

Malnad College of Engineering, Hassan

[An Autonomous Institution Affiliated to VTU Belagavi]



Autonomous Programme

Bachelor of Engineering in Civil Engineering

Digital Drafting for Civil Engineers

LAB MANUAL

Prepared by Dr. Sumana Jayaprakash

III Semester

Academic Year: 2024-25

Department of Civil Engineering

Vision of the Department

The Department of Civil Engineering will be a centre of excellence in industry-oriented teaching, training, research, professional ethics, social responsibility, and continuing education for practicing engineers through sponsored research and consultancy services

Mission of the Department

1. To improvise the curriculum to include contents pertaining to situational experience of a variety of sites and develop a sense of social responsibility and to enhance research orientation of students through internship programs.
2. To enhance sponsored research and consultancy works to achieve effective industry-institute-interaction and conduct Continuing Education Programme for practicing engineers.
3. To inculcate professional ethics through quality and modern construction practices.
4. To switch over to modern methods of material testing, Engineering analysis and design.

Program Educational Objectives (PEOs)

PEO1: The graduate will be successful professionally and contribute to core civil engineering construction projects, infrastructure projects, alternative construction technology projects, green buildings towards environmental sustainability for academic domain as well as for research and pursue higher studies.

PEO2: The graduate will be professionally sound in a broad area of knowledge of various dimensions of civil engineering and allied fields.

PEO3: The graduate will be a team leader/effective team member with ethical values, versatile, quick learner will adapt to given professional context with lifelong learning capability.

PROGRAM OUTCOMES (POs)

1. **Engineering knowledge:** Apply knowledge of mathematics, natural science, computing, engineering fundamentals and an engineering specialization as specified in WK1 to WK4 respectively to develop the solution of complex engineering problems.
2. **Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions with consideration for sustainable development. (WK1 to WK4)
3. **Design/Development of solutions:** Design creative solutions for complex engineering problems and design/develop systems/components/processes to meet identified needs with consideration for the public health and safety, whole-life cost, net zero carbon, culture, society and environment as required. (WK5)
4. **Conduct investigations of complex problems:** Conduct investigations of complex engineering problems using research-based knowledge including design of experiments, modelling, analysis & interpretation of data to provide valid conclusions. (WK8).
5. **Engineering tool usage:** Create, select and apply appropriate techniques, resources and modern engineering & IT tools, including prediction and modelling recognizing their limitations to solve complex engineering problems. (WK2 and WK6)
6. **The engineer and the world:** Analyze and evaluate societal and environmental aspects while solving complex engineering problems for its impact on sustainability with reference to economy, health, safety, legal framework, culture and environment. (WK1, WK5, and WK7).
7. **Ethics:** Apply ethical principles and commit to professional ethics, human values, diversity and inclusion; adhere to national & international laws. (WK9)
8. **Individual and collaborative team work:** Function effectively as an individual, and as a member or leader in diverse/multidisciplinary settings.
9. **Communication:** Communicate effectively and inclusively within the community and society at large, such as being able to comprehend and write effective reports and design documentation, make effective presentations considering cultural, language, and learning differences.
10. **Project management and finance:** Apply knowledge and understanding of engineering management principles and economic decision-making and apply these to one's own work, as a member and leader in a team, and to manage projects and in multidisciplinary environments.
11. **Life-long learning:** Recognize the need for, and have the preparation and ability for i) independent and life-long learning ii) adaptability to new and emerging technologies and iii) critical thinking in the broadest context of technological change. (WK8)

PROGRAM SPECIFIC OUTCOMES

PSO1: The Graduates will demonstrate ability to design a civil engineering system, components or process to meet desired Project needs.

PSO2: Graduates will be familiar with civil engineering professional software tools and demonstrate their ability in applying them for the solution of design situations.

Knowledge Profiles (WK)

Washington Accord's Knowledge Profiles (WK) are a set of eight defined knowledge areas that engineering graduates are expected to master, encompassing essential theoretical and practical expertise necessary for global engineering practice.

- WK1** Understanding of natural and social sciences.
- WK2** Mathematics, numerical analysis, data analysis, and computing.
- WK3** Engineering fundamentals.
- WK4** Specialized engineering knowledge.
- WK5** Engineering design and operations, including sustainability.
- WK6** Engineering practice (technology).
- WK7** Role of engineering in society, sustainability, and professional responsibility.
- WK8** Current research literature and critical thinking.
- WK9** Ethics, professional responsibilities, and inclusive behavior.

