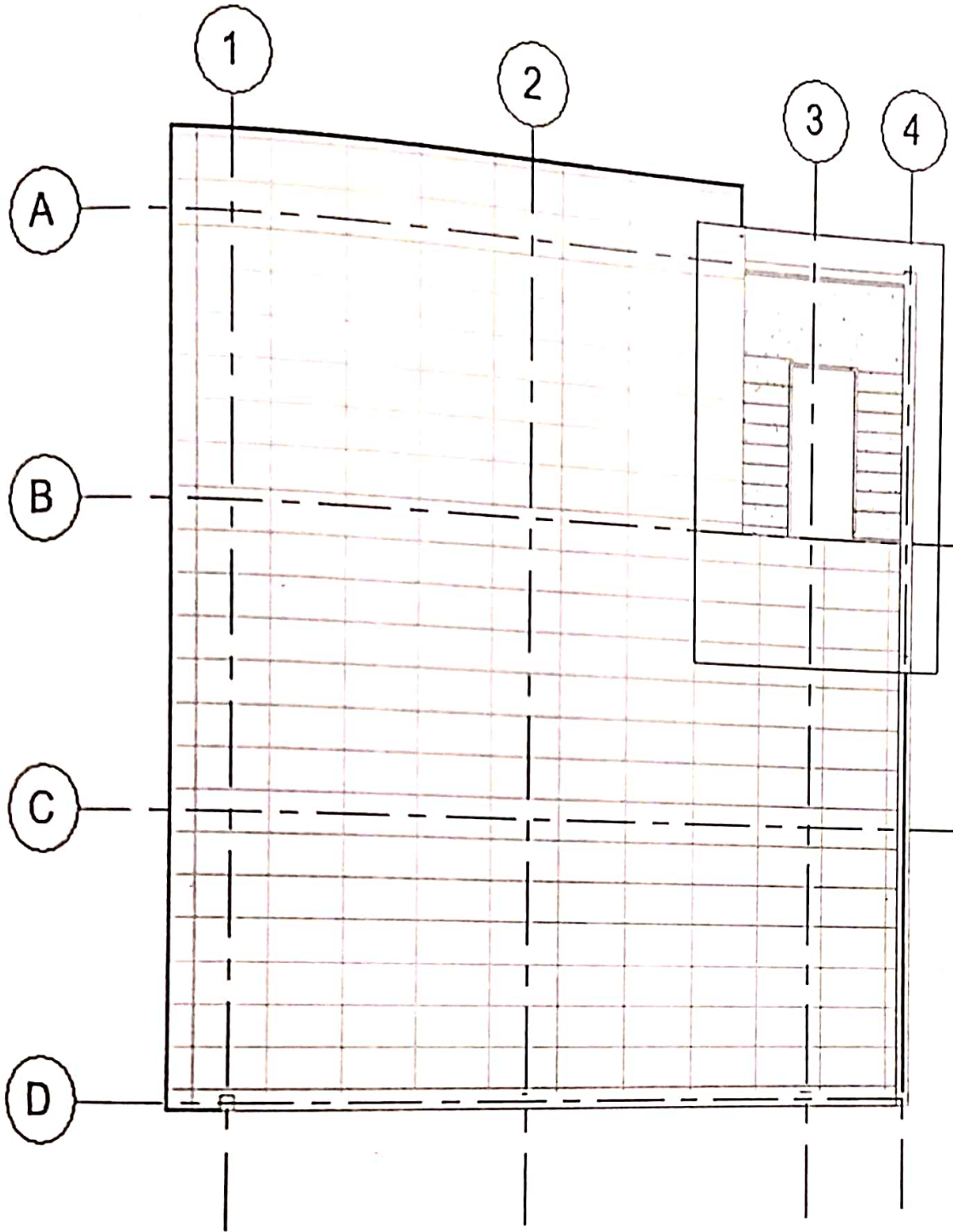


FIG. 27 6<sup>TH</sup> LEVEL PLAN



### 3.3. ELEVATION PLAN

An elevation plan provides us with an idea about what the finished building will look like. Just as a floor plan or a reflected ceiling plan illustrates how the building's floor or the ceiling will look after completion, the elevation plan shows the structural and architectural details of a building. In the architecture industry, the term 'elevation' refers to an orthographic representation of the exterior sides of any building. In some cases, we use elevation plans to illustrate the interior.

An **elevation plan** or an elevation drawing is a 2D view of a building or a house seen from one side. In general, the elevation floor plan is a two-dimensional flat visual representation of one facade as it displays the height of key features of the development about a fixed point from the ground level.

Some of the elevation drawings will include:

- The basic outline of the building.
- The outlines for the main door, windows, and garage area (if any).
- The detailed dimension and shape of the required roof area.
- Some important projects like eaves and pipes.
- Some of the most accessed elevation plans will include level datums, like the finished ground level and floor positions.
- Dimension of the entire building is noted on the sides.
- Legends, notes, and scale are mentioned at the bottom of the elevation floor plan.
- Any other portion of the building (like a chimney or water tank on the roof) may be visible from a certain projection angle.
- Balcony areas or the exterior walls that are already completed by the builder.

