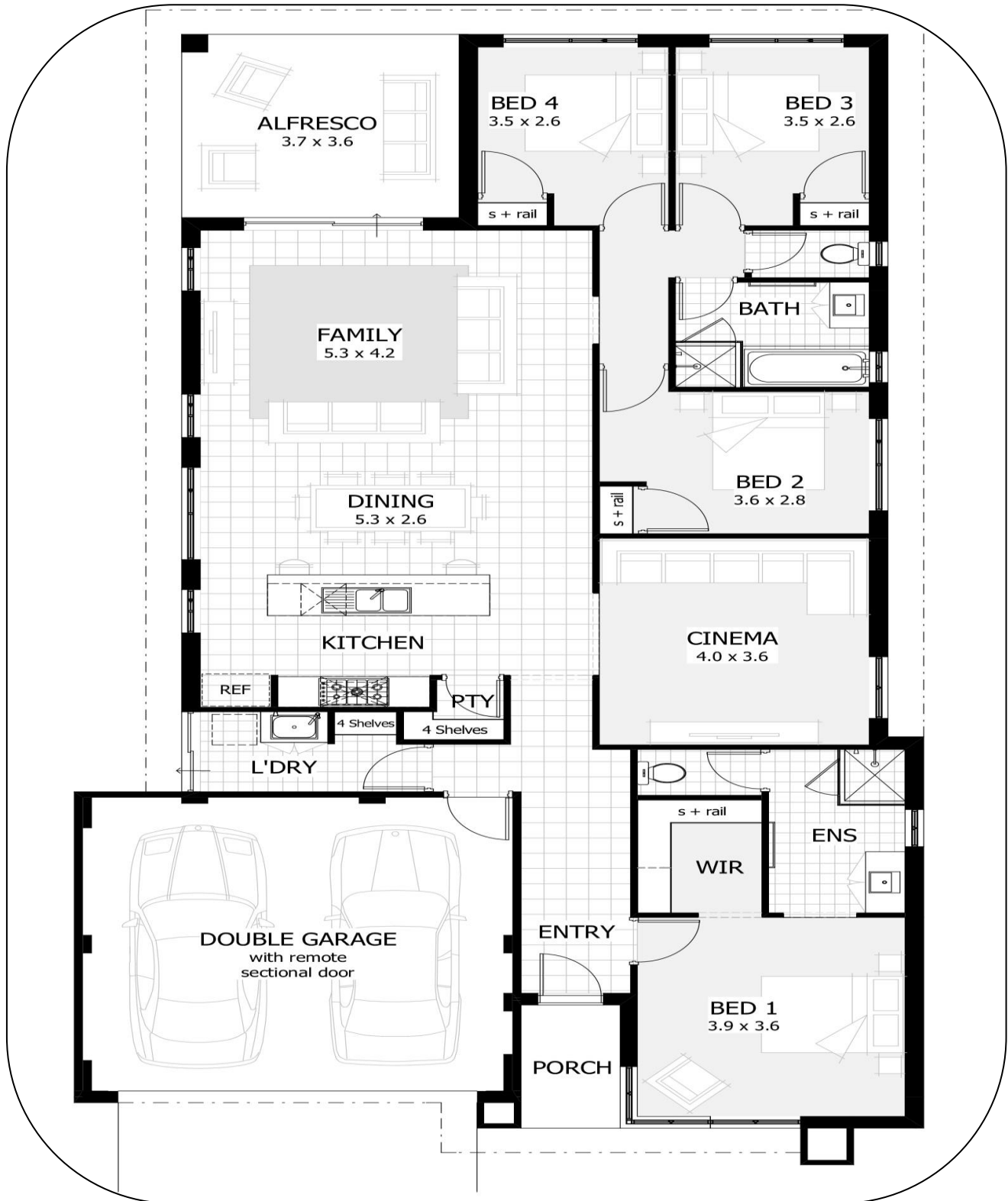


COMPUTER AIDED ENGINEERING DRAWING



Vision of the Department

To provide quality education embedded with knowledge, ethics and advanced skills and preparing students globally competitive to enrich the civil engineering research and practice.

Mission of the Department

- To aim at imparting integrated knowledge in basic and applied areas of civil engineering to cater the needs of industry, profession and the society at large.
- To develop faculty and infrastructure making the department a centre of excellence providing knowledge base with ethical values and transforming innovative and extension services to the community and nation.
- To make the department a collaborative hub with leading industries and organizations, promote research and development and combat the challenging problems in civil engineering which leads for sustenance of its excellence.

Program Educational Objectives

- PEO1: Exhibit their competence in solving civil engineering problems in practice, be Employed in industries and undergo higher studies.
- PEO2: Adapt to changing technologies with societal relevance for sustainable development in the field of their profession.
- PEO 3: Develop multidisciplinary team work with ethical attitude & social responsibility and engage in life - long learning to promote research and development in the profession.

Program Outcomes

List of Program Outcomes for Civil Engineering:

- a. An ability to apply knowledge of mathematics, science and engineering principles to civil engineering problems.
- b. An ability to analyze design and conduct experiments and interpret the resulting data.
- c. An ability to design a system, component or process to meet desired goals in civil engineering applications.
- d. An ability to function on multi disciplinary teams.
- e. An ability to identify, formulate and solve challenging engineering problems.
- f. An understanding of professional and ethical responsibility.
- g. An ability to communicate effectively through verbal, written and drawing presentations.
- h. An ability to understand the impact of engineering solutions in a global, economical and social context with a commitment on environmental and safety issues.
- i. An ability to recognize the need of engaging in lifelong learning and acquiring further knowledge in specialized areas.
- j. Ability to excel in competitive examinations, advanced studies and become a successful engineer in construction industry.
- k. An ability to use the techniques, skills and modern engineering tools and software for engineering design and practices.
- l. The understanding of basic finance & management techniques and construction practices including work procurement and legal issues.

INDEX

S.no	Date	Name of the Experiment	Page no.	Signature of the faculty
1		Familiarize with basic commands of CAD software		
2		Drawing conventional signs of building materials		
3		Drawing building components like doors, windows etc.		
4		Drawing plan, section and elevation for single storied buildings.		
5		Drawing plan, section and elevation for a two storied buildings Display Commands.		
6		Drawing different layout diagrams using CAD software.		
7		Drawing diagrams by using different layers in CAD software		
8		Drawing plan of single storied residential buildings		
9		Drawing plans of commercial buildings.		
10		Drawing different aspects in 3D views		

R21019-COMPUTER AIDED ENGINEERING DRAWING PRACTICE

<i>Program Outcomes</i>	a	b	c	d	e	f	g	h	i	j	k	L
<i>Course Outcomes</i>												
1. Understand the concept of CAD software		H	H				H		H		H	
2. Draw various building components using CAD software.		H	H		M		H				H	
3. Visualize various aspects in 3D views of buildings by using		H	H				H			M	H	

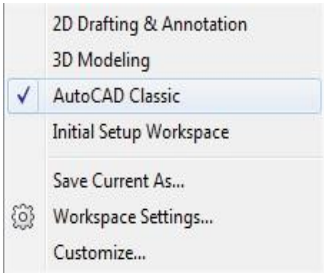
software.												
4. Draw plan, section and elevation of residential buildings and commercial buildings.		H	H				H	L		H		

S.NO	NAME OF THE EXPERIMENT	PAGE NO.	CO'S MATCHED	PO'S MATCHED
1	Familiarize with basic commands of CAD software		1	b, c, g, h
2	Drawing conventional signs of building materials		2	b, c, g, h
3	Drawing building components like doors, windows etc.		2	b, c, g, e, h
4	Drawing plan, section and elevation for single storied buildings.		4	b, c, g, i, k
5	Drawing plan, section and elevation for a two storied buildings Display Commands.		4	b, c, g, i, k
6	Drawing different layout diagrams using CAD software.		4	b, c, g, i, k
7	Drawing diagrams by using different layers in CAD software		2,4	b, c, g, i, k
8	Drawing plan of single storied residential buildings		4	b, c, g, i, k
9	Drawing plans of commercial buildings.		2,4	b, c, g, i, k
10	Drawing different aspects in 3D views		3	b, c, g, i, j, k

Experiment- 1

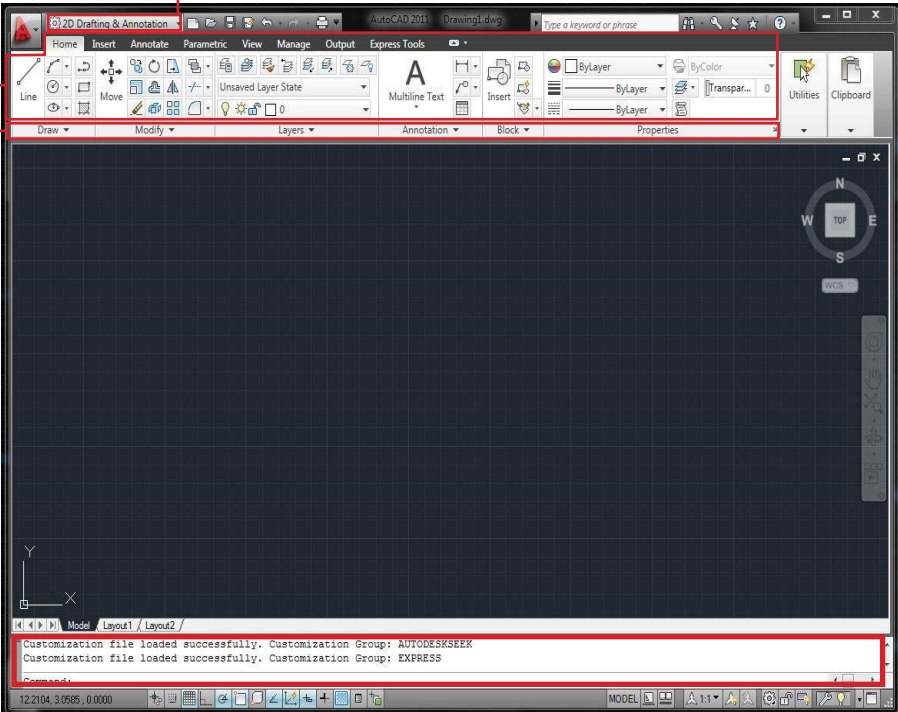
Familiarize with basic commands of CAD software

workspace



If you are used to the workspace in older version, you can choose

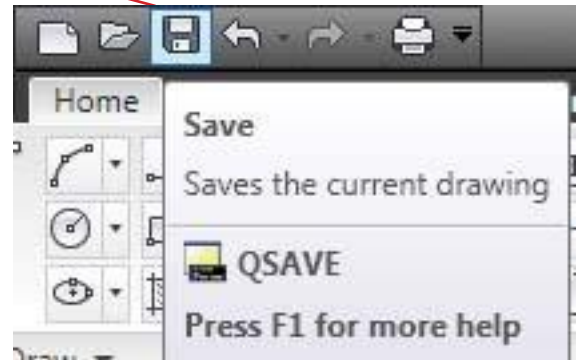
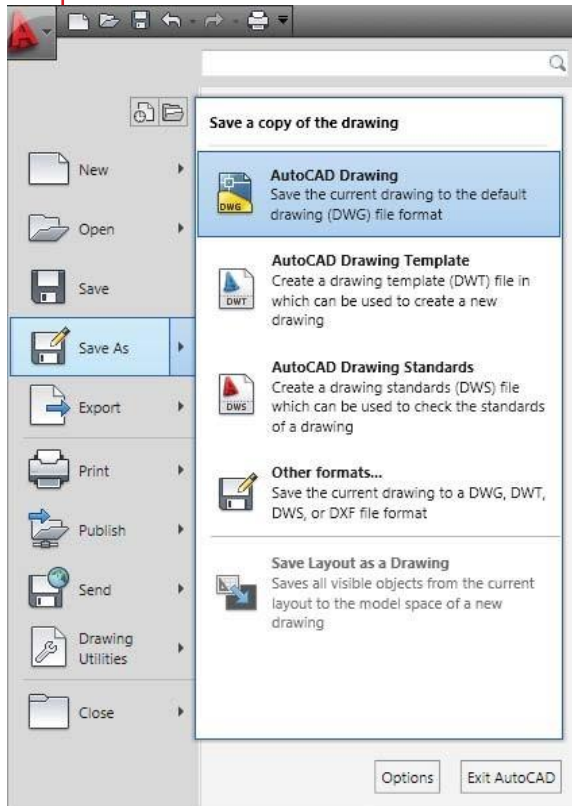
Tabs
Panels



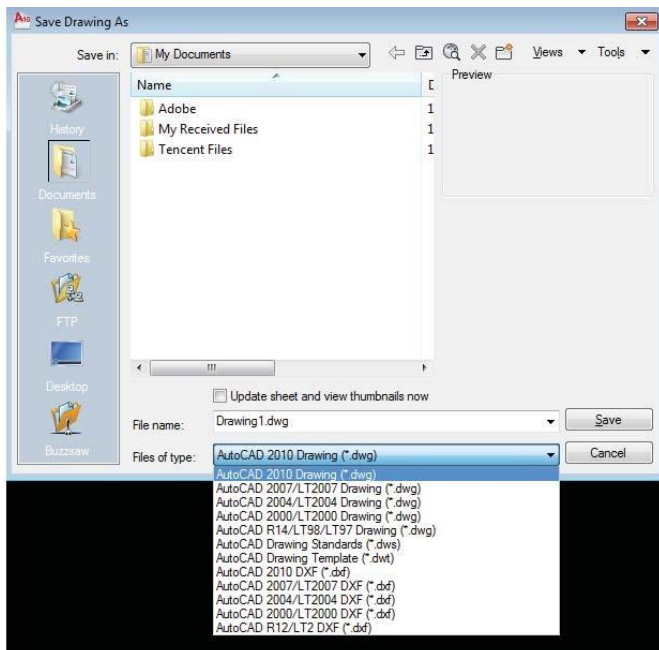
enter commands for drafting and other functions here (recommended way to draw because it is faster than clicking icon) This line will also show options within a tool. Please make a habit to constantly check the command line for what you can do with the tool you selected.

save

When you open AutoCAD, there is an existing sheet called "Drawing1.dwg". You can work on this sheet and then save it by either of these two ways.