Program Outcome (PO)

The revised Program Outcomes (POs) are a streamlined set of eleven competencies that engineering graduates must achieve, aligning with international standards to ensure a comprehensive and globally recognized engineering education.

- PO1** Engineering Knowledge.
- PO2** Problem Analysis.
- PO3** Design/Development of Solutions.
- PO4** Conduct Investigations of Complex Problems.
- PO5** Engineering Tool Usage.
- PO6** The Engineer and The World.
- PO7** Ethics.
- PO8** Individual and Collaborative Teamwork.
- PO9** Communication.
- PO10** Project Management and Finance.
- PO11** Life-Long Learning.

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List of Exercises:

1. Introduction to BIM. Understanding building drawings in a 3d environment (CO1)
2. Using 3D tools creation of Levels and Grids. (CO1, CO2)
3. Application of various techniques used in the modeling of walls. (CO1, CO2)
4. Using 3D tools components of doors and windows, and floor slabs. (CO1, CO2)
5. The modeling of staircases and railings. (CO1, CO2)
6. 3D Modeling of a single storied two-bedroom house with plumbing and sanitation details. (CO1, CO2)
7. Generation of Topo surface and contours using site tool for a given project. (CO1, CO2)
8. Placing room tags and room legend options. (CO1, CO2)
9. Create new sheet and place views such as floor plans and plot the sheet. (CO1, CO2)

Self-study component: Each student shall on the internet observe and understand spatial characteristics of architecturally designed Buildings, download and document the same. Relate and create similar features in the lab exercises. The students shall visit- ongoing project sites and study for real time experience of BIM.

Text Books:

1. Linkan Sagar, Sristry Rawal REVIT 2019 Architecture step by step. BPB Publications. 2019
2. S.P Arora, S.P. Bindra The Text book of Building Construction, Dhanpat Rai Publications.

Reference Books:

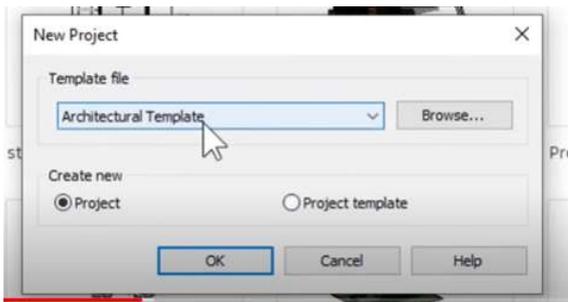
1. Shah. M. H. and Kale. C.M. "Building Drawing" Tata Mc Graw Hill Publishing Co, New Delhi.
2. Linkan Sagar, Sristry Rawal REVIT 2019 Architecture Training Guide, BPB Publications. 2019.
3. REVIT ARCHITECTURE lab manual.

SESSION 1 PROCEEDURE TO BE FOLLOWED IN THE LABORATORY:

1. Introduction to BIM. Understanding building drawings in a 3d environment (CO1)

BIM SOFTWARE: REVIT ARCHITECTURE. To create BIM Model. Welcome screen. Model files and family files available. Open recent files to access your file.

1. When opening new file: MODELS- new- select architectural template – project- okay.



2. Project opened. Quick access tool bar- Open save, 3d, Section view....etc. Tabs available. File tab, Architectural tab (walls, roofs etc), Structural tab (beams, walls etc), Steel tab, System tab (MEP Works), Insert tab (Decal, import cad, Pdf, Image, revit link) Annotate (dimension relations 2d options), Analyze, Massing and Site tab (creation of surfaces, contours, site components etc), Collaboration tab, View tabs (plan, section view, Manage tab (settings) Modify tab (offset, mirror, copy etc)

3. Properties Panel on left side for settings. Three things available. Property/ Edit type property/ quick property.

4. Project Brower on the right side for browsing. Can be dragged by holding on top. To see the documents. Floor Plans, Ceiling plans, Elevations, Sections, schedules, sheets created.

5. Bottom display: Scale, Graphic display options, hide/ show options etc.

6. Four cameras on the screen. Drawings should be done within them. It is for elevations. Don't delete them. Multiple files can be opened on the screen.