The core purpose of **creating an elevation plan** is to illustrate what the exterior and interior of an actual building elevation would look like when seen from the front or a particular angle. In addition to this, the elevation plan or elevation drawing serves several other important purposes, like

- **Easy Construction:** Once you have laid out everything in the elevation drawing, you now know how the entire building or the house will look from the front. It will give you an n-number of chances to make any changes that you deem fit with the right budget and resources.
- **Easy Maintenance:** If you have created an elevation plan while constructing your house, you will know everything that went into making the front of the building. If your house needs renovation or some maintenance work, you can share it with the builder, who will know the exact place they need to put down their efforts.
- **Saves Resources:** Another important benefit of creating an elevation floor plan is to save money and time. If you are not happy with the elevation drawing, you will surely not be happy with the final house design. So, instead of wasting your hard-earned money on the building, you can put all of your efforts into creating the right elevation floor plan. Once everyone involved in the project is completely satisfied, you can only begin the construction work.
- **Easy Modifications:** Changing or modifying the front of the house or any other important interior part is extremely easy with the elevation plan. For instance, with the help of an elevation drawing, you can change the position of windows, modify the height of the chimney, change the locations of the shelves or doors, or more!
- **Easy Accessibility:** Like any other architectural design, an elevation drawing informs the owner or the builder of any unexpected problem they might face while building the house. For instance, the elevation plan includes the existing walls or trees that might interfere with an overhang.

## Create an Elevation View

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Use elevation views to look at a project from different locations, either exterior or interior.

1. Open a plan view.
2. Click View tab ► Create panel ► Elevation drop-down ►  (Elevation).

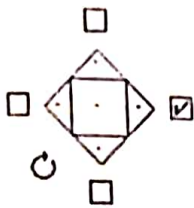
The cursor appears with the elevation symbol.

3. (Optional) In the Type Selector, select a view type from the list, or click Edit Type to modify an existing view type or create a new view type.
4. Place the cursor near a wall, and click to place the elevation symbol.

**Note:** As you move the cursor, you can press Tab to change the position of the arrowhead. The arrowhead snaps to perpendicular walls.

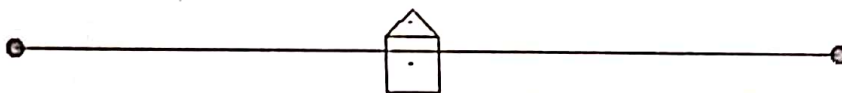
5. To set different interior elevation views, highlight the square shape of the elevation symbol, and click.

The elevation symbol displays with check box options for creating views, as the following image shows.



**Tip:** The rotation control is useful for aligning to angled elements in the plan.

6. Select the check boxes to indicate where you want to create elevation views.
7. Click away from the elevation symbol to hide the check boxes.
8. Highlight an arrowhead on the symbol to select it.
9. Click the arrowhead once to view the clip plane:



Elevation symbol with clip plane

The end points of clip planes snap and join to walls. You can resize the width of the elevation by dragging the blue controls. If the blue controls do not display in the view, select the clip plane and click Modify Views tab ► Element panel ► Element Properties. In the Instance Properties dialog, select the Crop View parameter, and click OK.

10. In the Project Browser, select the new elevation view.

The elevation view is designated by a letter and number, for example, Elevation: 1 - a.