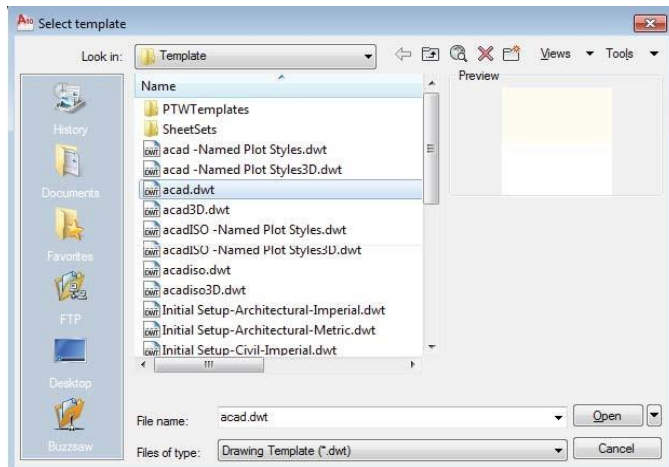
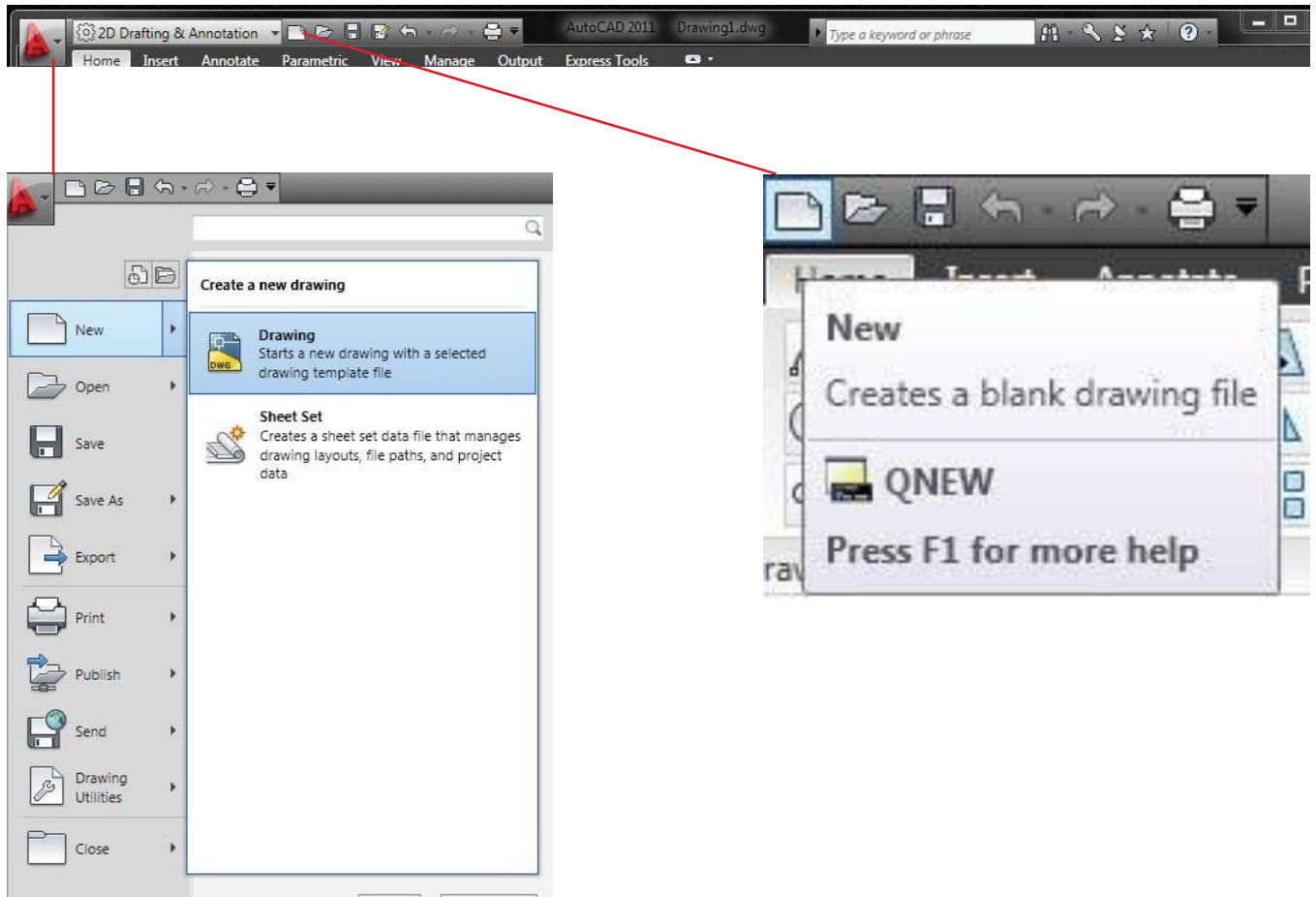
After the first time save, you can click this button or use shortcut Ctrl+S to save your drawing. It is a good habit to save your work frequently in case the software crashes or power off.



The drawing is saved as AutoCAD 2010 Drawing as default. If you want to open it in other softwares (like Sketch Up, Rhino) or lower version AutoCAD, you have to save it as a lower version.

set up a new sheet

There are two ways to set up a new sheet



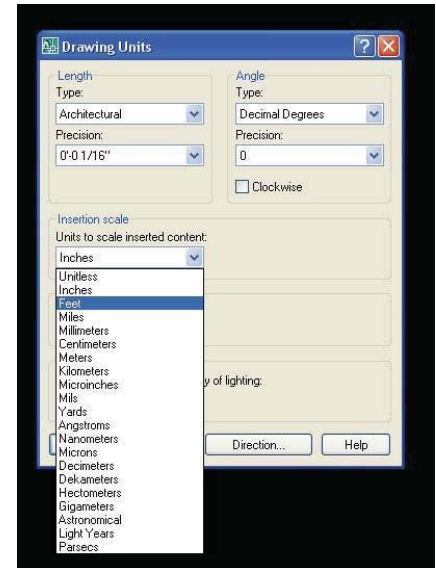
The default format is "acad.dwt". In practice field, you may be required to use a template.

drawing units (units)

You can set the drawing units in **Tools > Units**. As a default, the measurements in the drawing is unitless. For example, when you draw a line with length "10", AutoCAD doesn't know if it is 10 miles or 10 millimeters until you set the unit. Remember to set it before you start drawing, or scale the drawn objects accordingly if you change the unit in the existing drawing.

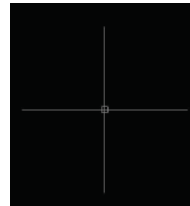
Architectural (i.e. 1'-3 1/2") and engineering (i.e. 1'-3.50") units are most frequently used in the states. Please note that you have to specify the type of units in Insertion Scale tab when it is set to decimal, scientific, or fractional units.

For example, if you want to use millimeter:
set "Type" in Length window to Decimal > set Insertion Scale to Millimeter



cursors

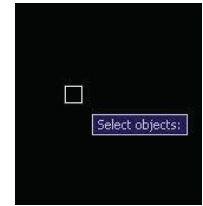
When you are not in command, the cursor looks like a cross with a square in the middle. When you are in drawing-related commands, the square disappears. When you are in modify-related commands, only the cross disappears. You can escape from a command by hitting **Esc** key.



not in command



in drawing command



in modifying command

select / deselect

You can select the objects by clicking on an object or drawing a window around it. **Drawing a window from left to right selects everything that the window crosses. Drawing a window from right to left selects everything that the window contains.** You can deselect objects by doing the same operation while holding down **Shift** key, or deselect everything by hitting **Esc** key.

general shortcuts

Many general shortcuts are used in AutoCAD.

For example:

Ctrl+S saves the dwg file (qsave)

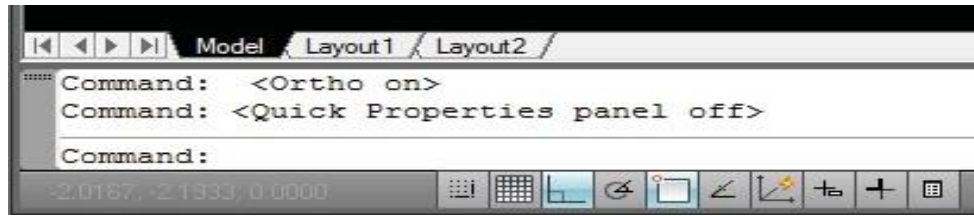
Ctrl+Z undoes the previous action (u) and Ctrl+Y redose the undone action again (redo)

Ctrl+C copies and Ctrl+V pastes

Ctrl+P opens the plot window (plot)

snap & tracking

There are settings that help you draw accurately. Please pay attention to the tabs below the command line and click on them to turn on/off.



Snap Mode: snaps to increments of the spacing that you specify. (i.e. if you set it to 2 in both x,y direction, it will snap on 2,2;2,4;10,8 etc)



Grid Display: displays grids with the spacing that you specify



Ortho Mode: restricts movements to horizontal and vertical directions.



Polar Tracking: tracks increments of the angle that you specify(i.e. if you set it to 30 degrees, it will track 30,60,90,120 degrees etc.)



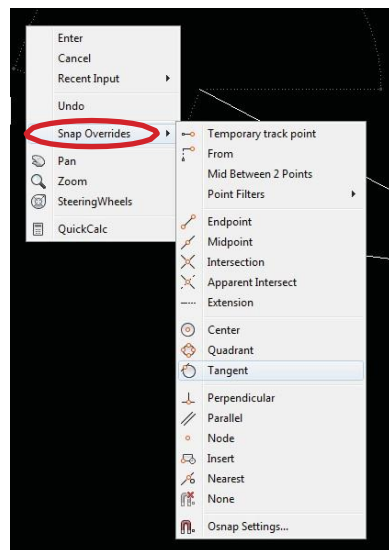
Object Snap: snaps to existing objects on the screen. **You can also activate specific Object Snap during drawing/inquiry operations by right clicking and selecting snap overrides.**



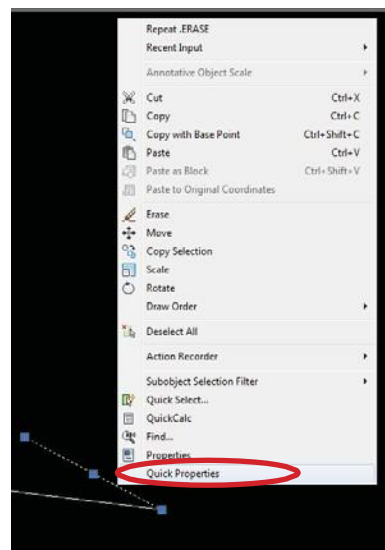
Show/Hide Lineweight: turns on/off the line width on display.It does not affect the line widths on plot.



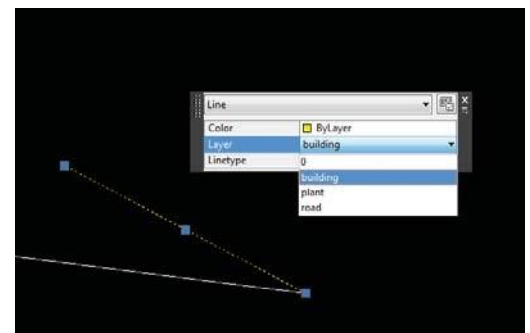
Quick Properties: displays the properties of selected object(s). Another way to show properties: After select a object/object, right click and select "Quick Properties". You can change the object(s) properties here(layers,color and linetype.)



snap overrides



right click



quick properties

Draw

There are two ways to draw

1. type full or short name in command line(increase efficiency)
2. Icon: Home/Draw



short name

LINE (l): draws a line from **one point to another.**



POLYLINE (pl): draws a line/curve with **multiple control points.**

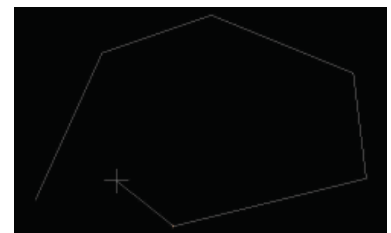
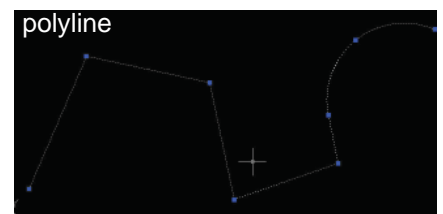
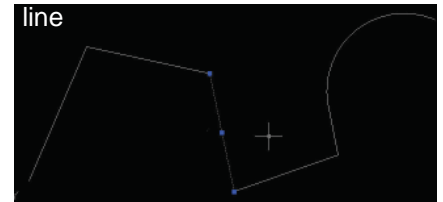
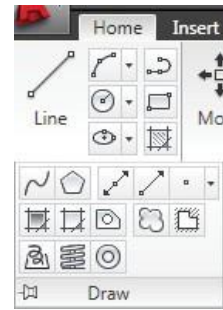
Pay attention to the command line while using POLYLINE tool; it will show you variety of options for the next move you can take. Following are some of the examples.

If you hit **“Esc”** while drawing a polyline, the line terminates at the last point you clicked.

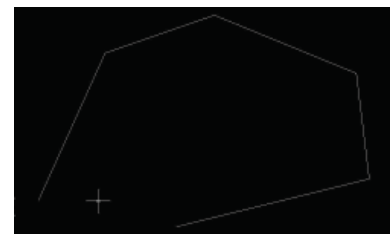
If you type **“cl”** while drawing a polyline, it draws a segment that connects the starting point and the last point you clicked (the line becomes a closed shape).

You can also draw an object with arcs using POLYLINE tool.

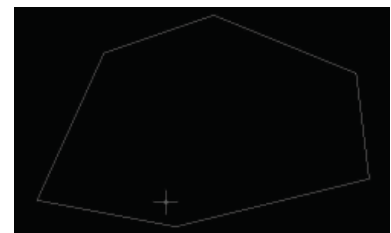
If you type **“a”** while drawing a polyline, your next segment will be an arc. It will continue to draw arc segments with tangent to the previous arc.



drawing a polyline



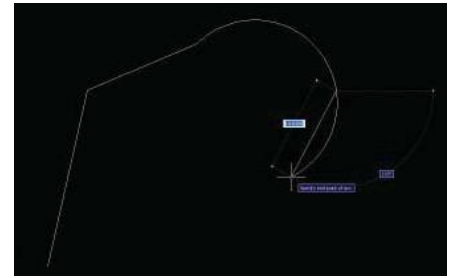
hitting Esc



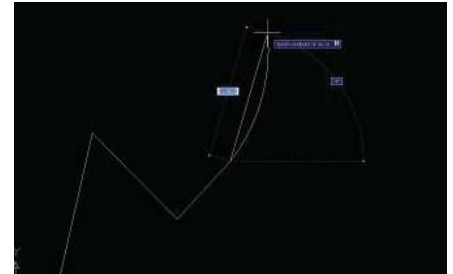
typing “cl”



If you type “s” while drawing an arc segment, you can define an arc angle by specifying three points that the arc goes through.



If you type “r” while drawing an arc segment, you can define an arc radius.

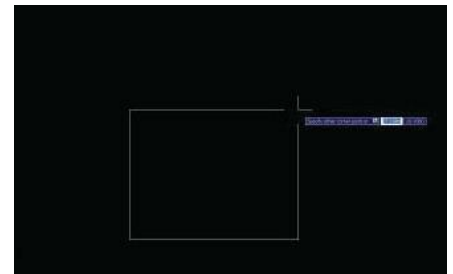


RECTANGLE (rec): draws arectangle by defining two corners.

Click on the point where you want to place the first corner of a rectangle or type in x,y coordination for precise input.

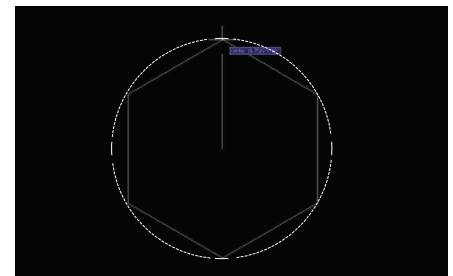
If you type “@” after defining the first corner, you can specify the second corner by x,y coordination. For example, type @36,24 for 36” x 24” box.

If you type “d” after the first corner, you can specify the second corner by the x and y distance from the first corner. For example, type “d” > space > 36 > space > 24 for 36” x 24” box.

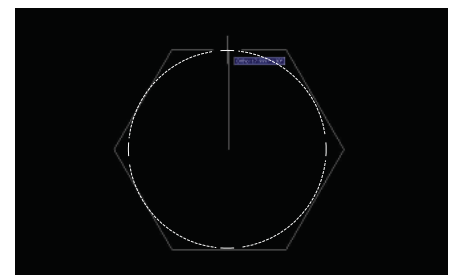


POLYGON: draws a polygon by number of edges.

If you choose to inscribe in circle, it draws a polygon **inside the circle** with the radius you specify.



If you choose to circumscribe about circle, it draws a polygon that **contains the circle** with the radius you specify.



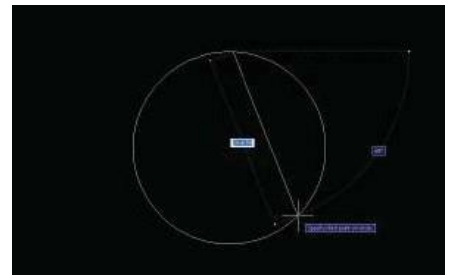
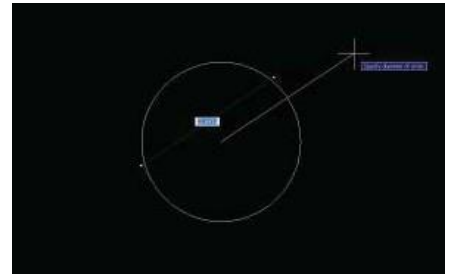


CIRCLE (c): draws a circle.

First click will define center of the circle. define the **radius** by typing it in or clicking.