7. Architectural tab: Drop down options are available.

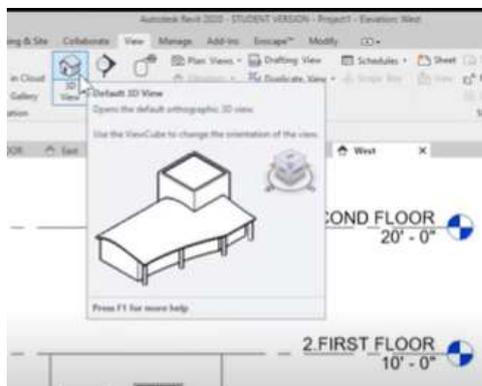
SESSION 2:

- Using 3D tools creation of Levels and Grids. (CO1, CO2)

1. For creating new level go to Level, click and use tracking line and draw a level at 3 m. Rename the level. Height can also be changed. More floors can be added. Should be completed before drawing the floor plans.



2. Go to view and 3D view or the house symbol in the quick access tool bar. The project is seen in 3d view with all the walls, doors and windows.



7. If colour required visual style at the bottom of the screen should be accessed. Select realistic or shaded or consistent colours.



8. If various views are to be seen use the view cube at the top right hand corner of the screen. Press Shift+press scroll of mouse for free hand rotation and views. No floors yet. Press on the view cube and orbit is also available.

9. Double click on Ground Floor in Project Brower tab to go the Ground floor. Double click on 3d view to see the 3d view etc.

10. The view cube is on the right hand top, to be used for seeing the various views. For free hand orbit press shift +scroll of the mouse together.

11. Close all the opened windows to close project. Save the project in appropriate folder.

12. To start new project, on the welcome screen, select architectural template/ metric template and project.

13. Rename the levels in the project browser in one of the elevation view. Rename as 1.Ground Floor and 2.First Floor and change dimension of first floor to 3 m.

14. Add new level called Plinth level at- 0.45m from ground level. Double click on Ground Floor in Project Browser to start drawing the Ground Floor plan.

SESSION 3

- Application of various techniques used in the modeling of walls. (CO1, CO2)
1. To draw wall: Click on Architecture tab – wall- properties tab- drop down – select the wall required- select- 0.23m wall. Change default wall size – edit type – Type properties- Reveals the family and type.- Duplicate drop down on type.
 2. In REVIT Architecture software, every time a new entity is required, it should be duplicated, otherwise the default entity will get modified. Hence duplicate the wall, rename, enter the new sizes required : In structures-edit – material – 0.23m – okay.



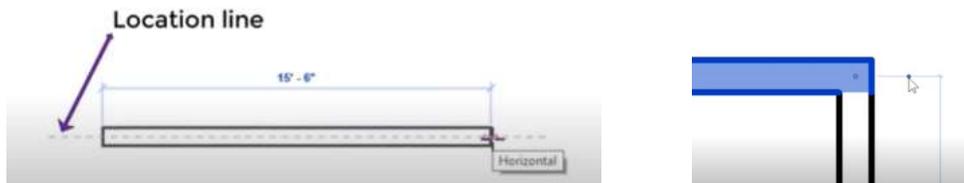
3. Before drawing wall enter the height and in height give as 3m on the ribbon. Location line : Finish face interior. Start drawing the wall- zoom in. Dimensions seen. Draw with mouse, move the cursor. The location line should be made as finish face exterior/ interior/ centre as per the requirements.



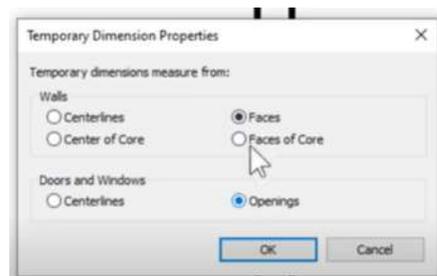
4. Move the direction of the wall by mouse and enter dimensions and continue drawing the

wall. Double escape to come out of command.

5. Temporary dimension shown when we click on the wall. Click on the space bar button and switch the location line. .



6. Go to manage on tab- additional settings – temporary dimensions. Select faces. For doors and windows select openings. Okay.