# 1. NORTH ELEVATION

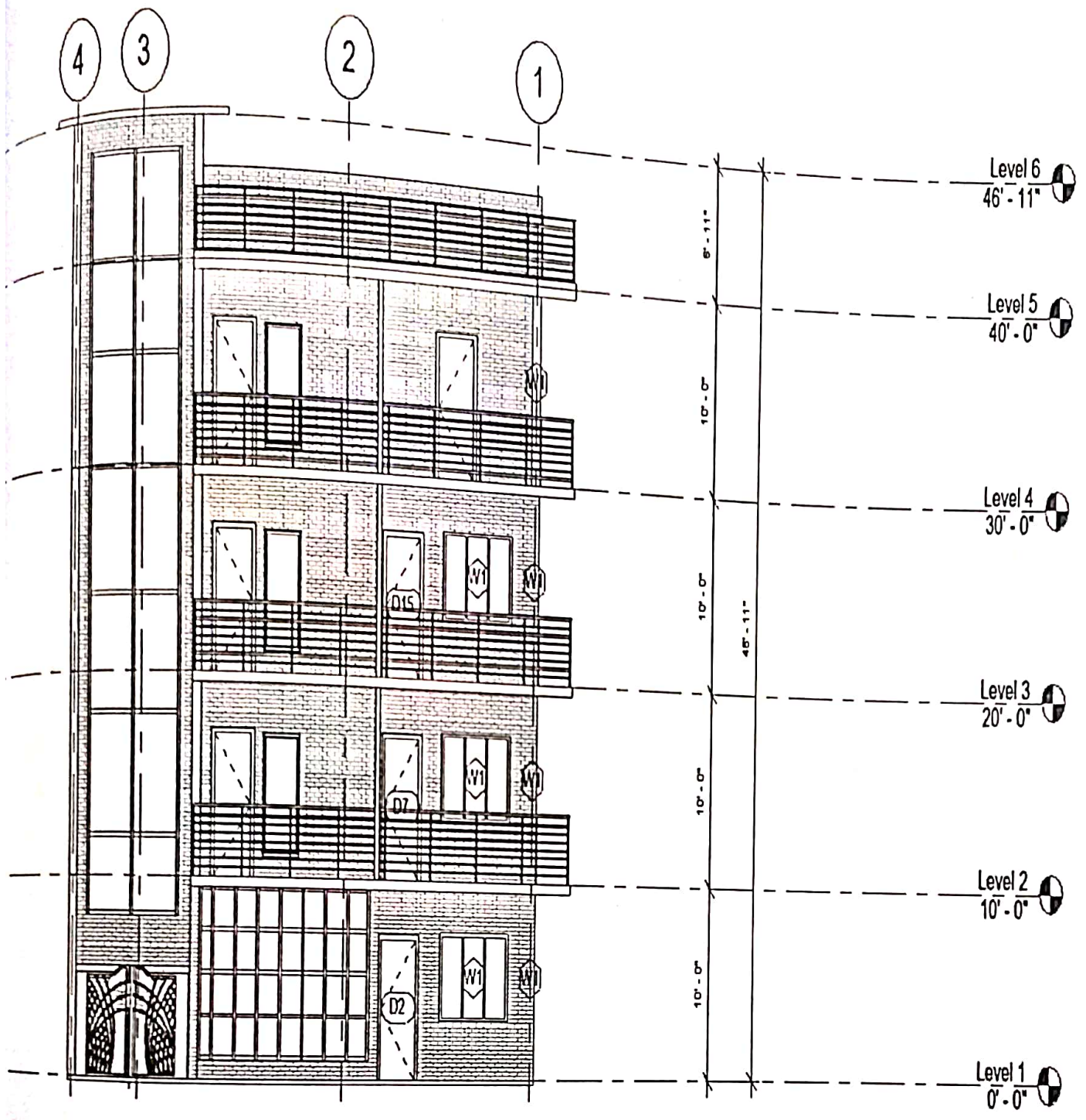


FIG. 28 NORTH ELEVATION

2. WEST ELEVATION

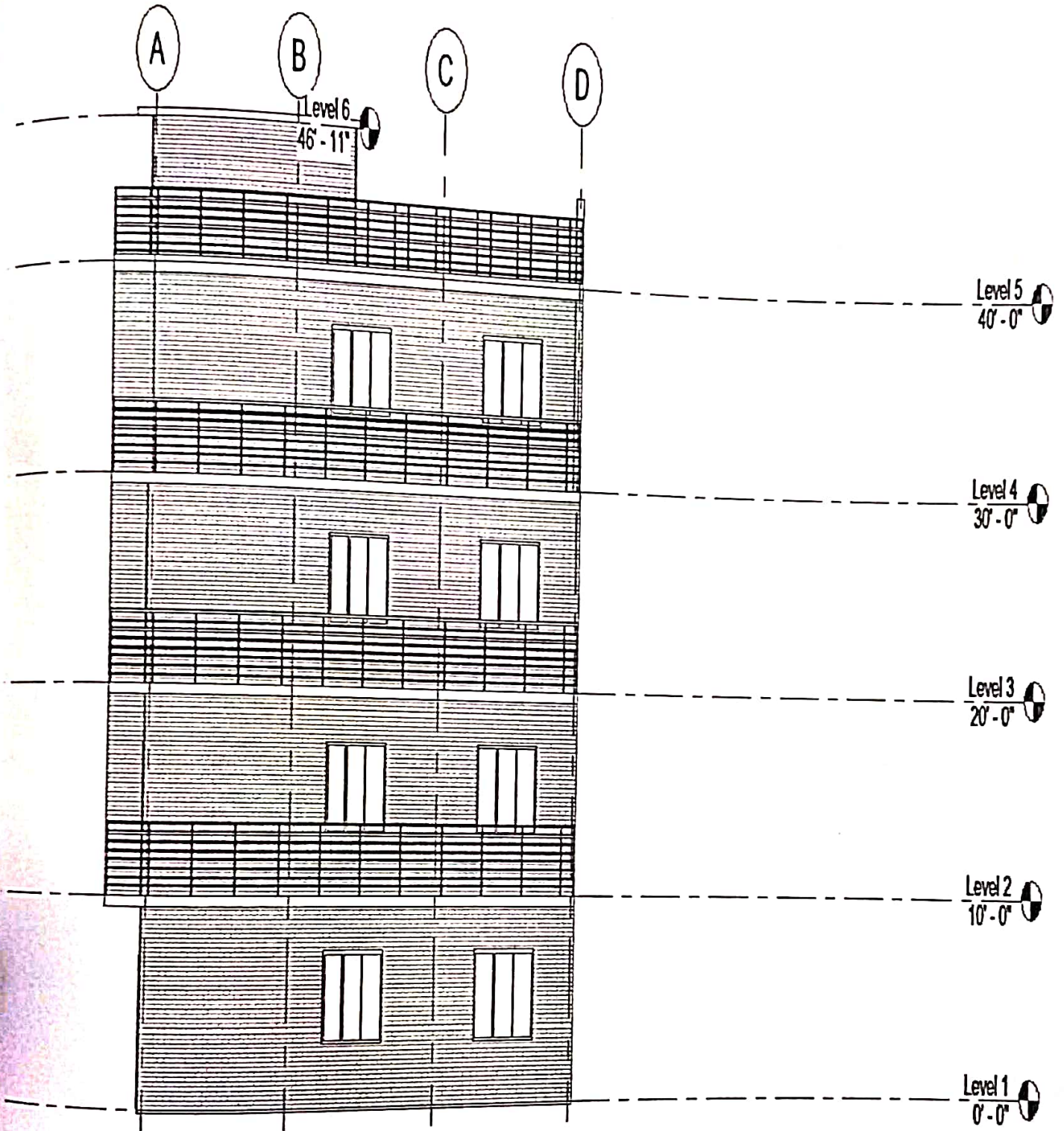


FIG. 29 WEST ELEVATION

### 3. SOUTH ELEVATION

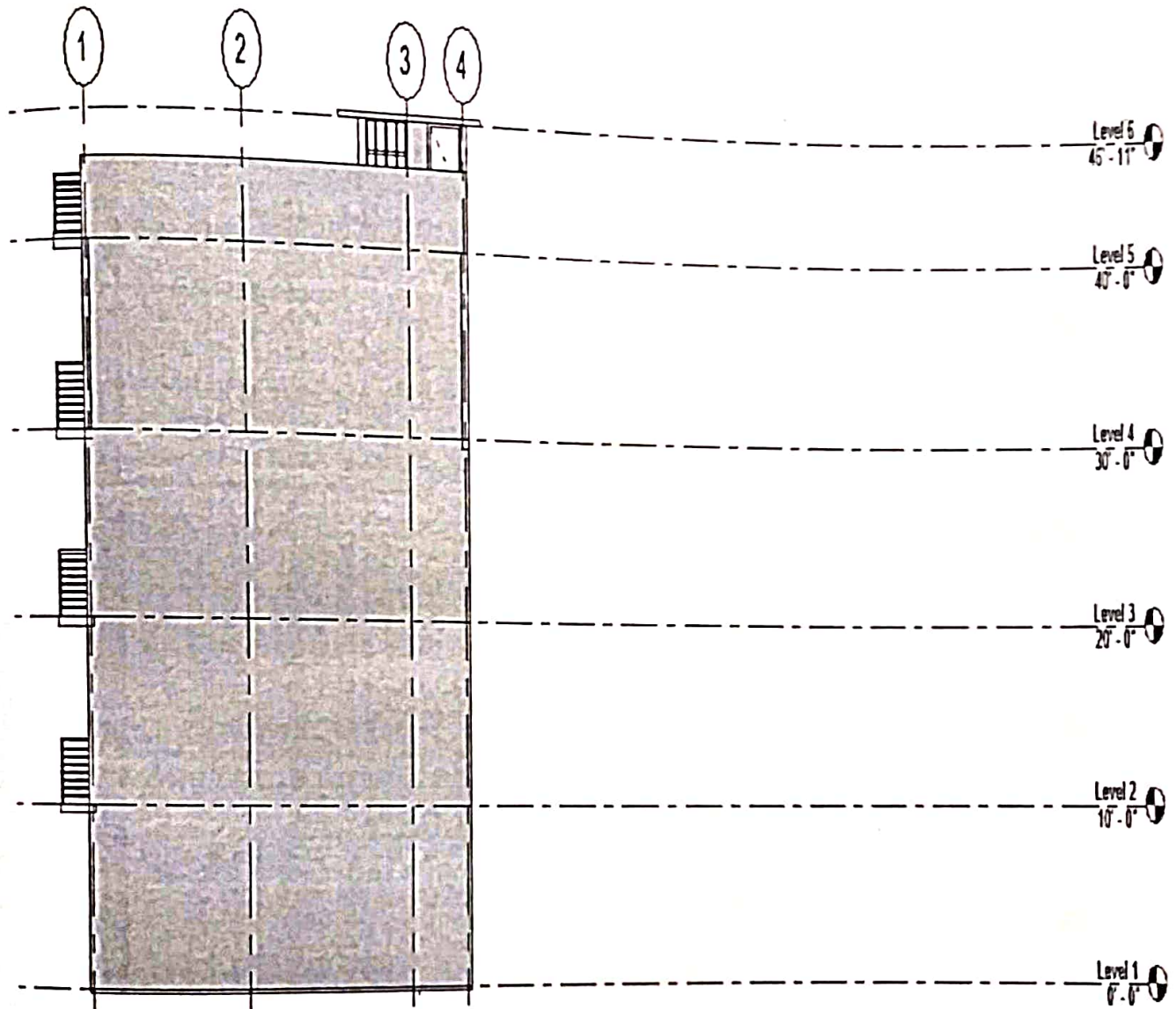


FIG. 30 SOUTH ELEVATION



# 4. EAST ELEVATION

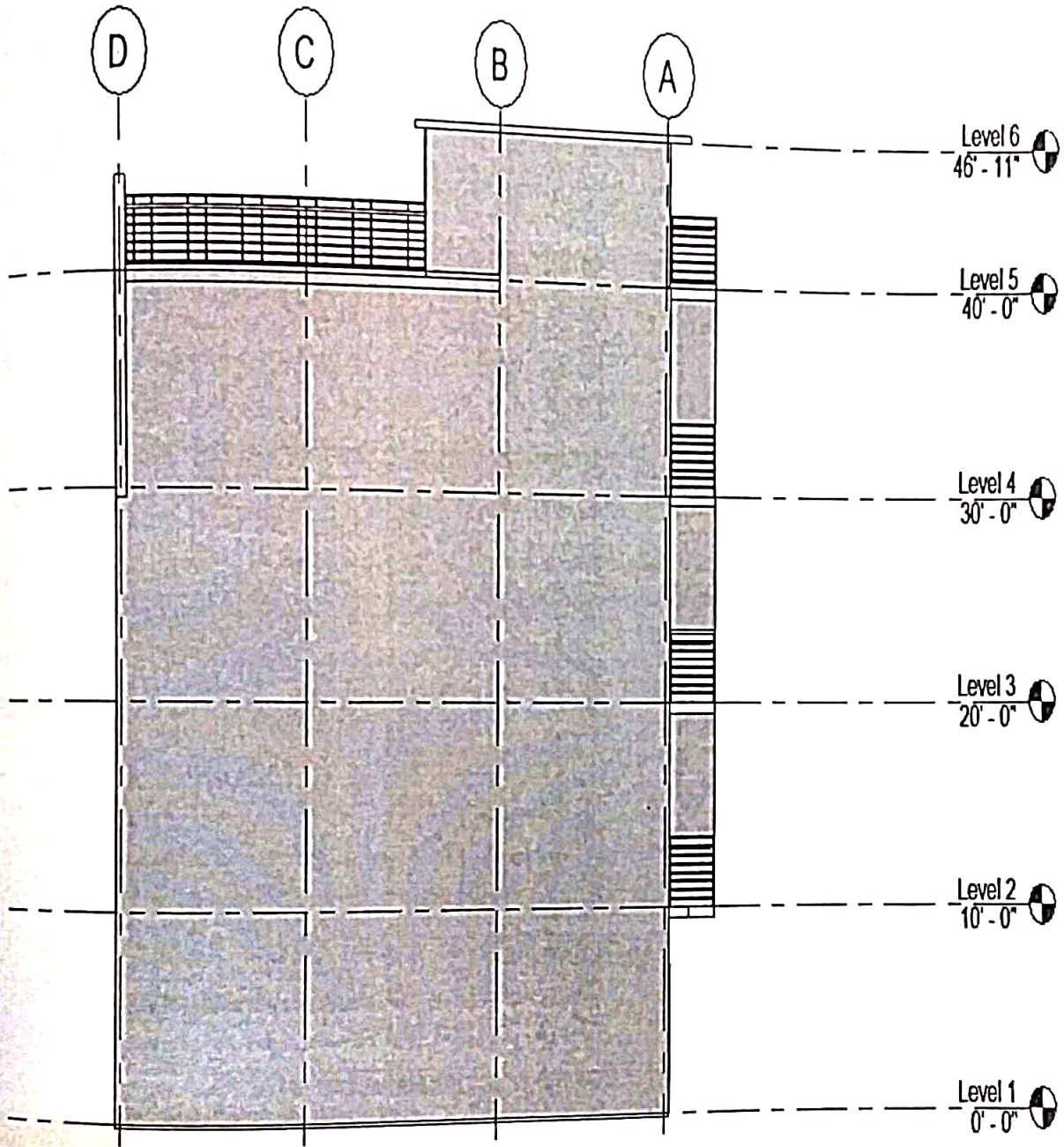


FIG. 31 EAST ELEVATION

## Chapter 4

# Rendering

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The term rendering in most forms of commercial design refers to the act of making an end-product or concept visible to an audience. Depending on the particular sector and business model of the renderer, this may be anything from a two-dimensional animation video to an internal rendering for architectural firms.

While rendering is a hallmark of many creative sectors that require the use of advanced visual imagery that would otherwise be difficult or expensive to replicate in the physical world, there are certain limitations to its use, and as such are usually used only in specific roles or situations.