If you type “d” after the first click, it will draw a circle with the diameter that you specify.

If you type “2p” or “3p” **before** clicking the center, it will draw a circle that goes through the points you specify.

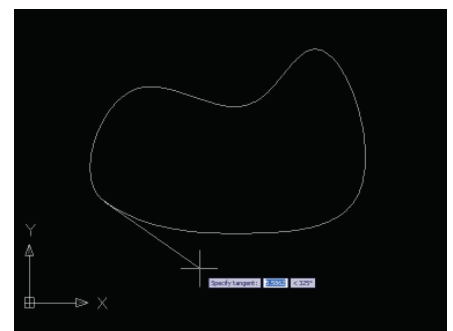
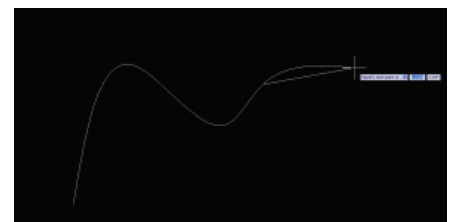


SPLINE (spline): draws a spline connecting multiple points.

Define the points that a spline goes through by clicking.

End the tool by hitting Esc (terminates the spline at the last point clicked) or typing “cl” (adds a curve back to the starting point).

Spline has a tendency to increase the file size and may cause complication when modify later. Excessive use of splines are not recommended especially when sharing a file with other people.



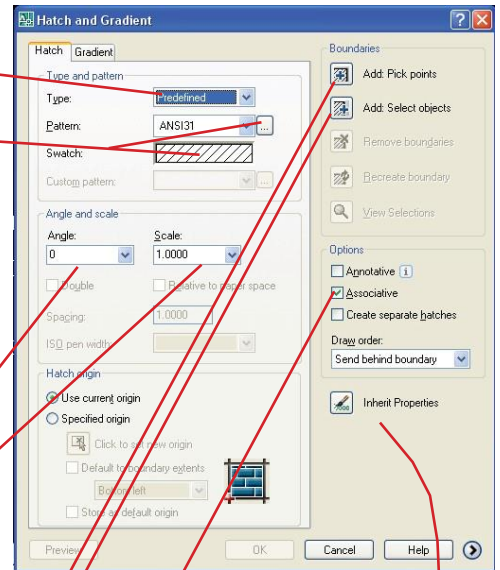
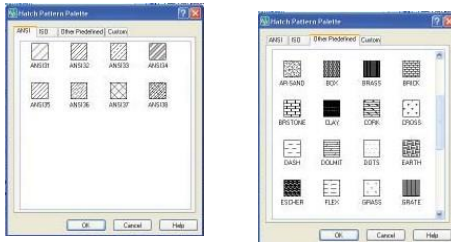


HATCH (h): fills an enclosed area or selected objects with a hatch pattern or fills.

Type: usually predefined

Pattern: choose the pattern from list (pull down) or clicking either of these.

The window below pops up. ISO has basic patterns. Other predefined tab shows commonly used patterns such as BRICK, EARTH, GRAVEL, CONC, SAND...

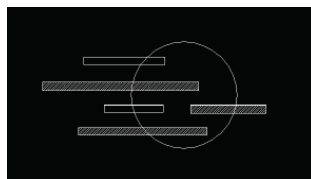


You can modify the angle and scale of patterns

When hatching a space defined by different objects such as an overlapped zone of 2 circles, select "Add Pick points". The more complex the area is the longer it takes to calculate. You get an error message when the area is too complicated to calculate. Zooming in/out to the hatching area sometimes helps. You can also manually manipulate the selection areas by using buttons below: "remove boundaries" and "recreate boundaries"



When hatching a complete object, such as circle, rectangle, or polygon, select "Add select object". If you wish, you can pick multiple objects at one time.

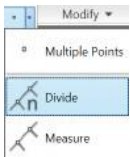


Check "Associative" if there is a possibility that the shape of the hatch may be modified later.

You can copy/paste the exact hatch properties from existing hatches by clicking this.

Once the selections are set, let's check how it looks by clicking "preview" button on the left corner. Modify angle and scale if necessary.

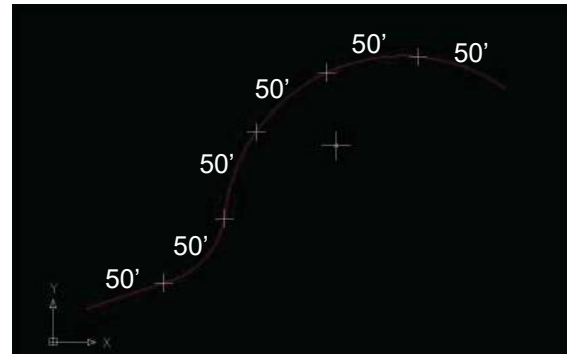
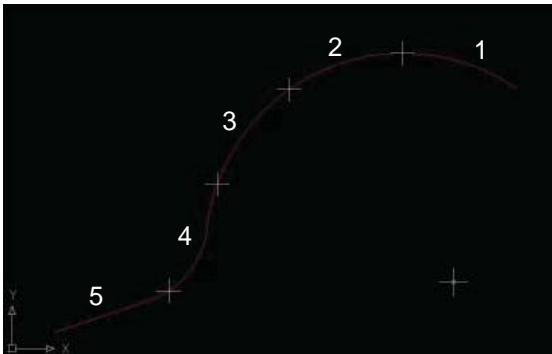
You can also modify the property after you complete the command. Double click the hatch and the property window will pop up. Simply make changes.



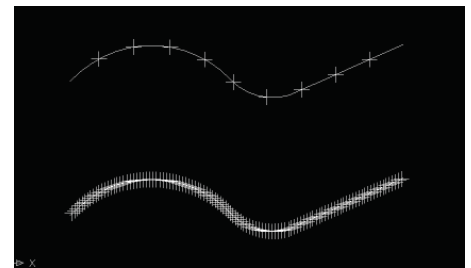
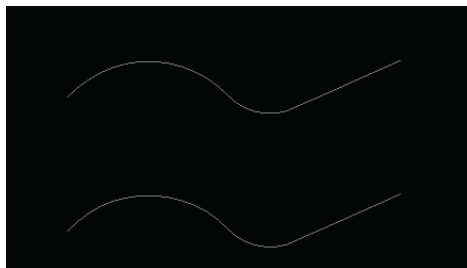
DIVIDE (div): Divide an object into certain length or perimeter segment. You can draw from the node or you can place objects along the nodes. i.e. You want to place 5 trees equally on a line.

Select object to divide, enter # of segments.

MEASURE (me): Places point objects or blocks at measured intervals on an object. i.e. You want to place trees every 50 feet.



As default, the cross nodes won't show up unless you type "pdmode" and change value to 2 or 3. It is not necessary to show them up. You can snap the nodes by choose "Node" in "Object Snap" setting. If you don't want to plot nodes, do not forget to change pdmode value back to 0 before you plot.

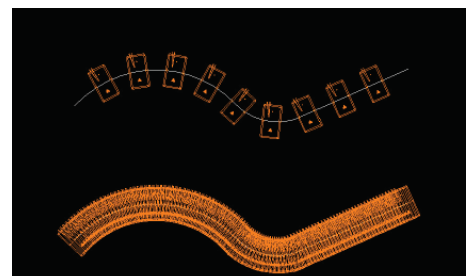


You can directly place blocks by specifying a block instead of #s.

Divide or measure, select the object, (b) for block, type the name of block (must be exact name), define if you want the block to align the curves or not, enter # of segments or length of segments.

Do not forget to place blocks at the ends.

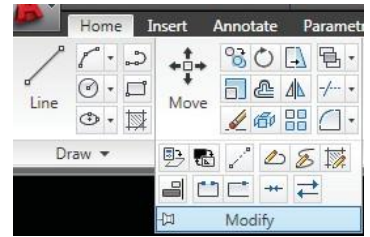
This may be useful for placing plants, light, etc...



Modify

There are two ways to modify

1. type full or short name in command line(increase efficiency)
2. Icon: Home/Modify



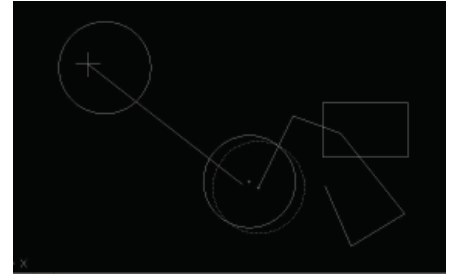
ERASE (e): erases the selected objects. You can get the same effect by selecting objects and hitting Delete key.



COPY (cp): copies the selected objects from one place to another.

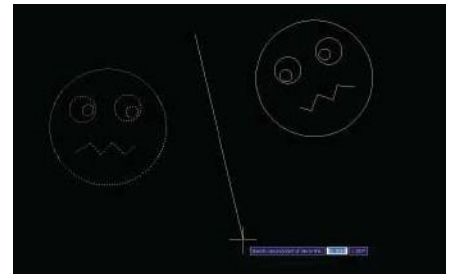
Select objects, click/type the base point and the second point that you want to copy objects to.

You can also copy+paste objects by selecting objects and right-clicking on them. It will save objects in clipboard and allows you to copy things from one file to another. Select “copy with basepoint” to copy things between files at precise locations.



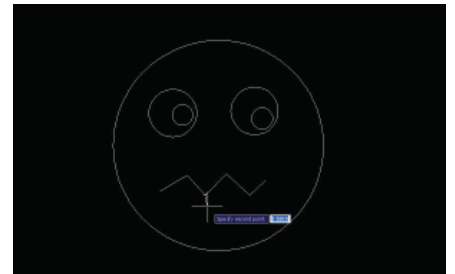
MIRROR (mi): mirrors objects along the line that you define.

It will ask you whether you want to keep the original object or not after defining the mirror line. type “y” for yes or “n” for no.

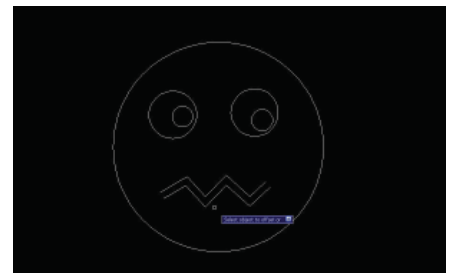


OFFSET(o): offsets objects to the distance you specify.

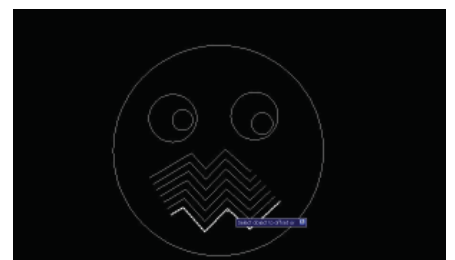
It will ask you the distance to offset objects first. you can specify it by typing the distance in or clicking two points on screen.



After entering the distance, grab an object to offset and click on the side that you want to offset it to.



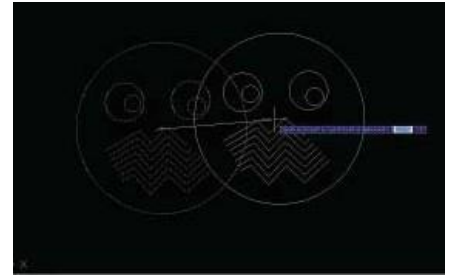
You can offset an object multiple times in the same distance by repeating click.





MOVE (m): moves the selected objects from one place to another.

Select objects, click/type a base point and the second point that you want to move objects to.



SCALE (sc): scale objects by the ratio you specify.

select objects, click/type a base point and click/type the scale numerically.

you can also scale objects by the relative distances using "Reference" points.

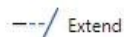
select objects, click/type a base point, then type "r" for Reference.

click the base point again, then click the second point to define the original distance. click the third point at where you wish the previous point to be after scaling objects.

In this way, it will scale the objects by the distance ratio of base point to the second point : base point to the third point. Position of the base point needs to be constant.



TRIM (tr): trim objects along specified objects.



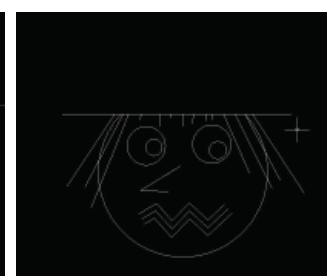
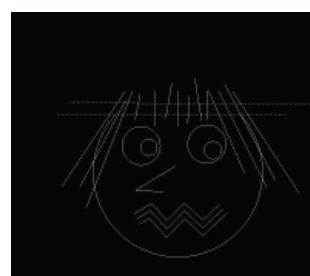
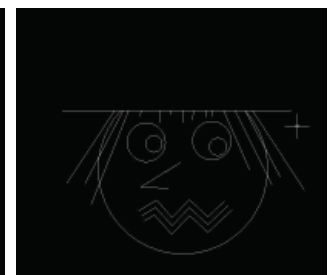
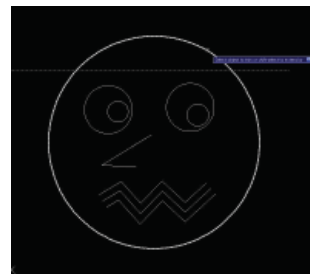
Create objects that you want to use as trim edges.

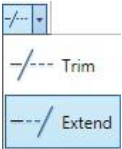
Click on Trim tool, select the trim edges and hit enter, click on the objects to trim **on the side that you want to erase**.

You can trim multiple objects at once by using selection window or "fence" tool.

To use selection window, draw a window after selecting trim edges instead of directly clicking on objects to trim.

To use fence, type "f" after selecting trim edges and draw a line. It will trim everything that the line crosses.

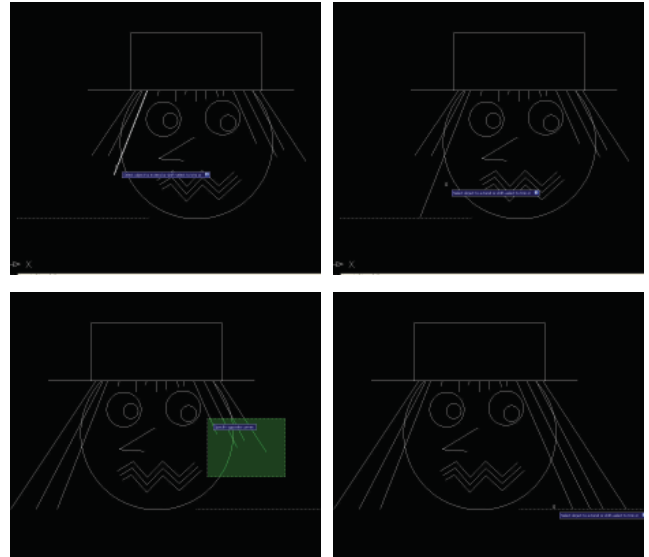




EXTEND (ex): extend objects to reach specified objects.

Basic operation is similar to “trim”. Select objects that you want to use as extend edges and hit enter, click on the objects that you want to extend.

You can also extend multiple objects at once by using selection window or “fence” tool. For directions, please see “trim” section.



EXPLODE (x): break selected complex objects such as blocks and polylines down to lines and arcs.



POLYLINE EDIT (pe): There are extensive options to edit polyline. **Please pay attention to the command line for the available options and directions.**

```
Command:
Command: _pedit
Enter an option [Open/Join/Width/Edit vertex/Fit/Spline/Decurve/Ltype gen/Reverse/Undo]:
```

Useful options are:

Close: adds a line to close an open polyline.

Join: joins touching multiple polylines into one object

AutoCAD does not join vertexes when overlapped. Make sure that the lines/arcs that you want to join are touching at an exact point. If you are unsure, move one of the vertexes away and put it back together using “end point” snap.

Edit Vertex: modifies control points.

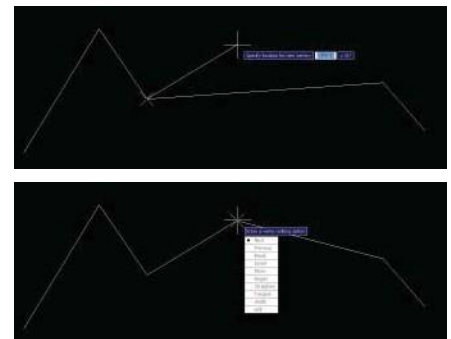
After you select Edit Vertex, a little X appears at the end of a polyline. It will move to the next control point every time you hit Enter. You should navigate this X to the control point that you want to modify.