7. Draw room anticlockwise. Click on the dimension of wall to change the length of wall.

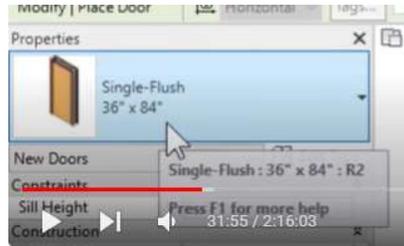
EXERCISE 1

Measure draw your house in pencil on graph sheet in a group of 4 students. Draw the plan of your house using the REVIT ARCHITECTURE software. Take four pictures of the house and stick in your graph book. Scale to be used: 1:100. Wall thickness: 0.23m. Partition Wall = 0.15m Floor height : 3m. Window sill height: --- Window height: --- Door Height. Window height of kitchen:---- Window sill height of Kitchen:---. Sill height of of ventilator:---- Height of ventilator:-----

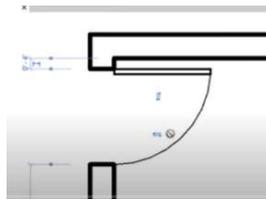
SESSION 4:

- Using 3D tools components of doors and windows, and floor slabs. (CO1, CO2)

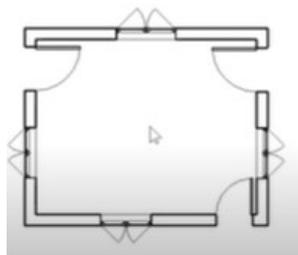
3. Click on Door in the tab- select the required door in property dropdown.



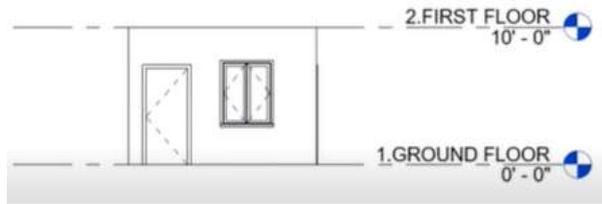
4. Place the door in the required place in the wall. Space bar to flip the direction of the door. Move the mouse on the door to flip the door. After placing door, the directions and side can be flipped by using the arrow marks available. Temporary dimensions also available.



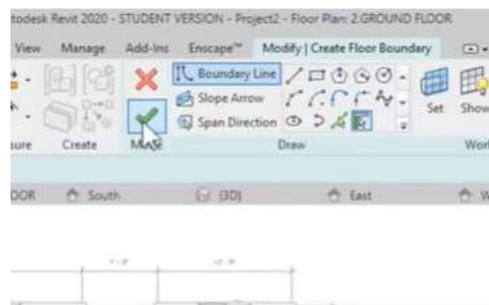
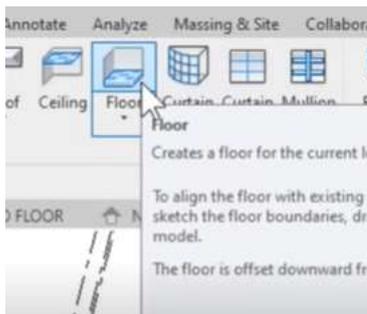
5. Repeat the process for window as done for the door. The window can be moved in the wall after placement. Keep shutters outwards.



6. Only plan of the room is drawn. In the project browser the various drawings of the project are available. Level 1 Plan and various elevations available. In the elevation two levels are seen by default. Level1 at 0m and Level2 at 4m. The height of the level can be changed by double click on the dimension. The Levels can also be renamed to Ground Floor First Floor. New levels can also be added. Note that Level 1 is presently not seen as we have not done 1st floor plan. It is seen in grey. If not seen go to underlay on the properties tab.



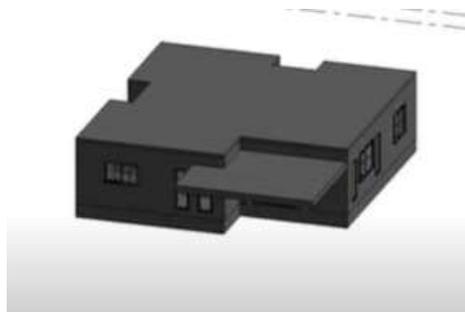
As can be seen in the 3D model, floor is not yet provided. For placing floor Go to ground Floor. Architectural tab- Floor option. Once the floor is done using the different shapes available. The right mark green symbol (finish) needs to be checked as shown in the figure. The wrong mark red symbol can also be selected to cancel the floor. If you do not finish/ cancel all other options of operation get freezed. Select the required floor with the required thickness (if not available edit type to required thickness by duplication. To draw the plinth (thickness =0.45m) take a line and draw on the existing wall line. It should be a closed figure without breaks. Click on finish after the drawing. Line must be in closed loop.