Rendering in design sectors such as architecture or engineering is only one part of a toolbox filled with various methods to communicate, illustrate or otherwise emulate ideas and products for potential clients, other professionals in related career sectors, or even simply as proof of concept artwork.

### **IMPORTANCE OF RENDERING:**

The concept of rendering a design has existed before the inception of computers and computer generated imagery even began. Considering the particular scope of certain designs, whether architectural or otherwise, it may be difficult to communicate the exact vision an architect or other type of designer has in mind, especially to parties with no knowledge of design.

Apart from this, the designer they may benefit from seeing their work realized before their eyes, albeit in a digital environment. Doing this allows the designer to ascertain whether their particular design is up to their standards and free of any errors.

By combining these two factors, one may be able to see why the process of rendering a design is an important cornerstone of any sort of design sector, with fashion designers, interior designers, architects or even engineers being able to visualize their creations and share it with others.

Sharing the output of the designer's work allows it to be placed under scrutiny, whether by its creator or a third party, of which will reduce the chance of any errors and improve upon the original idea via critiquing and rigorous peer review.

### BENEFIT OF RENDERING:

1. Cycles - The fastest rendering process
2. Enscape - The best architectural renderer
3. Lumion - With free elements library
4. Blender - For super-realistic rendering
5. LuxCoreRender - Provides HDR rendering
6. Kerkythea - The most customizable
7. Clarissee - For science fiction videos
8. Arnold - The most accurate result
9. Indigo Renderer - Suitable for industrial design needs
10. Wings 3D - For beginners
11. V-Ray - With the most flexible engine