Adding a control point:

Navigate X to the control point **right before** the segment that you want to add a point. Type “i” to insert a vertex. click where you want to add a new point. Hit Esc to exit the option.

Dividing a polyline at a control point:

Navigate X to the point that you want to divide. Type “b” for break. Type “g”. Hit Esc to exit the option.



Spline: makes a selected polyline into B-spline curve.

Decurve: makes a curved polyline into lines.

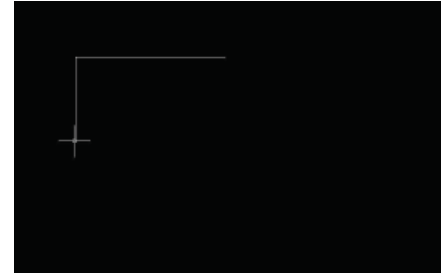
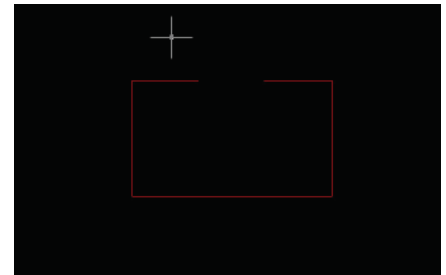
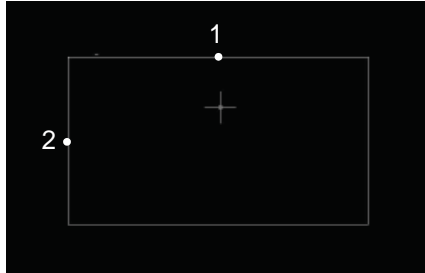


BREAK (br): can make a cut in continuous line.

Choice 1) select an object by clicking where you want to start the break, specify the second point.

Choice 2) select an object, (f) for first point, then click the second point.

When breaking a non-closed shape, the break occurs simply between two points. When breaking a closed shape, the break occurs between two points **counterclockwise**.

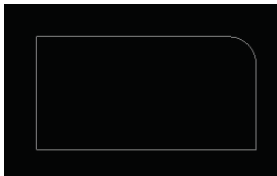


FILLET (fillet): connects two objects with an arc that is tangent to the objects and has a specified radius.

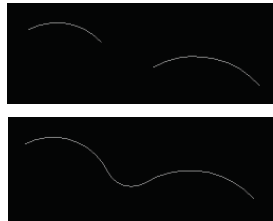
Select radius, type number, select first object, and then the second one. **If you don't enter a number, the two lines will extend to join each other.**

You can fillet:

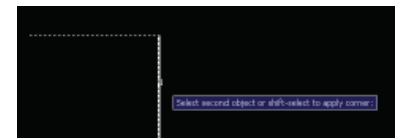
- rectangle



- arcs



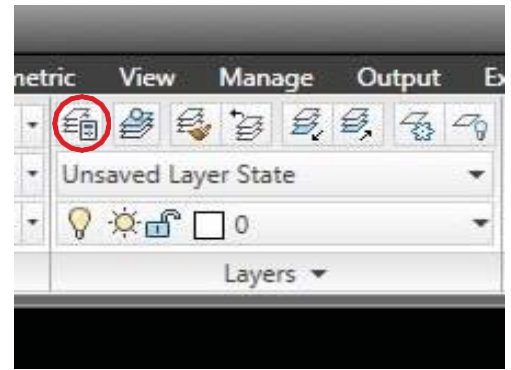
- circles
- ellipses
- different line types
etc



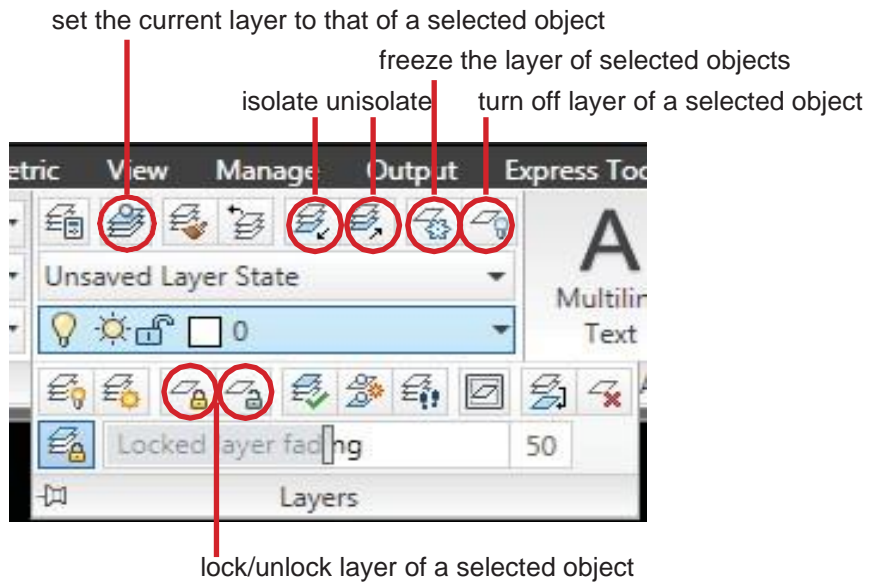
Layers

AutoCAD uses layer systems like Photoshop and SketchUp to organize a drawing.

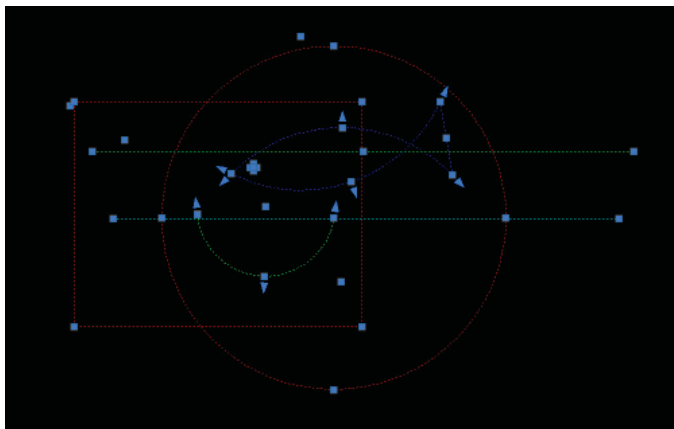
Layer palette shows your current layer name and state. To access Layer Manager, click on the highlighted icon or type "layer" on the command



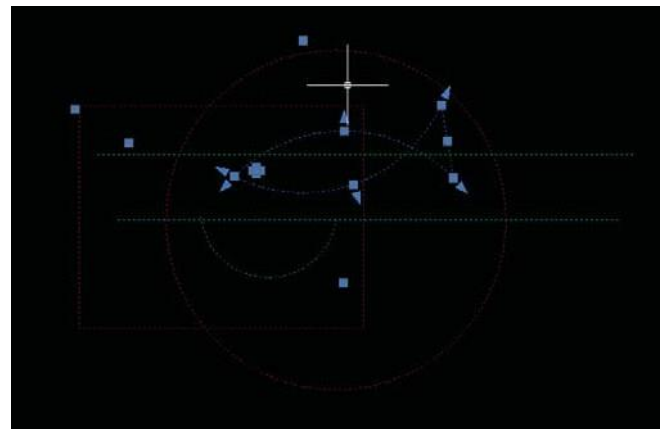
most useful layer icons, especially when you have a lot of layers.



Please make a habit to name and manage your layers appropriately. Generally, it is better to put the same objects in the same layer. For example, you can name them "column", "plant", "building", "road" and etc. If you manage your layers appropriately, you can lock/turn off/freeze all the layers except for the layers you are working on easily. In this way, you can select the objects you want easily.



right cross select all objects when all the layers are on



right cross only select the blue fish when other layers are locked

Layer Manager (layer)

turns on/off the layer
turned-off layers become invisible on the screen but geometric information is still in the drawing

freezes/defreezes the layer
frozen layers are invisible and geometric information is unavailable

locks/unlocks the layer
locked layers are visible but objects are not modifiable

makes the selected layer current
deletes the selected layer
makes a new layer
layer

indicates current layer

you can select layer colors by clicking here

changes layer line type (dotted, dashed etc.). You have to load the line type in a different window to be able to use it in the drawing

changes line weight

turns on/off on the plot. De- foints layer cannot be plotted by default

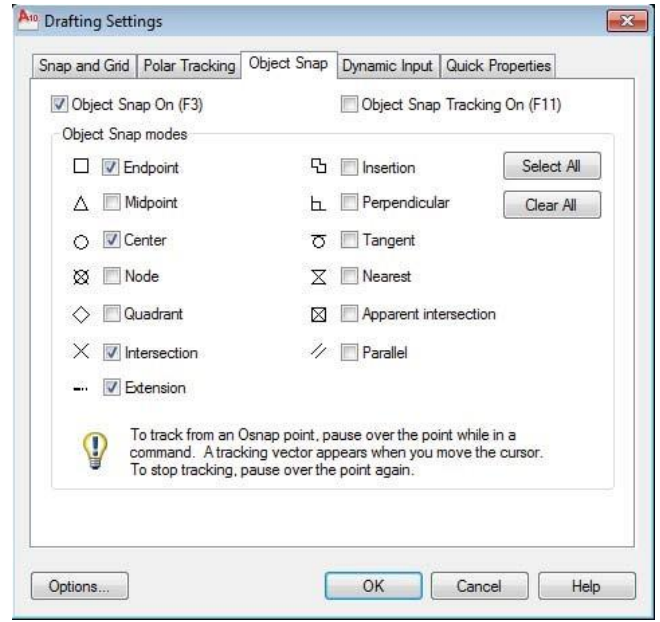
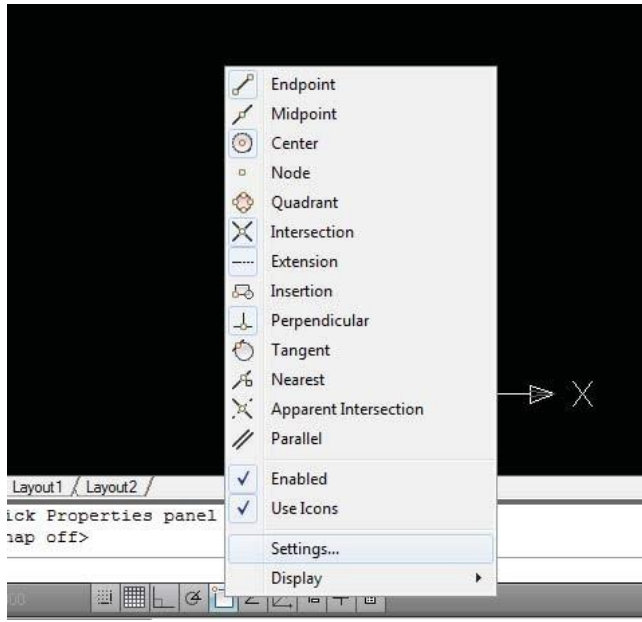
S...	Name	O...	Fre...	L...	Color	Linetype	Lineweight	Plot St...	P...	N...	Description
0	defpoints				wh...	Continuo...	Defa...	Color_7			
	Layer1				gr...	Continuo...	Defa...	Color_3			
	Layer2				red	Continuo...	Defa...	Color_1			
	Layer3				red	Continuo...	Defa...	Color_1			

Rightclicking on the layer names gives you more options to manipulate layers such as filters and selections.

Pulling down the layer name on the layer palette also allows you some control on layers.

You can turn off/on, freeze/ defreeze and lock/unlock layer easily here.

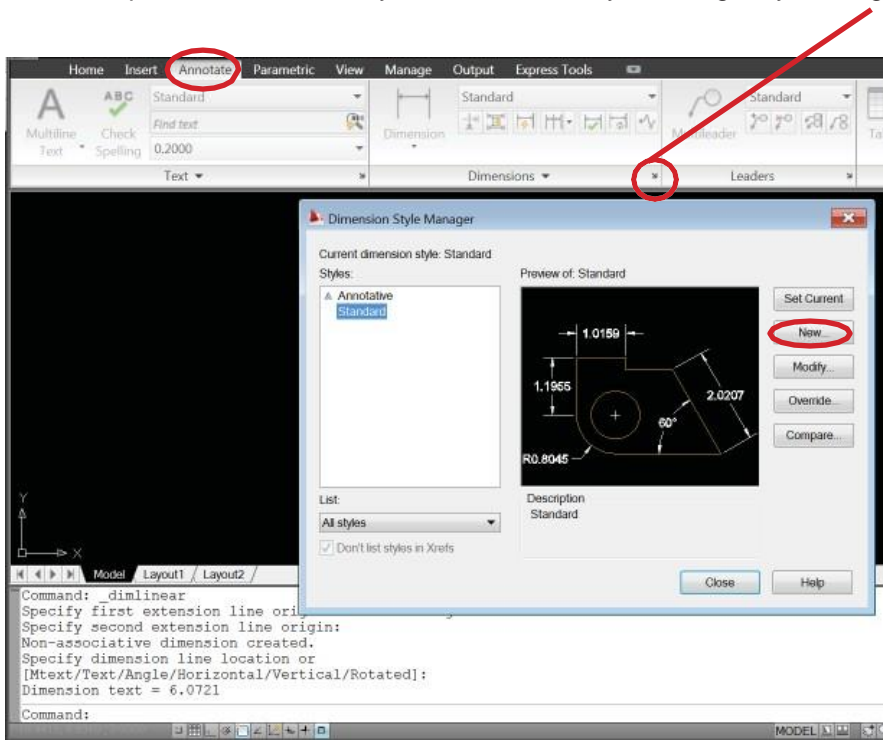
To adjust settings, right click on any snap/tracking tabs. A setting window will pop up.