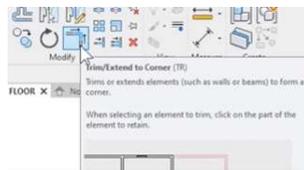
Watch the done plinth in Elevation also. Similarly draw the porch on 1st floor at a height of 2.7m . Go to first floor. The lower level plan is faintly visible. If not go to Underlay in the properties bar. Draw the porch line by Architecture-floor – line



Would you like the walls that go up to this floor's level to attach to its bottom. Click no. The portico floor is done. Watch in 3D view. As the porch is presently at the first floor level, select and give it a -ve height offset of 0.3m for first floor in the properties bar. Repeat the process at first floor level to create floor at 1st floor level. Would you like the walls that go up to this floor's level to attach to its bottom. Click Yes.



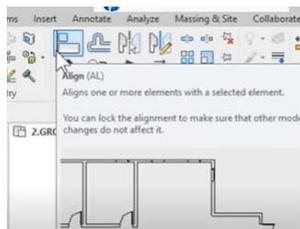
Trim: Go to modify- Trim extend to corner in the menu bar- short cut- tr



Split: Can be used to cut the wall. Shot cut - sl



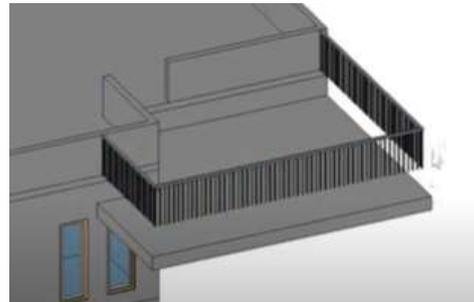
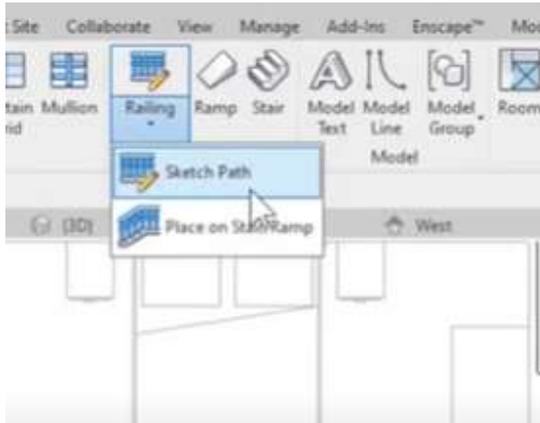
Align: Modify- align. To align two lines



SESSION 5.

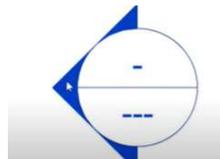
- The modeling of staircases and railings. (CO1, CO2)

Railing and Parapet.: For parapet. Draw a 0.15 waal on the edge of the floor slab where the parapet is required. Keep the wall unconnected ang give it a height of 0.75m. For railing two options are available. Select the sketch path. Sketch the path where required.



As the railing has been created on first floor. Go to first floor, select railing and give it a –ve offset of 0.3m Single click and change the style of railing to glass panel.

To Create section view. Go to view- section. Draw the line across/ along the building where the section is required. Direction can be changed.



Double click on the section icon to view the section. A new section has been added in the project browser tab. Right click and rename if required. Elevations are already available in the four diections in the project browser tab.

Tagging of Doors and Windows: Select the window. –Edit type – (go down)- Type mark as W1. Add the cost also. Repeat the same for all types of windows and ventilators used in the project.

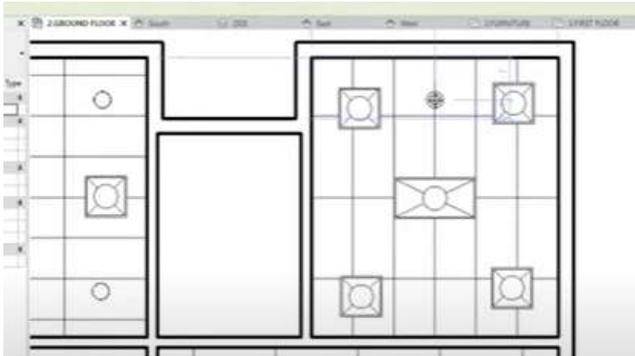
For tagging of Doors, select the door, no going to edit type change the name of the door in the properties tab in mark as D1. Repeat the procedure for all the types of Doors used in the projects .