4.1 RENDER VIEW AND 3D VIEW:

1. 3D VIEW

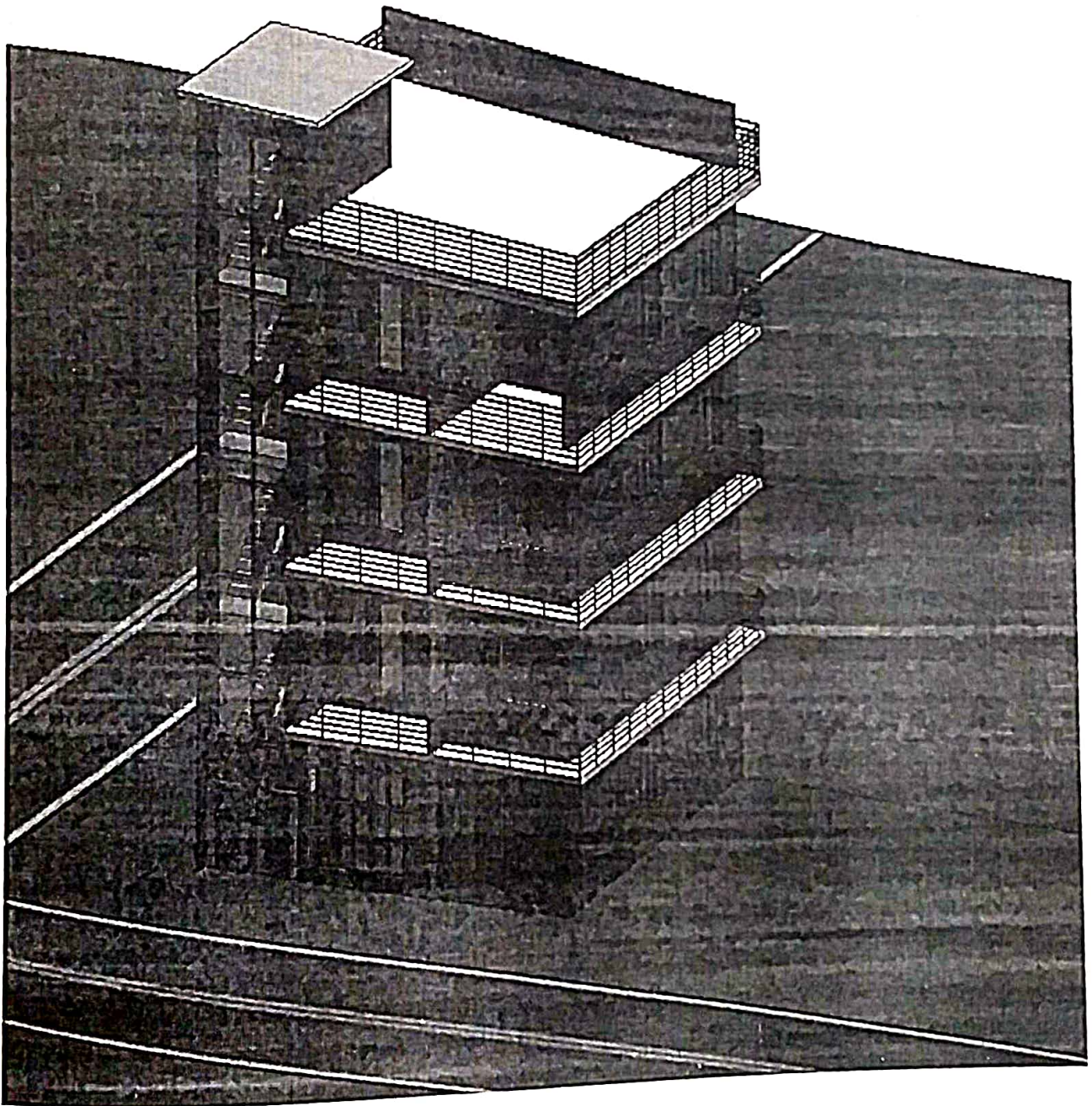


FIG. 32 3D VIEW



2. ENCAPE RENDER VIEW:

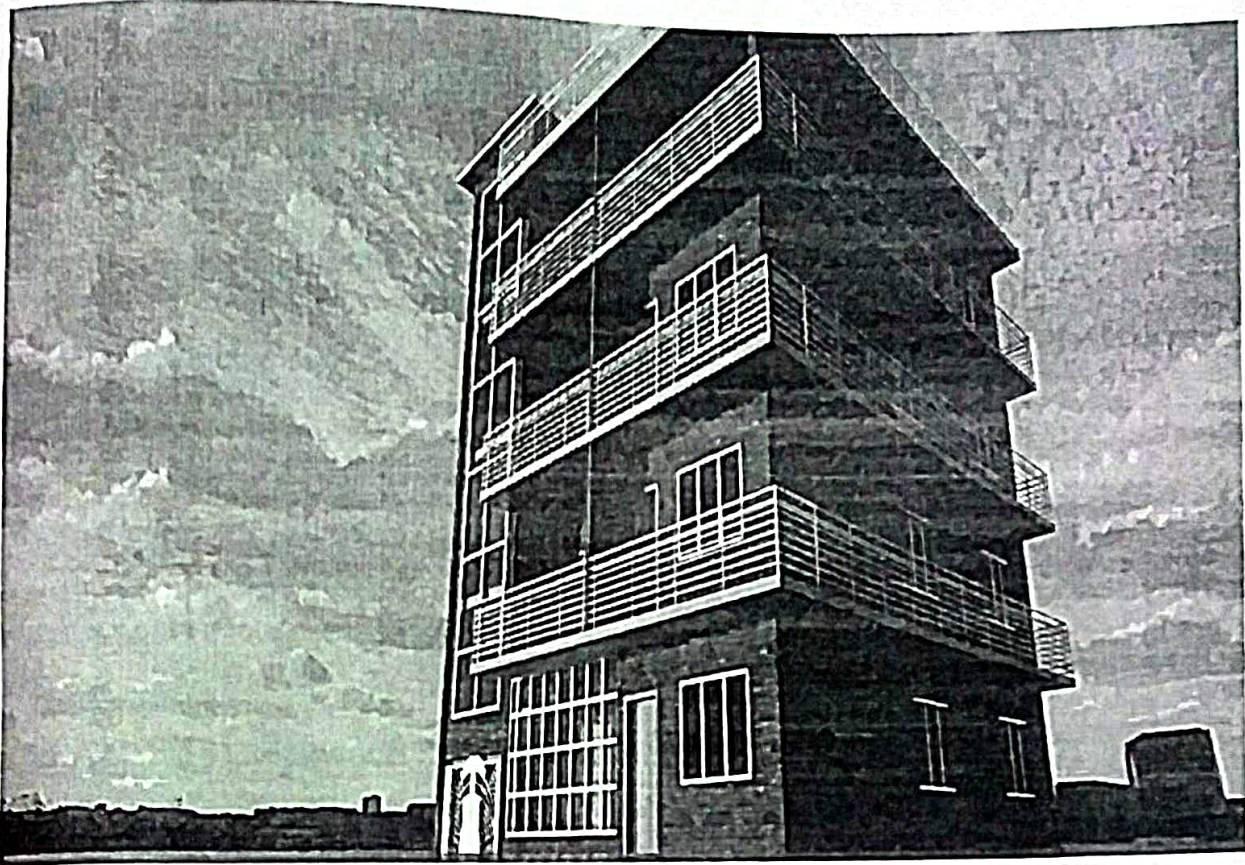


FIG. 33 RENDER VIEW 1

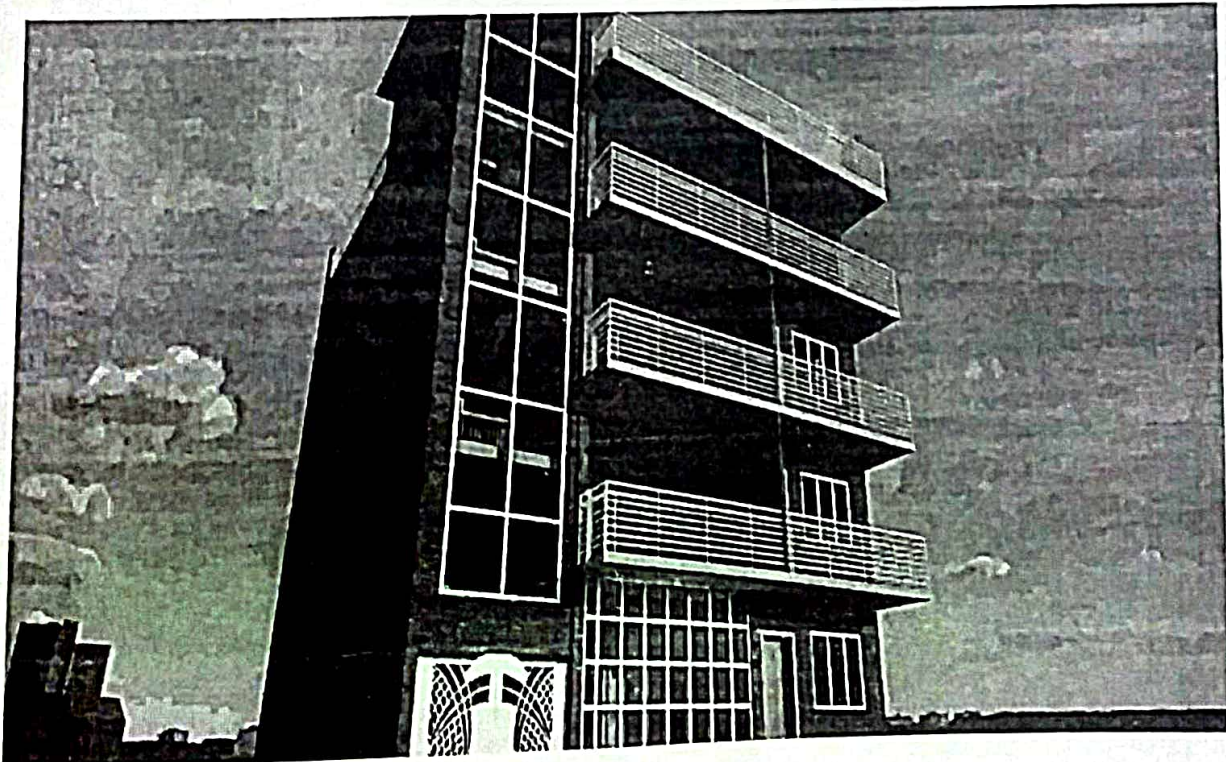


FIG. 34 RENDER VIEW 2



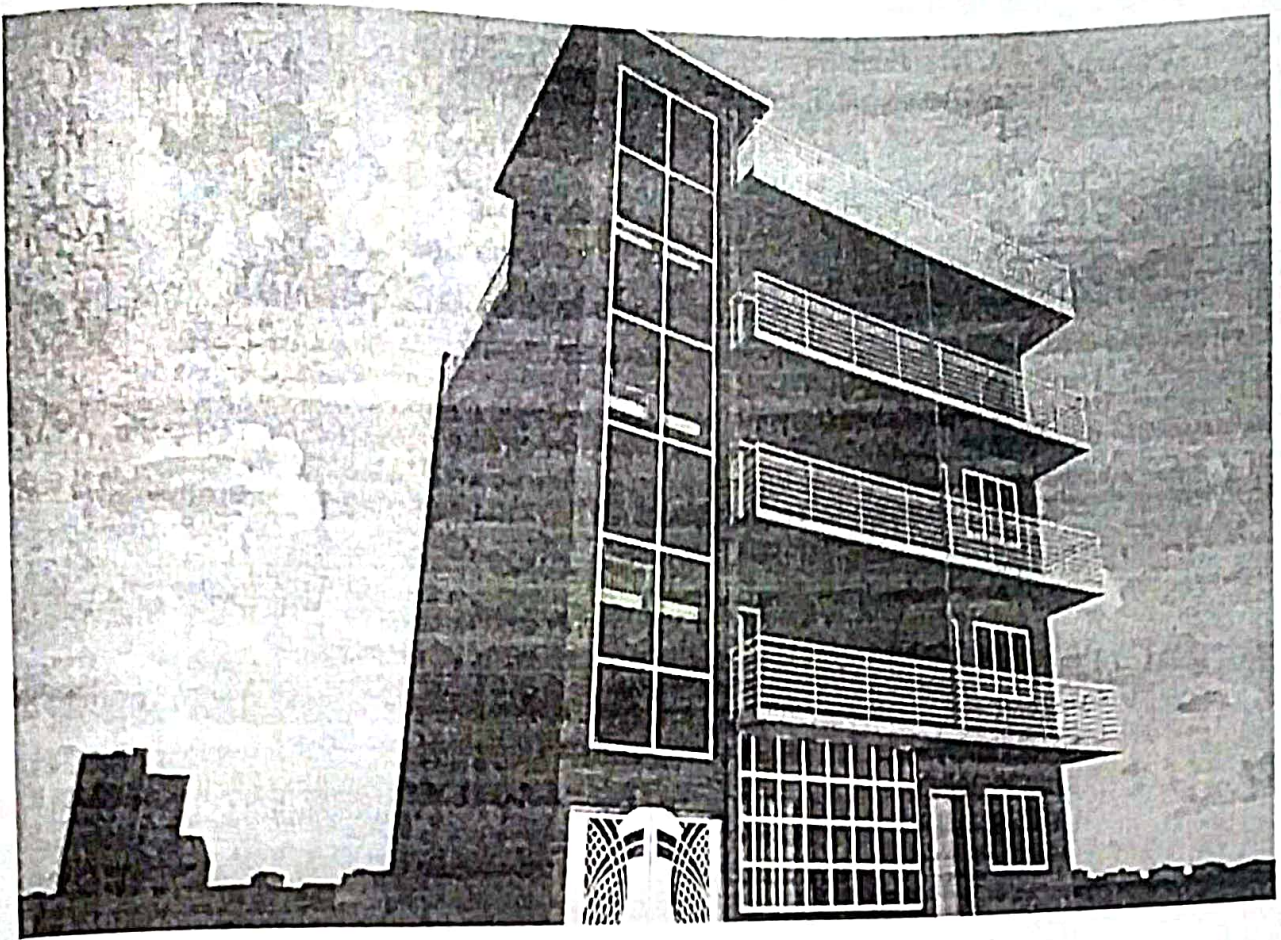


FIG. 35 RENDER VIEW 3

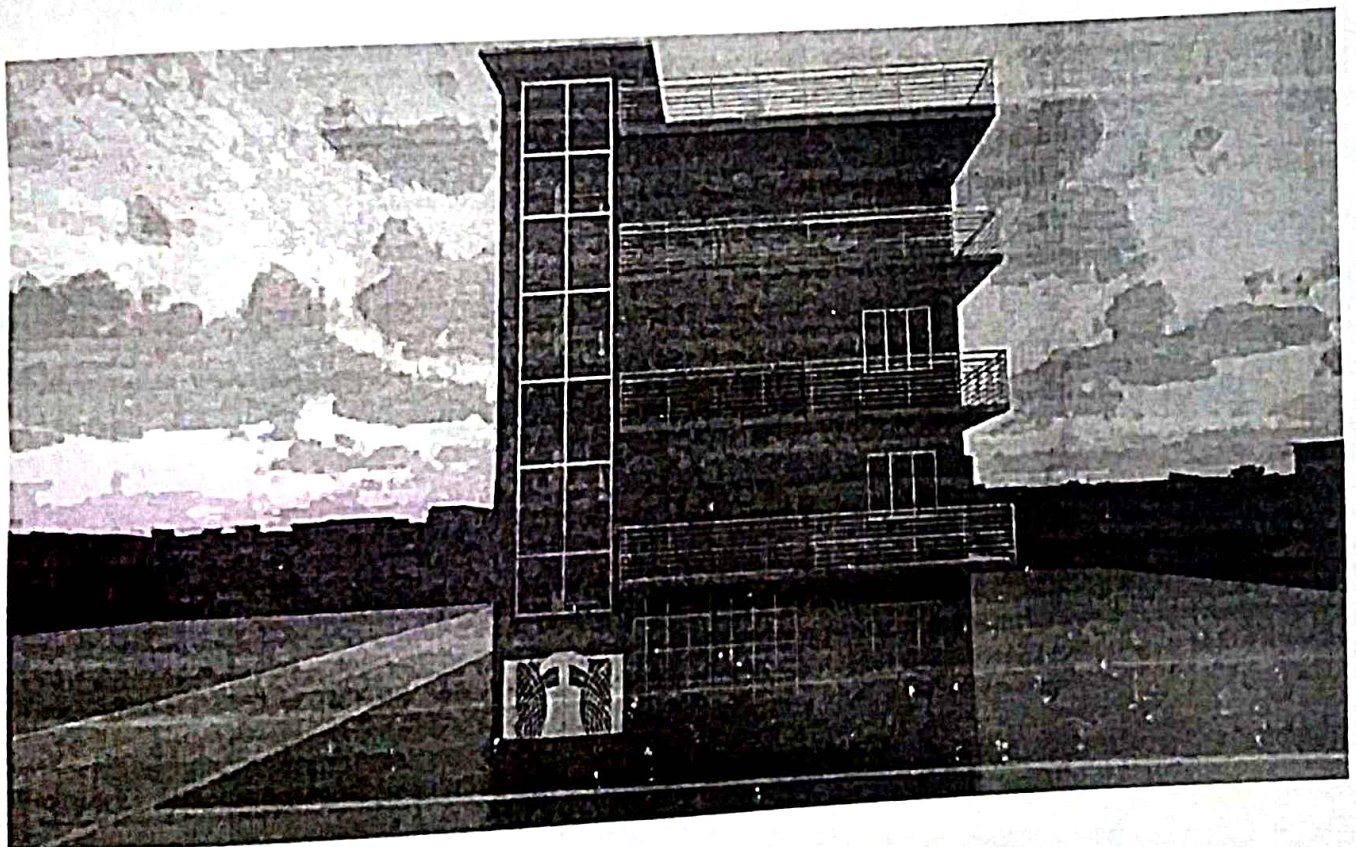


FIG. 36 RENDER VIEW 4



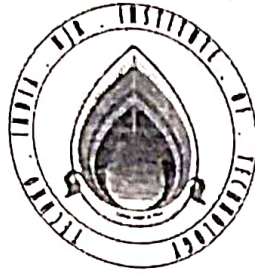
## *Chapter 5*

### *Conclusion*

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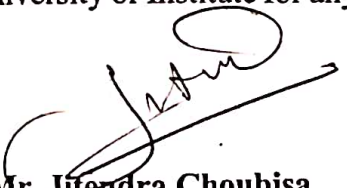
- ✦ This project gives realistic and accurate families ranging from furniture to lighting fixtures, as well as import existing models from other program. We can get the approximate estimation also. By the application of Revit.
  
- ✦ A clear design and modelling of a residential building with the efficient structural and architectural plans. It provide the overall knowledge of material take off and schedule/ quantities in the model of the building defined in the project.
  
- ✦ 3D realistic view enables us to indicate the family and the components placed within the building model.

DEPARTMENT OF CIVIL ENGINEERING  
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RAJASTHAN 2022 - 23



**CERTIFICATE**

This is to certify that the report entitled **Planning and Modeling of Residential Building by using Revit BIM** submitted by **Chandan Shah (19ETCCE001)**, to Department of civil Engineering in partial fulfillment of the B.Tech. Degree in **Civil Engineering** is a bonafide record of the seminar work carried out by him under our guidance and supervision. This report in any form has not been submitted to any other University or Institute for any purpose.

  
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