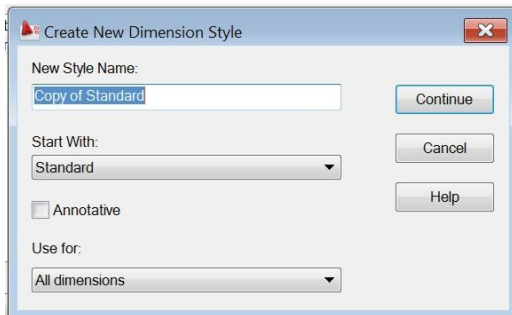
Annotate

Dimension Style Manager

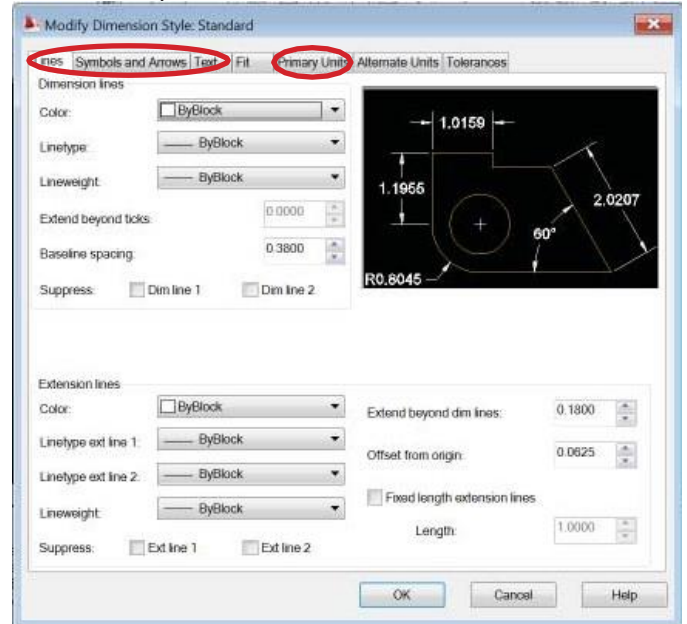
First, set up a new dimension style in Dimension Style Manager by clicking



choose new and set up a new style



choose continue and then you can modify the settings. The most important ones are:

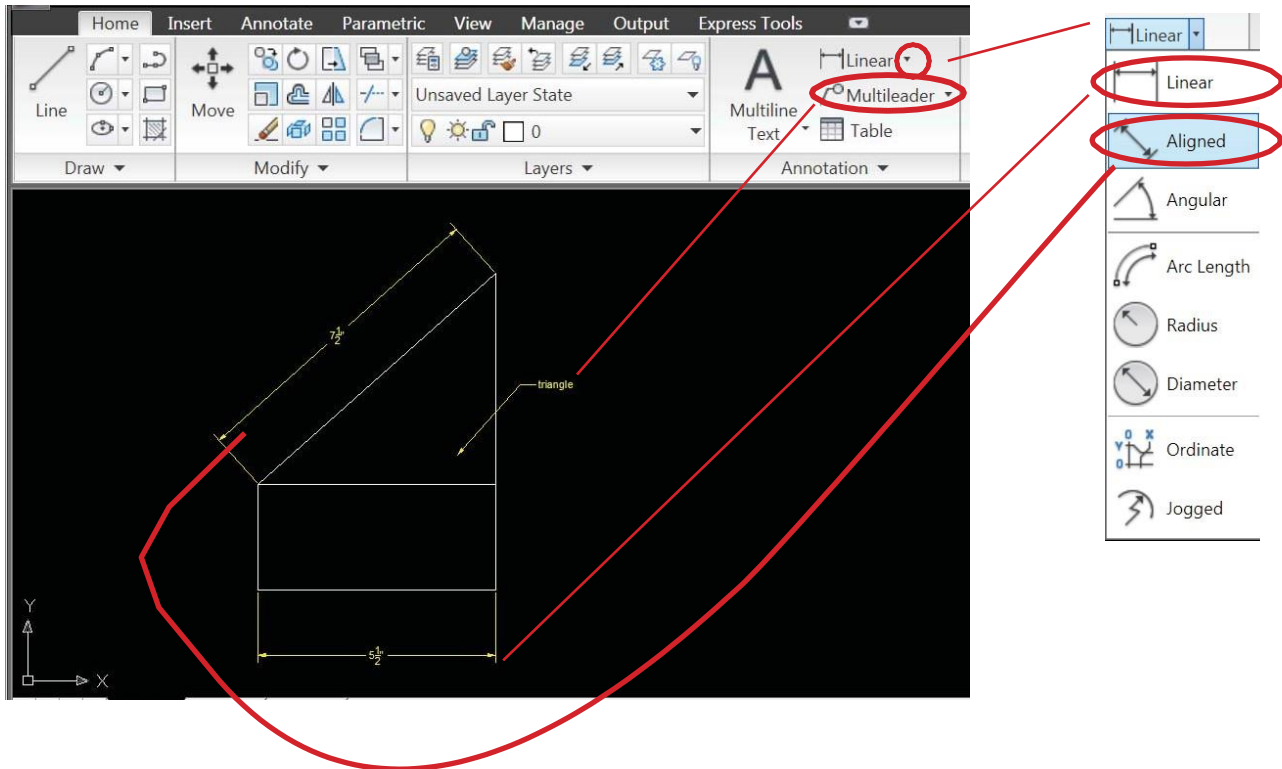


Set the right style as current if there are several by choosing "set current"

Modify dimension styles by choosing "modify"

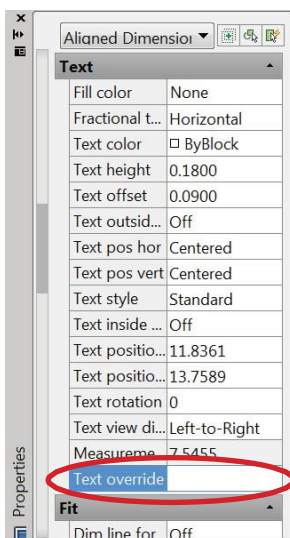
Dimension

set a new layer for dimension, then use the following tools.

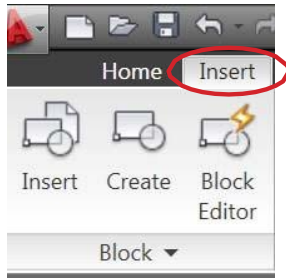


Dimension text override

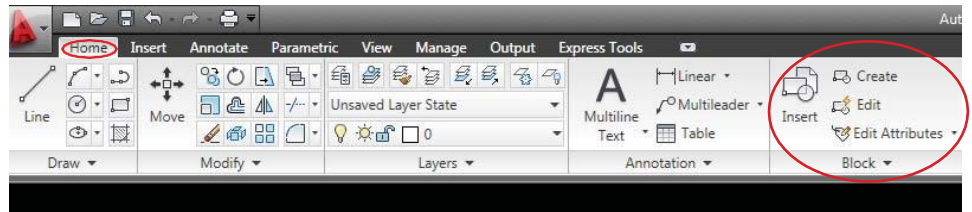
If the dimension is not correct but it is hard to change the drawing, you can override the text by: select the dimension>right click>select "properties"> "Text"> "Text override"> type the number you want



Block



or

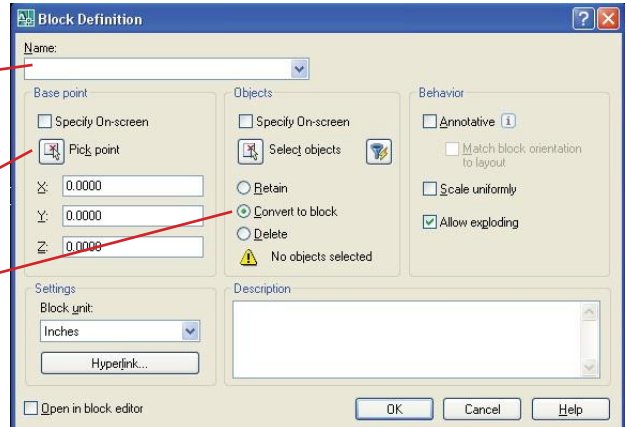


BLOCK: groups and objectifies selected lines as one entity.

Give a name easy to remember

Draw/move lines into layer 0 (or create block in new sheet, then later import the dwg file itself) select them, **block (b)**, pick base point by clicking pick point, later this point is used as insertion point.

Make sure convert to block is checked

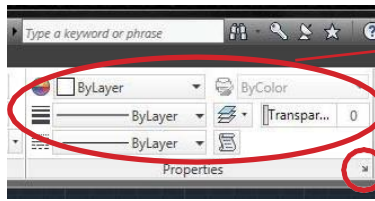


Once the block is saved, you can insert from the saved location

You can modify a block in "block editor"
Or explode, modify, then re-create the block.

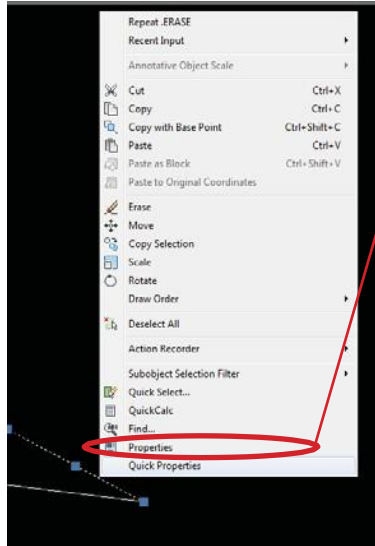
BCOUNT: count the number of objects made by the same block. The computer will ask "select objects" after you type "bcount". i.e. You can simply count the number of the blocks named "Tree-6ft" by selecting any "Tree-6ft" block. If you type "all" and press "Enter" button, it will count all the blocks.

Properties



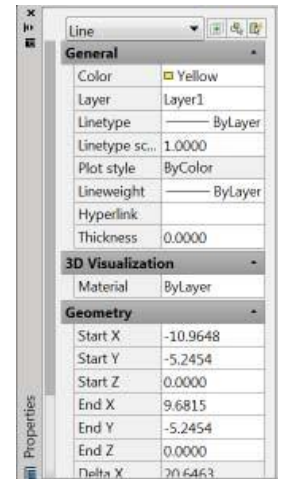
You can change main properties. Auto CAD 2011 adds "Transparency" feature here

Detailed properties list will pop up once right click



Detailed properties list will also pop up if you select a object/objects, right click and then select Properties.

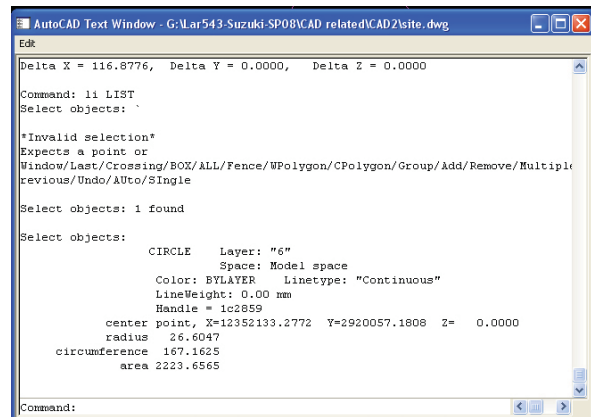
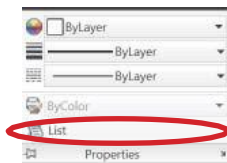
Properties can be overridden in this list



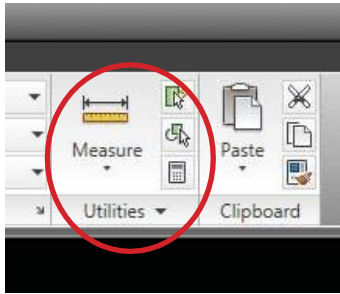
LIST (li): pops up a window with information of the selected geometry.

List, select object.

When you want to know the length of an arc or polyline, you should use either list of property.



Utilities



MEASURE

distance(di): measure the distance between two points. click the first point and then the second one.



FLATTEN : when you can't measure the distance correctly, check the elevation or z-value in list or property. If that is a file that does not require to have 3 dimensional information, create 2D file by flattening. The command is also useful to export sections and perspectives as 2D drawings.

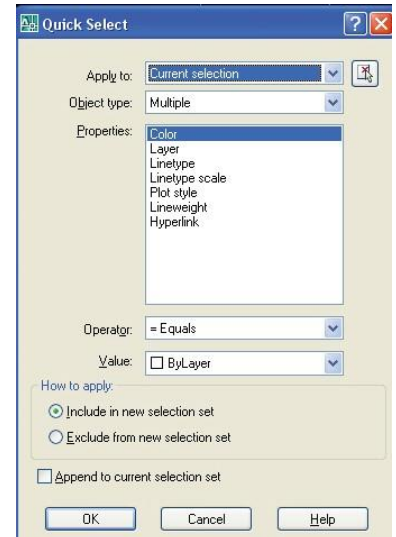


QUICKSELECT (qselect): allows you to select by different property values.

This is a useful tool especially when modifying a large amount of segments or small scale objects dispersed in a large area with particular property.

For example, you want to erase all blocks named "tree2" but not other tree blocks:

- Select "Entire drawing" on the top tab.
- Select "Block" on Object type tab.
- Select "Name" on Properties
- Change "Value" to "tree2" and click on OK button.
- It should bring you back to the drawing screen with all "tree2" blocks highlighted. Hit Delete to erase them.



Clipboard



MATCH PROPERTY (ma): applies the properties of a selected object to other objects (layer, color, line type...).

Matchprop, select the source object - the object you want to copy from, click the lines/objects that you want to paste the property.

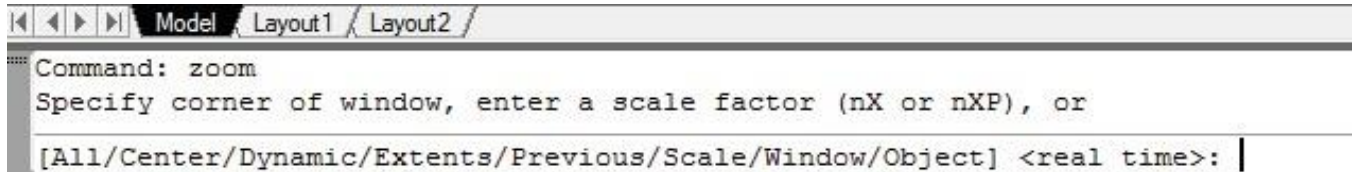


View

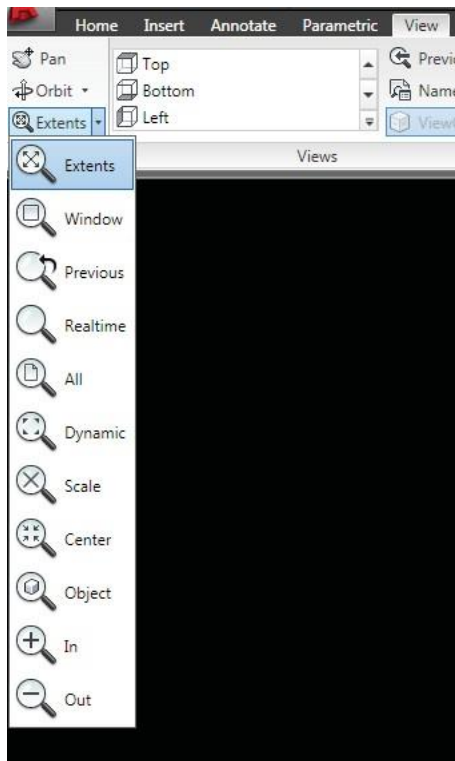
zoom (z)

There are three ways to zoom:

1. The middle wheel on the mouse allows you to easily zoom in and out.
2. type zoom(z in short) in command line.



3. View/Extents



(type "E" or "e" if use command line) allows you to zoom in/out to the whole area that you have any objects



(type "W" or "w" if use command line) allows you to draw a window around the area you want to zoom in



(type "P" or "p" if use command line) go back to last zoom area



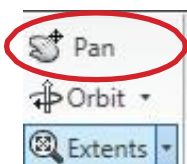
the same function as middle wheel on the mouse



(type "A" or "a" if use command line) allows you to zoom out to the entire drawings are

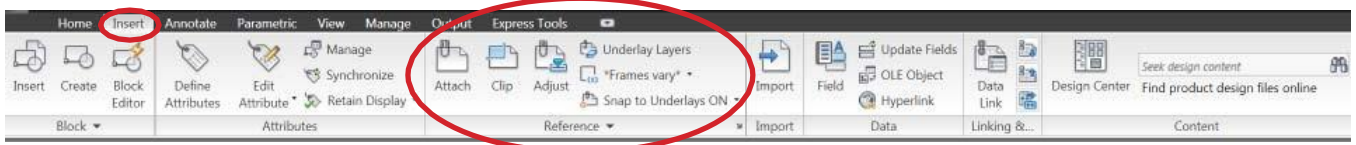


(type "S" or "s" if use command line) allows you to zoom in/out in certain scale



PAN(p) move the view

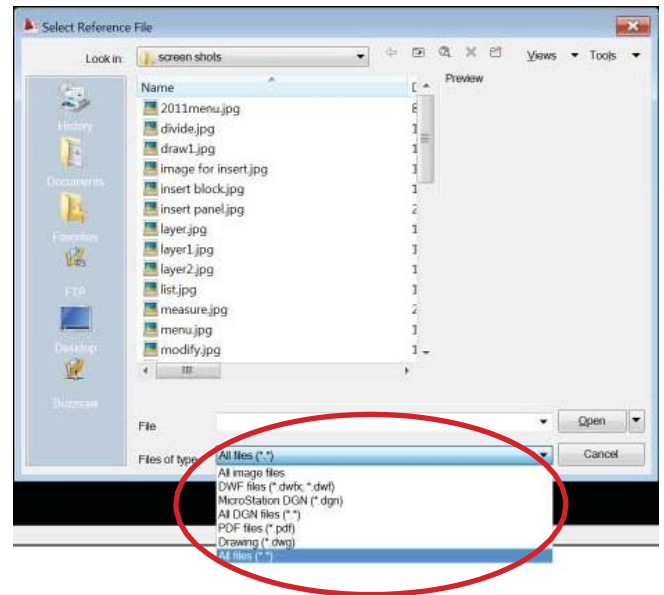
Insert reference



You can insert files in CAD, like image, other CAD drawing, excel form, pdf and etc.