Go to annotate – tag all- select door (check) tag and window tag in the popped up window. The tags can be moved if required.

Hatching can be done for the portico area by Annotate- region- draw rectangle using line or rectangle.

For column. Go to Ground Level Go to Column- architectural column. You can change size by edit type- duplicate rename and change dimensions. Once placed column can be moved by arrow keys. To chamfer the column only up to the portico select the column - attach top base on the ribbon. Select the top of the column and then the floor slab.

Ceiling Plan: Select ceiling then automatic ceiling. Use sketch ceiling if room is not closed one. Then click on finish. For light fitting in the ceiling, go to component-Place a component- load family-India folder- lighting-architectural lights-internal lights. Okay. It will get loaded. Select the light and place in the ceiling.

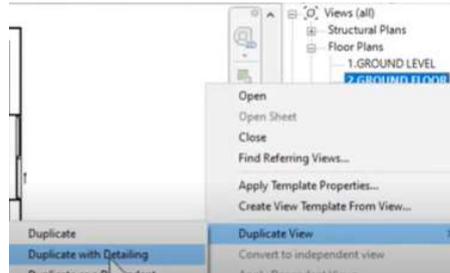


Section Box: Check on the section box in the properties browser. Use the arrow to control size in all directions. Check off the section box. Normal view appears.

SESSION 6.

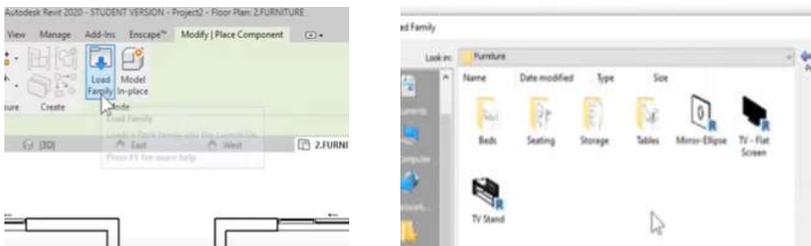
- **3D Modeling of a single storied two-bedroom house with plumbing and sanitation details. (CO1, CO2)**

Furniture: Place a component. Go to Ground Floor. Right Click on it and create a duplicate view with detailing.



Duplicate Ground Plan is ready. Right click and rename it as Furniture Plan.

Place a component. Ready made components available. However go to – Load Family. Go to India folder - us metric. Go to furniture folder and select your requirement. The selected furniture get loaded.



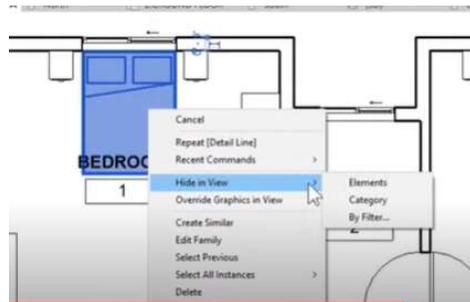
Double click on Bed/ storage cupboards/ TV/ Sofa set / tables/ Dining Tables for instance. Edit type and change the size as required. Place the furniture in plan. Use arrow key to move the furniture. Click on furniture and use space bar to rotate them in the required direction. For a TV/ handwash sink/ centre table Select the component and give it the required height in the properties tab. See the 3D to confirm that all the furniture are placed rightly. Select plumbing – architectural-Fixtures for plumbing components.

Place bath tub, water closet in the bathrooms.

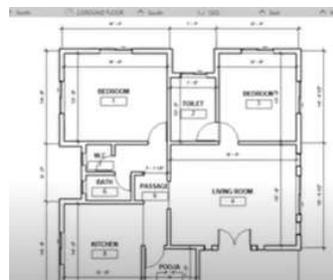
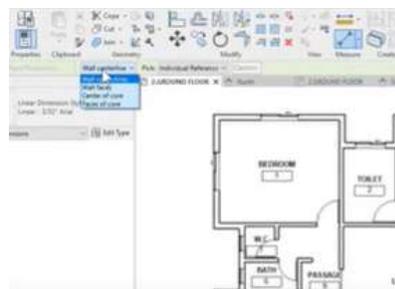
If only 2D line is to be drawn use annotate-detail line for portico line etc.

If furniture needs to be hidden in the ground floor plan. Select the furniture- right click- hide in view – category. (All furniture will be hidden. If elements is selected only that particular furniture will be hidden.

The procedure needs to be repeated for plumbing components.



Dimensioning of the rooms: Go to Annotate- aligned- Select -wall faces as dimensions should be written face to face. If centre line distance is required, then select-wall centerline.



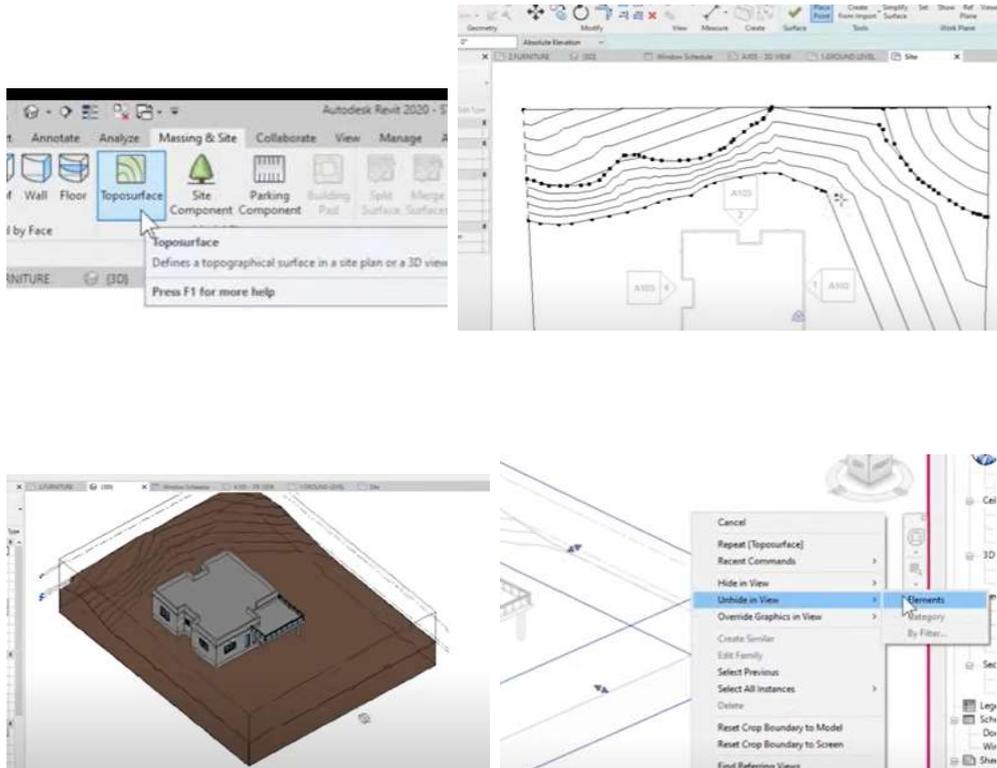
Do all the external wall dimensioning as centre to centre lines and internal rooms dimensioning as faces. Double click on 3D view to see the 3D view of the residence.



SESSION 7:

- Generation of Topo surface and contours using site tool for a given project. (CO1, CO2)

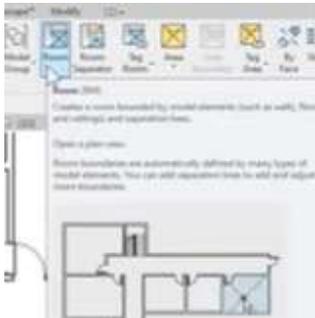
Toposurface. : Go to Site level – massing and site. Keep elevation as zero. Create a ground by four points. Use elevation of 5’ and draw the required contour.



Hide the section Box. To unhide.- bulb at bottom- click on the hidden object which get visible then unhide in view by elements/ category. Put off the bulb.

SESSION 8.

- Placing room tags and room legend options. (CO1, CO2)



Tag the rooms by using room. Tag on placement should be on. Place on all the rooms.