ATTACH: Click attach and choose the file you want to insert. Make sure you choose the right file format.



insert image

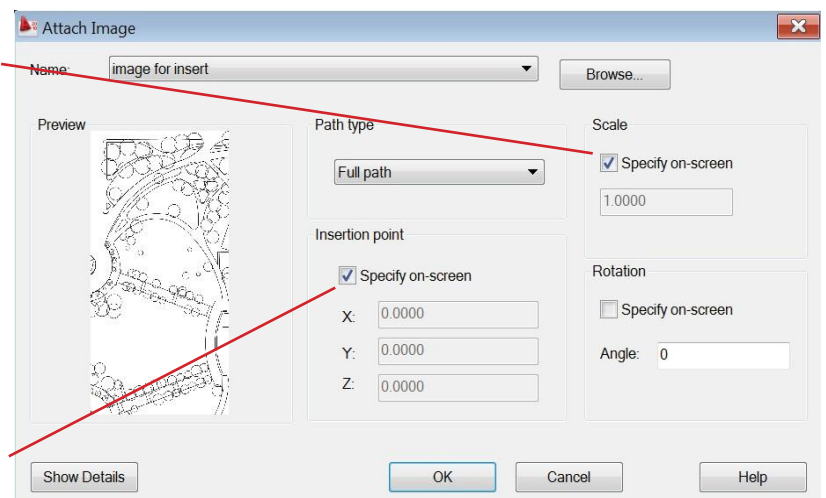
You can trace images, like hand sketch, after you insert them in CAD.

Create new layer "image" and set it as the current layer. Insert the image in this layer.

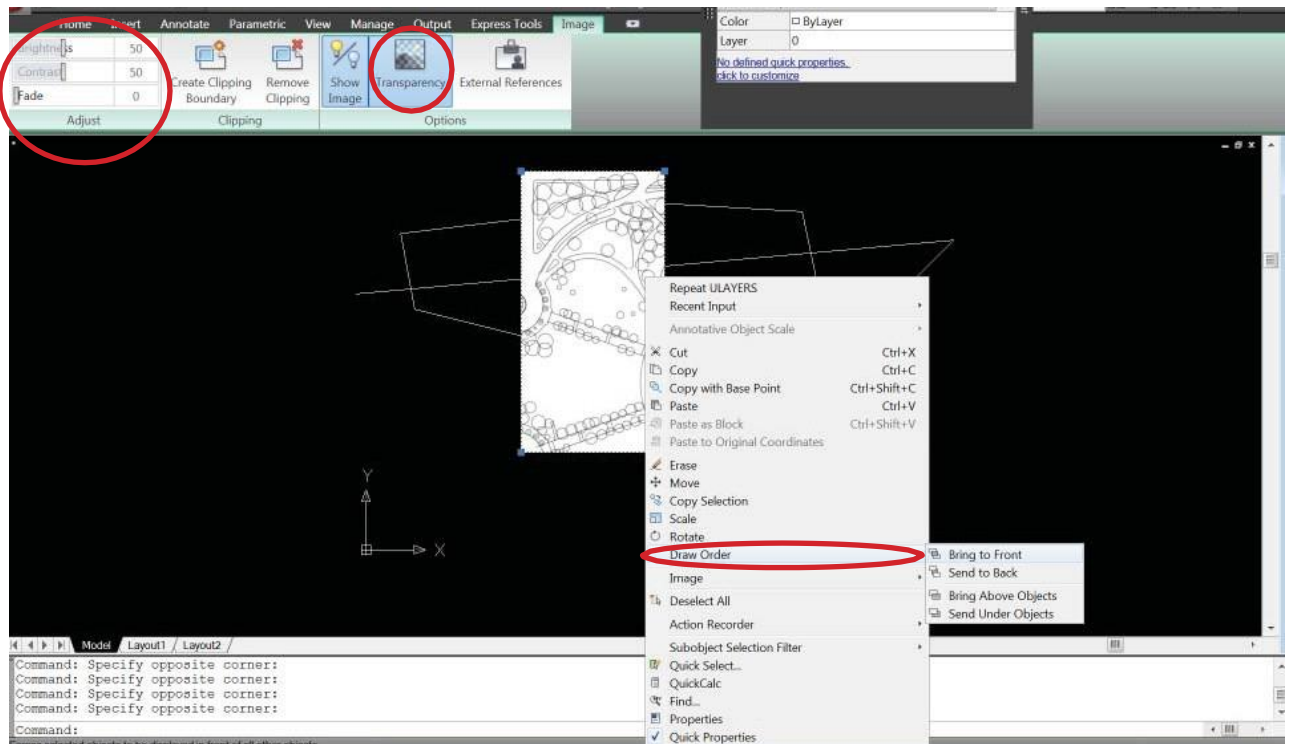
If you know the scale of the image, type value in Scale
i.e. 1"=10' drawing in the dwg with "inch" unit setting - 120 (10 x 12)
1"=200' drawing - 2400 (200 x 12)

If you don't know the scale of the image, guess and type an appropriate scale or check specify on-screen.

Keep "Specify on screen" checked unless you know the exact values of x and y coordinates.

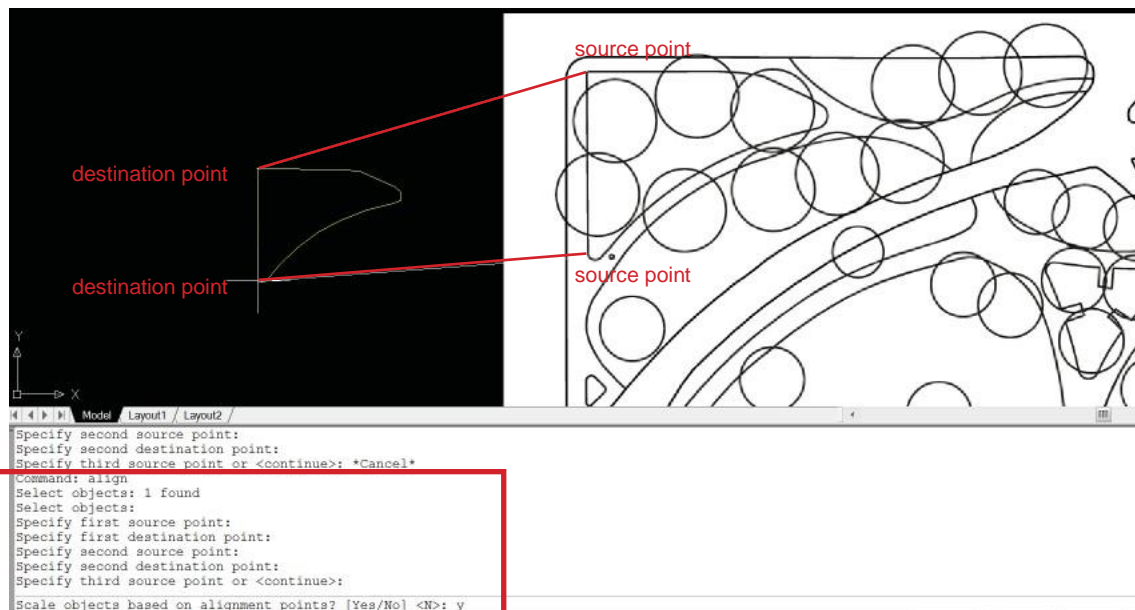


Select the image, and the adjust options will show up at the top.



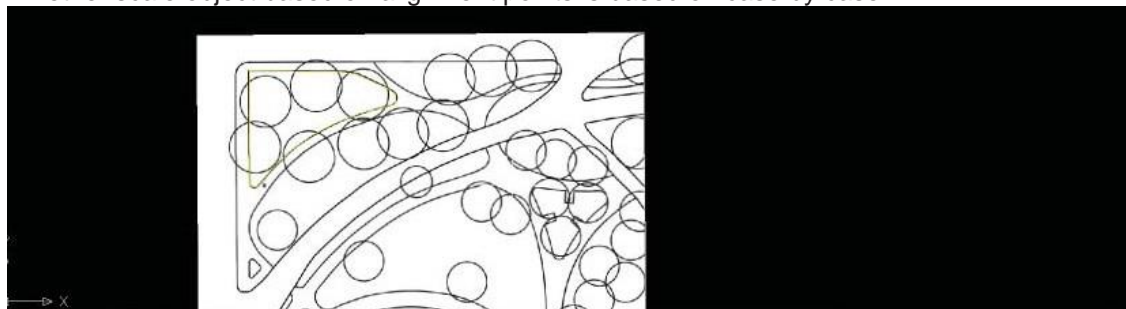
If the image is over other lines that you want to see, adjust the draw order by selecting the image, right clicking Draw Order > Send to Back

ALIGN: Align the image to the existing



For third point, normally just press enter.

Whether scale object based on alignment points is based on case by case.



SCALE(sc)

You can scale the image if you know a dimension of an object.

i.e. You know the length of the yellow edge is 2. You can scale the entire image based on it.



press enter after finishing selecting

If you know the scale, type it here. If you know a dimension of an object in your image, type R

click one end of the edge and then the other
type the new length

insert dwg.file- external reference (xref)

less useful at school but very important when you collaborate with other people in the office

When there is a file that you want to view in your drawing and are not intending to modify them, use external reference.

*Usually you are not supposed to modify files that you recieved from others.

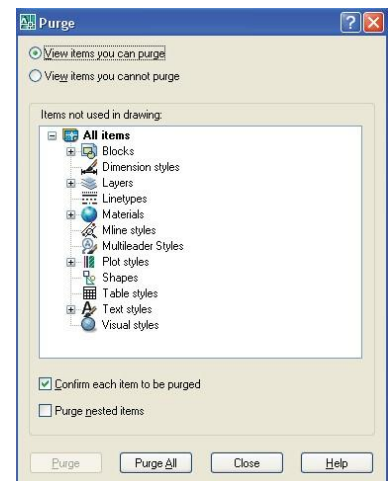
* before you start modifying and xrefing any existing documents (especially from external sources), it is a good idea to clean the files by purge and audit.

PURGE (pu): Removes unused named items, such as block definitions and layers, from the drawing

purge, click "yes to all" (in most cases, you want to purge everything) **AUDIT**

(au): Evaluates the integrity of a drawing and corrects some errors audit, (y)

for fixing errors automaticlaly



Attach vs overlay: generally choose overlay, unless you are submitting the files themselves to clients.

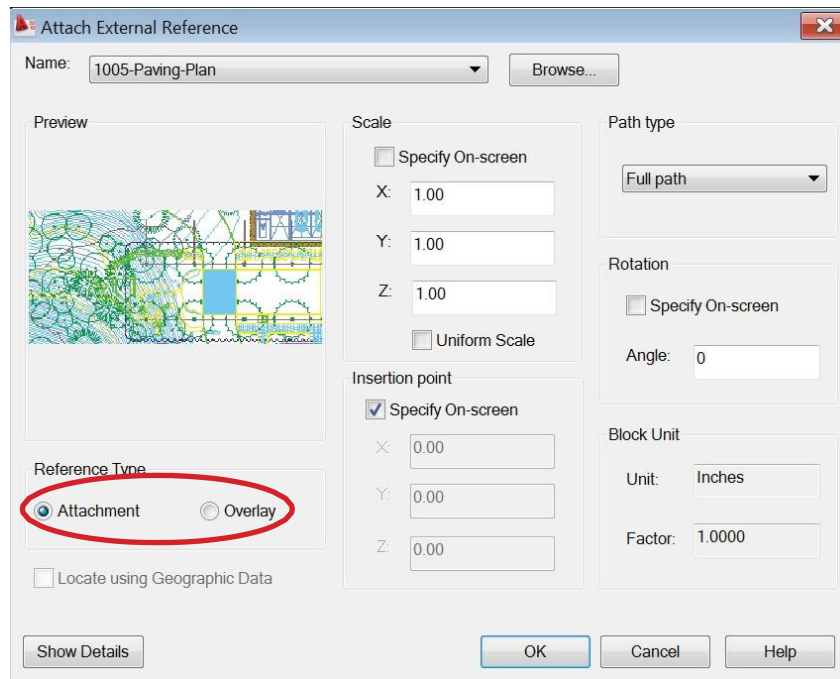
Attach = the attached xref will be carried to the next tier of files

i.e. if you xref a file that has attached xref, you will see both xrefs Overlay

= the overlaid xref will not be displayed in the next tier of files.

* it is commonly thought that the information itself is not carried by

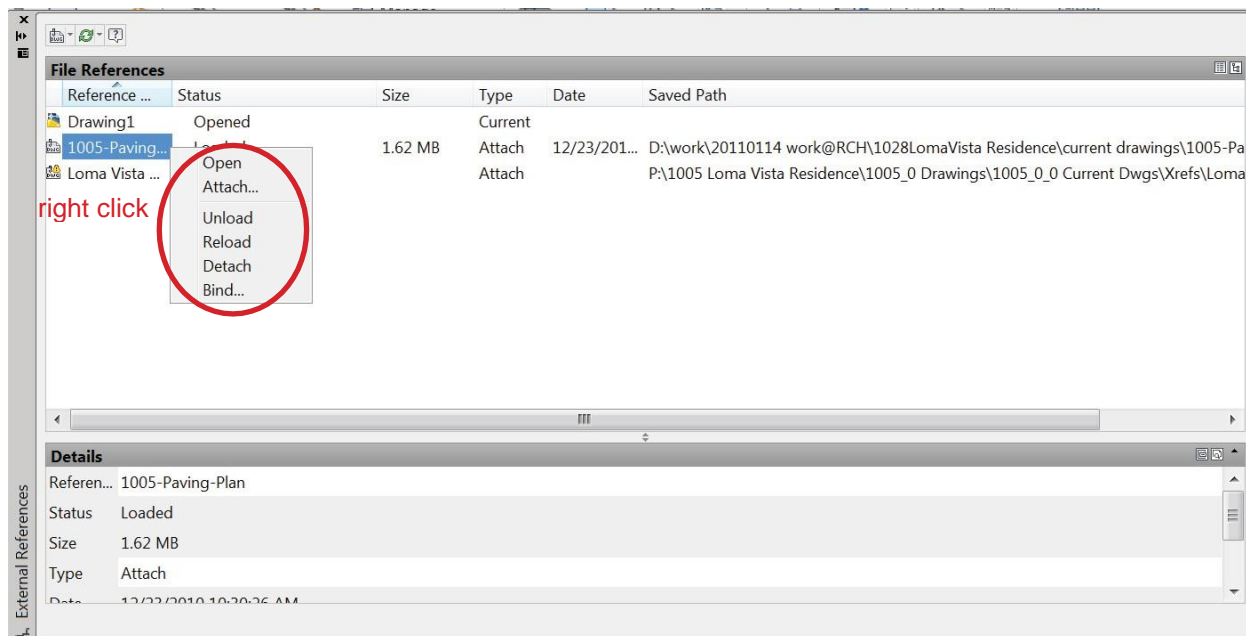
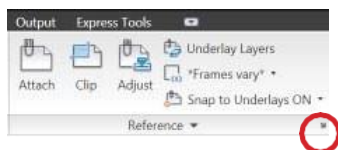
overlay. However, that is not always true. Sometimes overlaid information is carried as ghost and start cross refer- encing each other. This could cause slowing down the file and possible damage.



Browse the file, choose attach or overlay, choose insertion point , scale, rotation, in the case, it is a plan that has same ucs (origin 0,0) and drawn to full (1:1) scale, leave boxes unchecked.

If you are xrefing a file that is not created with same ucs, either pick the insertion point, or move the file and align after you attach it.

xreference manager



Unload vs Detach: Detaching delete the xref. Unloading just makes xref disappear from the screen.

Modify xreference

When you want to modify an xref file through the working file:
- refedit (or double click), save the change.

This option is not the most stable way to edit an xref. Unless you want to do a few very simple things, open the original drawing, edit and save it, then reload the xref in your working drawing.

When you want to copy objects from an xref drawing to your current drawing:
- Nested object copy (ncopy), select objects, enter, click the paste destination.

We are going to cut a simple section, ground line and a structure.

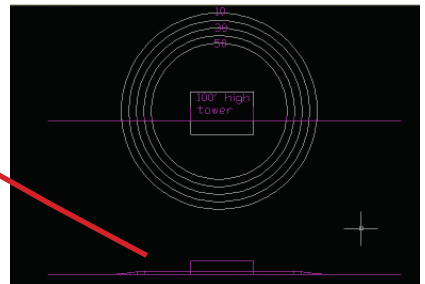
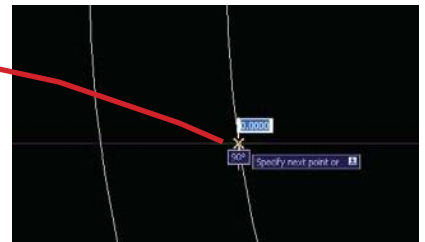
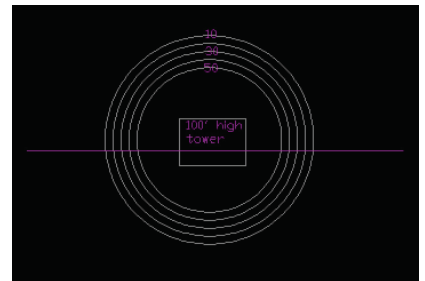
The basic idea is same as hand drawing.
- Make a section cut
- Extend the height

For example, on the right drawing, there is a 100' tall tower on the top of a mound. There are 10' contour lines.

Draw a section cut line.

Make lines from the intersection of the section cut and each contour line & structure line by typing the numbers (this drawing unit is in ichi = # should be multiplied by 12).

You can either connect lines where the reference lines are, or make a copy of lines, move them to the clear area, then connect them.

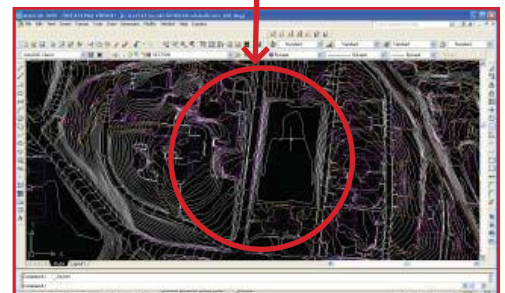
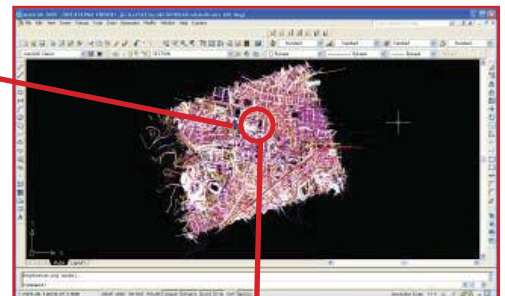


Now, let's practice on Carr's hill plan.
Open Carr's Hill Base file and zoom into Payton hall parking lot area.

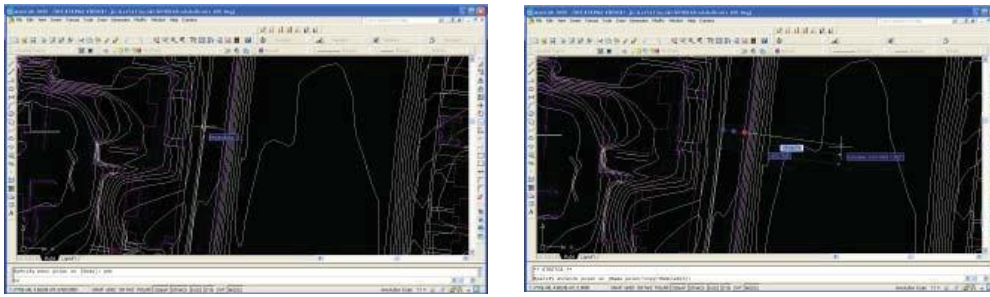
Let's create a new layer called "Section" and make the layer current
<click layer manager or (layer), click new layer icon, name the layer>

* If you are creating a section/elevation that includes multiple objects, you may want to create a layer for each object and color code them for your reference.
i.e. structure layer = red, trellis layer = blue, tree layer = green

Draw a line close to mid point of the football field, perpendicular to the street.
<line (L), click the first point, perpendicular (per), click the other side of the street>



Extend the line 200' (2400") to the both sides.



When the plan is angled like this case, you can either:

1) Rotate UCS (User Coordination System) according to the section line.

or

2) Make the section cut as is and rotate the reference lines later.

(This works when you can't change UCS for some reason, and the section is short and simple)

After completing the section, you should change UCS back to default (World), especially when sharing a file with someone else.

1)

Rotating the view

We are going to rotate the view based on the section line. We use **UCS** command.

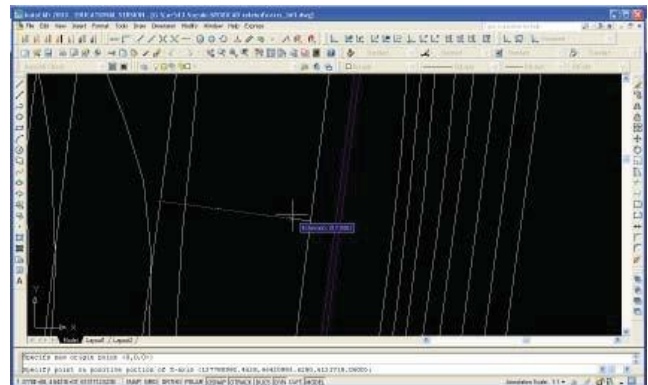
There are 2 steps

1. Creating new UCS

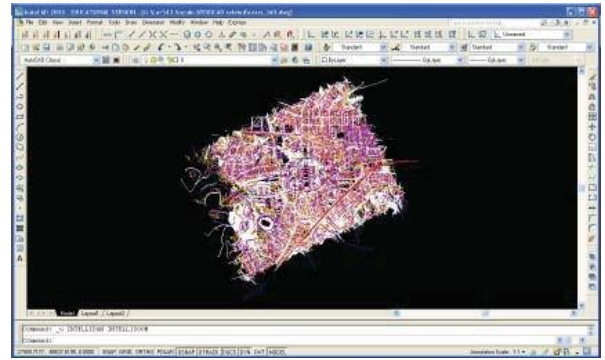
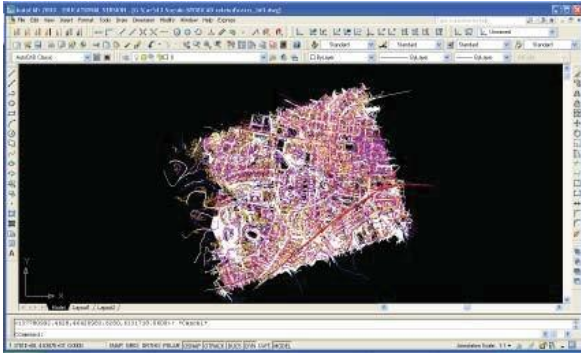
<type (UCS), then (e) to define XY coordinates by an element you want to align the X axis to, in this case your section line>

2. Changing the view according to the new UCS

< type (plan), choose current ucs or just hit Enter>



You can create section reference lines using **ortho snap**, you can save the file specifically for section or you can change the UCS back to **"world"** when you are done.

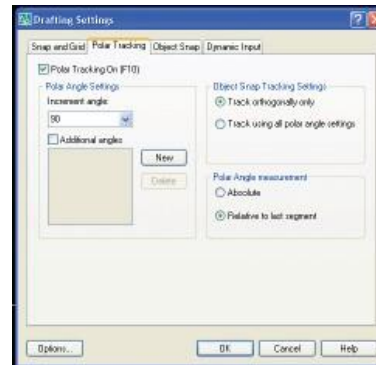


2)
Now we can try the way without changing the UCS.

There are multiple ways to do this. Drawing perpendicular reference lines to the section cut is one way.

To create perpendicular lines easily, turn the **polar tracking** snap on and open the setting by right clicking on it.

In “Polar Tracking” tab, “Polar Angle Measurement” section, click on “Relative to last segment”. The guideline perpendicular to the section cut will appear.



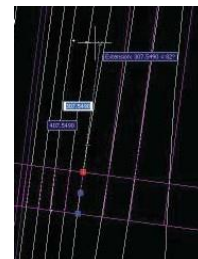
Draw perpendicular lines from the section cut intersections. When OSNAP intersection does not appear where it looks 2 lines intersect, try **Apparent Intersection**. This is because some lines have z values (elevation) and 2 lines are not exactly intersecting. Apparent Intersection selects intersected objects on the plan view.



<line (L), click Apparent Intersection or OSNAP apparent intersection on, click the first point and start a perpendicular line, move the cursor on the top of the second line, type in the height of the reference line>
Extend the lines to the appropriate height.

In this example, we do not have contour lines labeled. Let’s check the elevation in the property box and use that number.

Grab the end point at the section cut. Move it up and find the point that says extension. Where it shows “extension”, lock the point and type #s. When the “extension” does not show up, it usually helps to put the cursor over the original endpoint.



For fence, add 40” on the top of the elevation, for the structure add 240” on the top of elevation.

Area calculation

Create a new layer and give a clear name like “take off.”

Make polygons of the areas that you want to know.

If it is one connected polygon area, you can simply select the polygon and “list.”

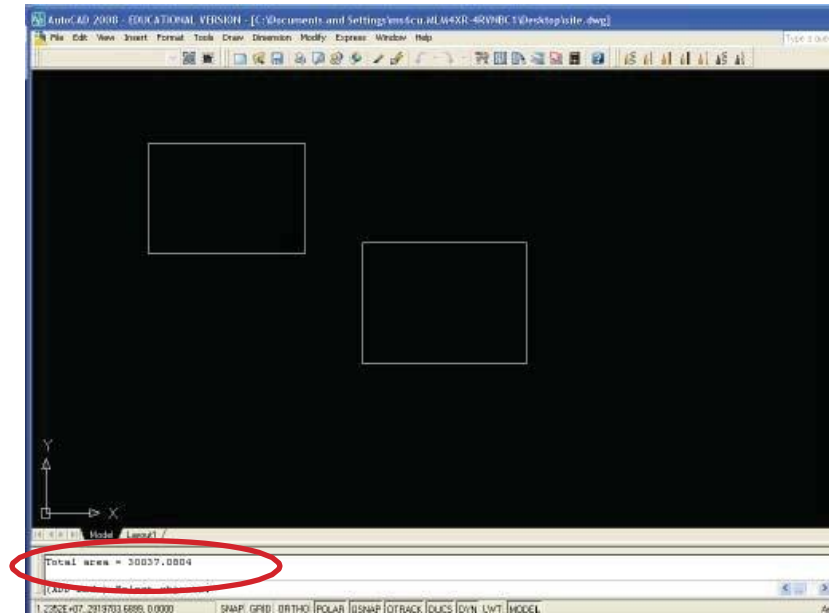
If there are multiple polygons, you can use the command “area.”



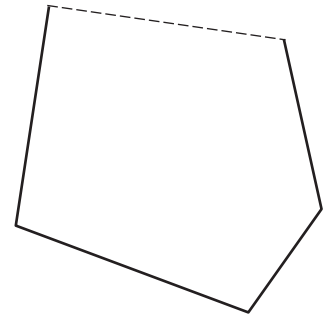
AREA (aa)

“a” for add, “o” for object, select polygons that you want to sum up.

Total area is shown in the command line.
You can subtract the areas by typing “s” and select shapes to subtract.



When you select an open object, CAD will automatically bound the area connecting the start and end points with a straight line.



Plot

You can plot either from the model space and layout space.

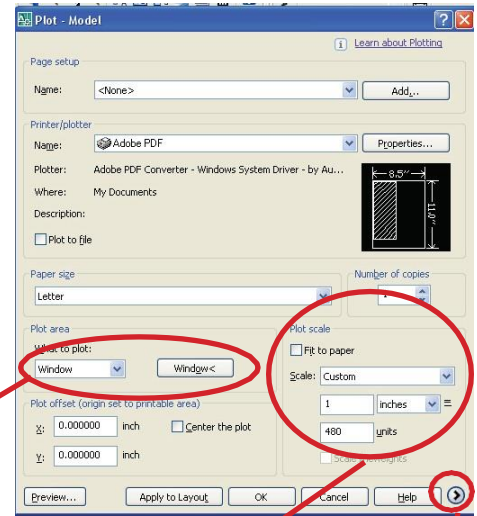
Plotting from the model space is used for quick not-to-scale reference printing or in-house basemaps.

Plotting from model space:

While you are in the model space, go to print, the window on the right pops up.

Choose paper size.

Select "Window" and draw a rectangle around where you want to plot.

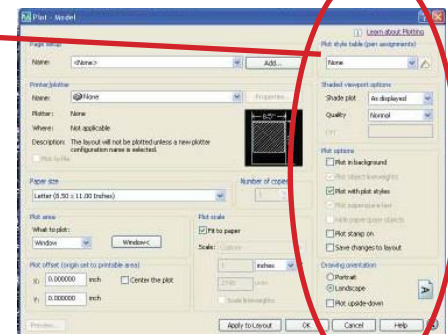


Check "Fit to paper" if the scale is not important. If you want to print in scale, put the appropriate number in the box. i.e. 1" = 40', 40 x 12 = 480 you type 480

By clicking the arrow on the bottom right, you get more options.

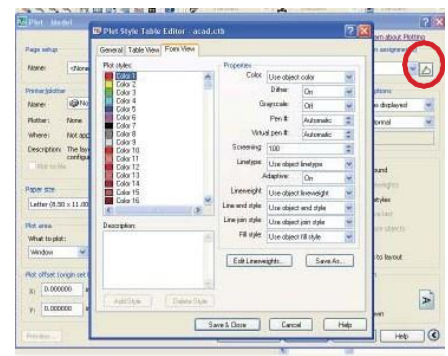
For plot style, you should select appropriate pen settings for the project. The CAD default is "acad".

CTB files translate the line colors on your drawing to line widths, types and tones using index color system. Firms often have their own standard settings, typically color 1 (red) being the thinnest line and lines becomes wider as the color number goes up.



You can also create or edit the CTB file by clicking the pen symbol on the right top.

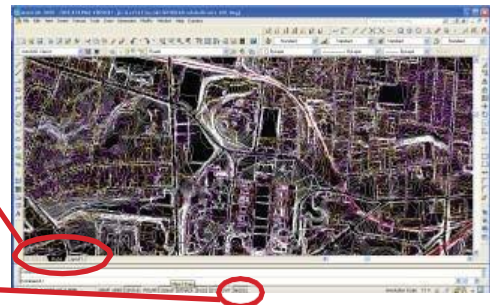
Some machines at A-school do not load CTB files. If that is the case and you want a monotone print, create your own CTB file or change all object colors to monotone and assign line width manually by individual object or layer in your drawing.



Plotting from layout:

Layout: You can change model space and layout space by clicking the tab on the bottom of display.

Layout is a sheet setting. Layout has 2 different spaces;
1) model space, 2) paper space
You can check which space you are in and change the status by clicking the tab on the fat bottom.



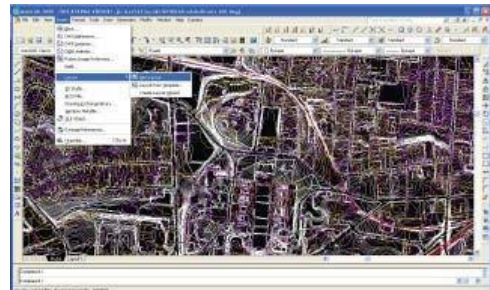
Make a new layout

insert>layout>new

or

right click the bottom tab "layout 1"

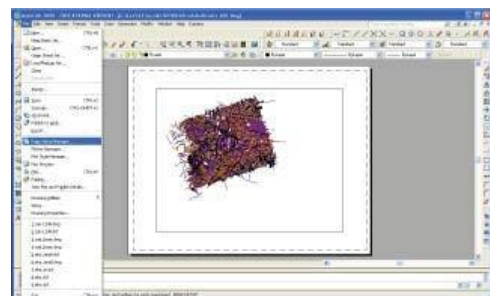
Name the new layout "11x17" - because that will be our page size



Go to the layout "11x17"

Open the "page setup manager"

Select "11x17" and click modify



Same as plotting from the model space.
Select "acad" for this exercise.