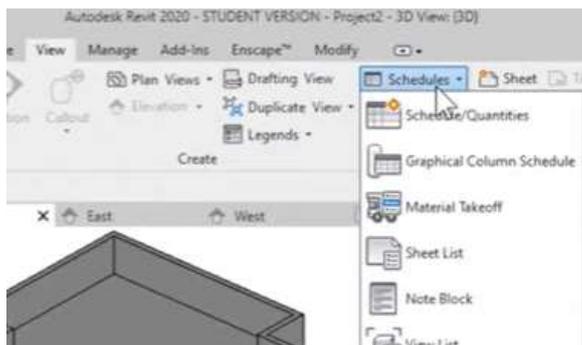
If no door between rooms use a room separator. Click on room separator and draw a line to separate the rooms.

Reduce the scale at the bottom bar.

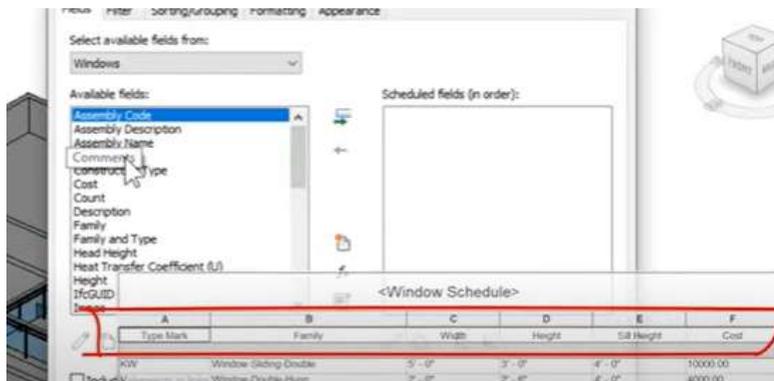
Rename the rooms as Living Room etc. Click on the side. Rename the next room.

The text can be moved by the move command, which appears as you go near a component.

Schedule of Doors and Windows:



Go to view- schedule – select the window for which schedule is to be prepared. Include cost/ type mark/ width/ height/ family/ cost/ sill height. Okay.



<Window Schedule>					
A	B	C	D	E	F
Type Mark	Family	Width	Height	Slab Height	Cost
KW	Window-Sliding-Double	5'-0"	3'-0"	4'-0"	10000.00
V	Window-Double-Hung	2'-0"	2'-0"	4'-0"	4000.00

Cost can be directly entered here, if not entered earlier during window tag. Type mark can also be corrected if there are mistakes. Go to fields- sorting and grouping-sort- type mark, uncheck on itemize below –Okay. Go to fields- formatting- cost – calculate totals- Sorting and Grouping - Check on Grand totals also- Okay.

Repeat the process for Door Scheduling. For putting cost, go to ground floor plan –click on door-edit type and add cost.

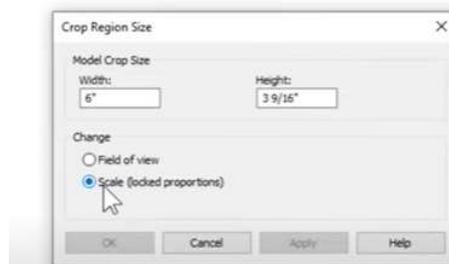
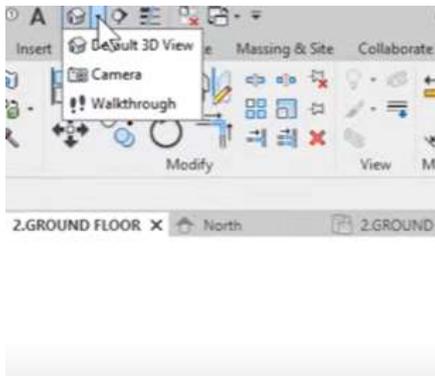
9.Create new sheet and place views such as floor plans and plot the sheet. (CO1, CO2)

SESSION 9.

- Create new sheet and place views such as floor plans and plot the sheet. (CO1, CO2)

Sheeting: Right click on sheets in project browser and select new sheet. Select sheet size/ load/ Us Metric-title blocks – select A4 sheet. Right click and rename sheet in project browser. Drag and Drop Drawings on the sheet. Go to Ground floor and drag the cameras close to the drawings. Hide the camera by category. Then drag the dwg on to the sheet. Create sheets for Elevations and sections. The levels can be hidden or dragged close to the drawing. Whatever changes are made in the drawings will get reflected in the sheets as well.

Camers setting for 3D views:



To change size of the 3D, click on the view – size crop—select scale- change width to 2'