Select appropriate printer and modify the properties by click the property button and go into property windows, if necessary.

For this exercise, choose Adobe PDF.

Choose Tabloid/11x17

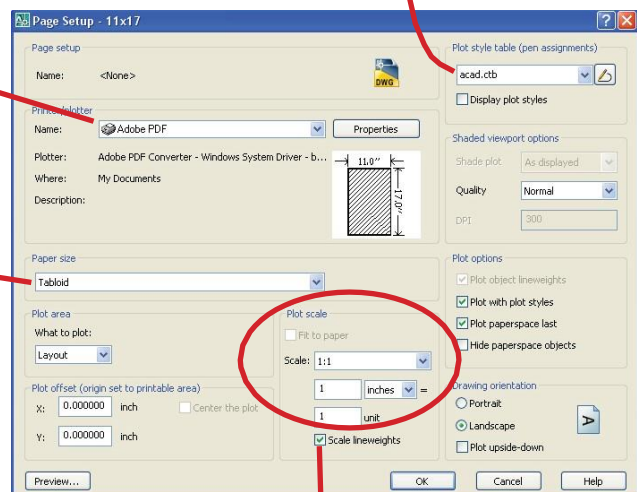
Make sure that the plot scale is correct.
If your dwg units are in inch, the default is right 1"=1unit

If your dwg units are in feet, that would be 12 inches = 1 unit

If your dwg units are in meter, you should choose millimeter instead of inch, then type

1000 millimeter = 1 unit

In metric CAD file, layout/plot space is always in millimeter. Model space units vary.



Check "scale lineweight" box when you are plotting in smaller scale or size, so that the lines are not too thick.

Layout uses a frame called “viewport” to display the model space. A sheet can have multiple viewports and you can turn on/off certain layers per viewport.

Let’s delete this existing viewport.

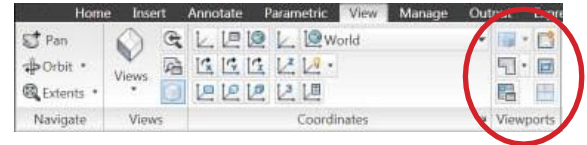
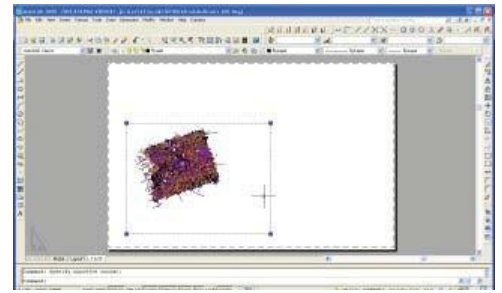
Create a layer called “mview” in the layer manager.

We want to create a new viewport.

View>Viewports>New Viewport
<(mv) for mview, (f) for fit, enter>

Fit automatically gives you the maximum fit for the sheet. You can adjust the rectangle afterwards too. If you want to be able to create non rectangular shape, choose (p) for polygonal and start drawing the box manually.

By double clicking inside of viewport, you can go into the model space and modify the objects in the model space. Double clicking outside of the viewport or clicking the tab on the bottom put you back into the paper space.



Exp 2: Drawing conventional signs of building materials

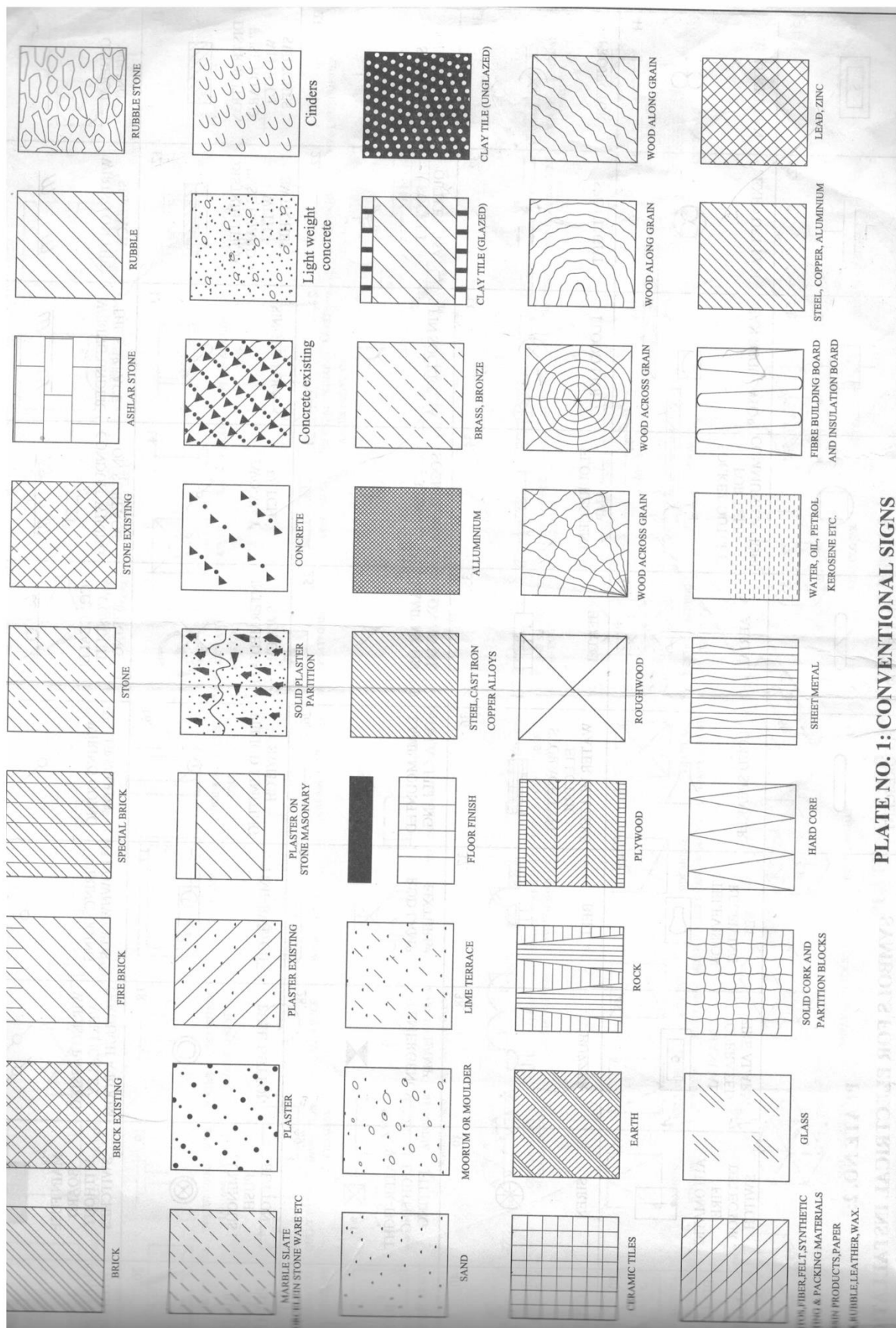
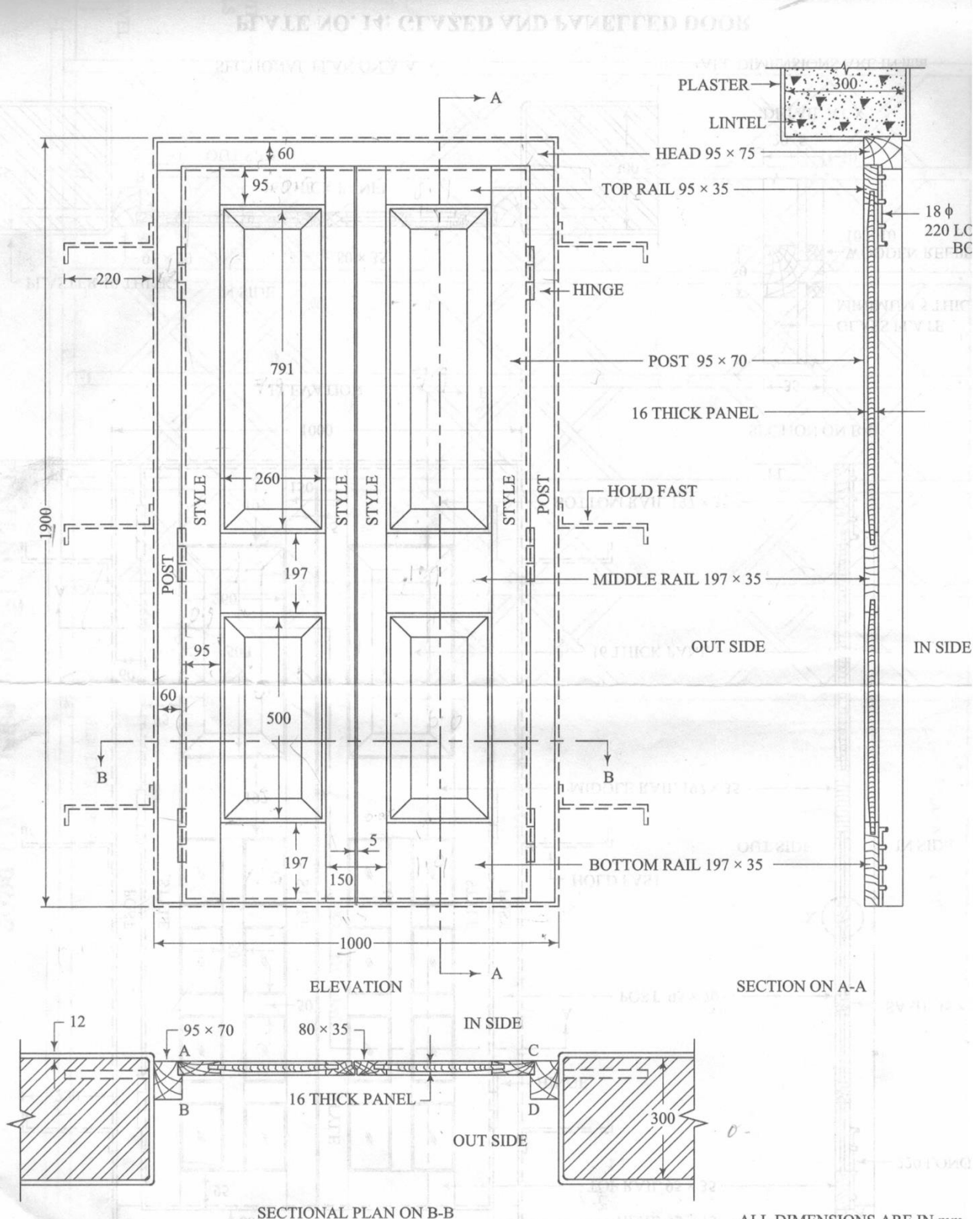


PLATE NO. 1: CONVENTIONAL SIGNS

PLATE NO. 3: CONVENTIONAL SYMBOLS

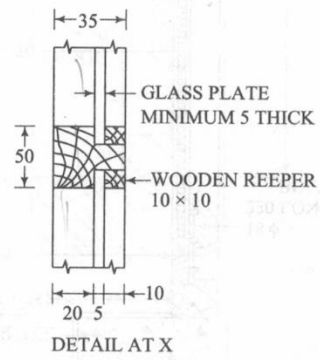
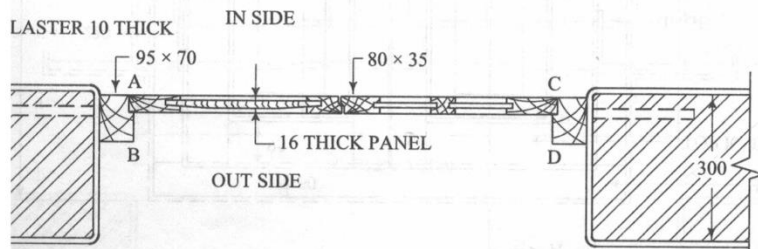
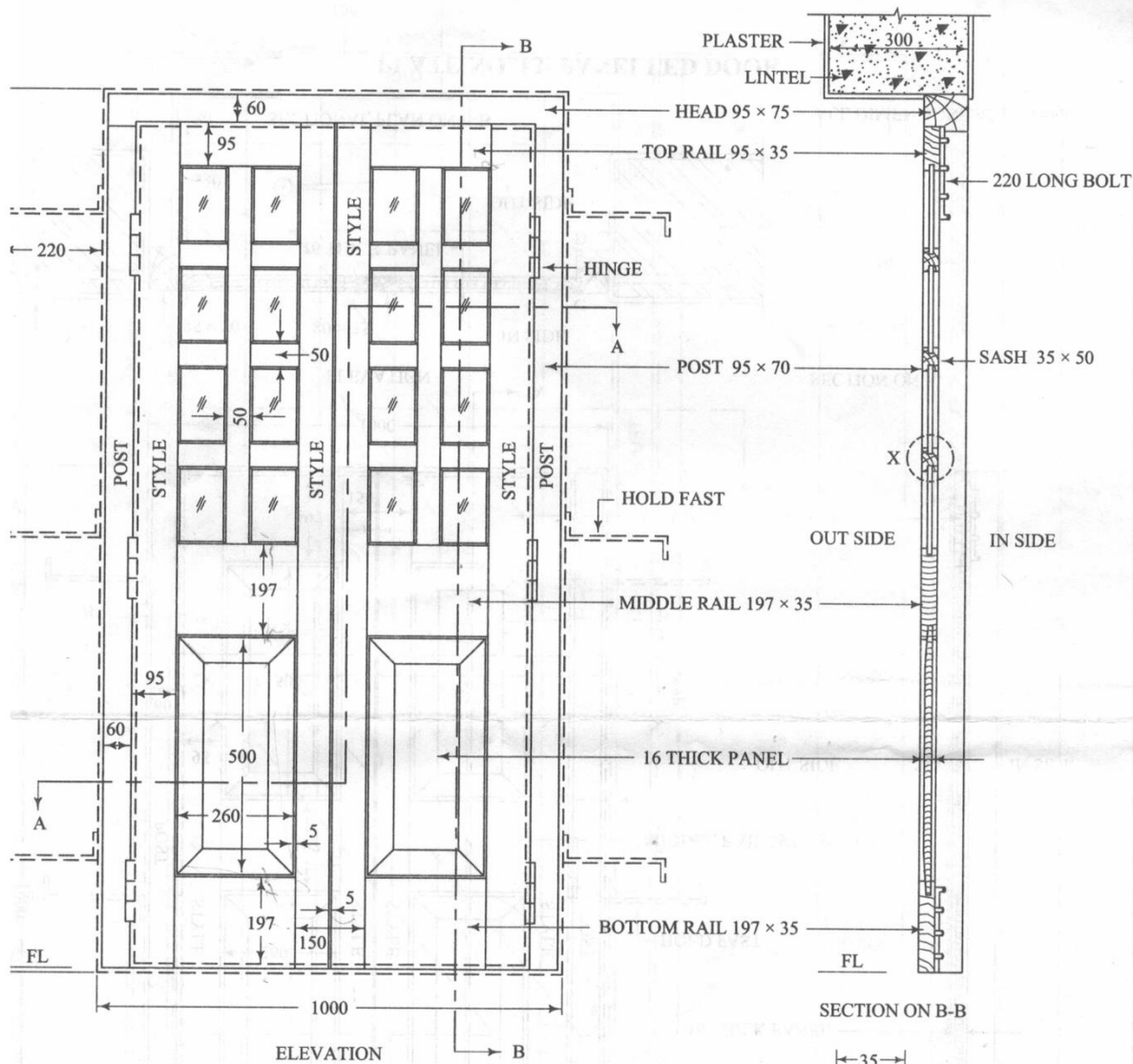
Exp 3: Drawing building components like doors, windows etc.

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ALL DIMENSIONS ARE IN mm

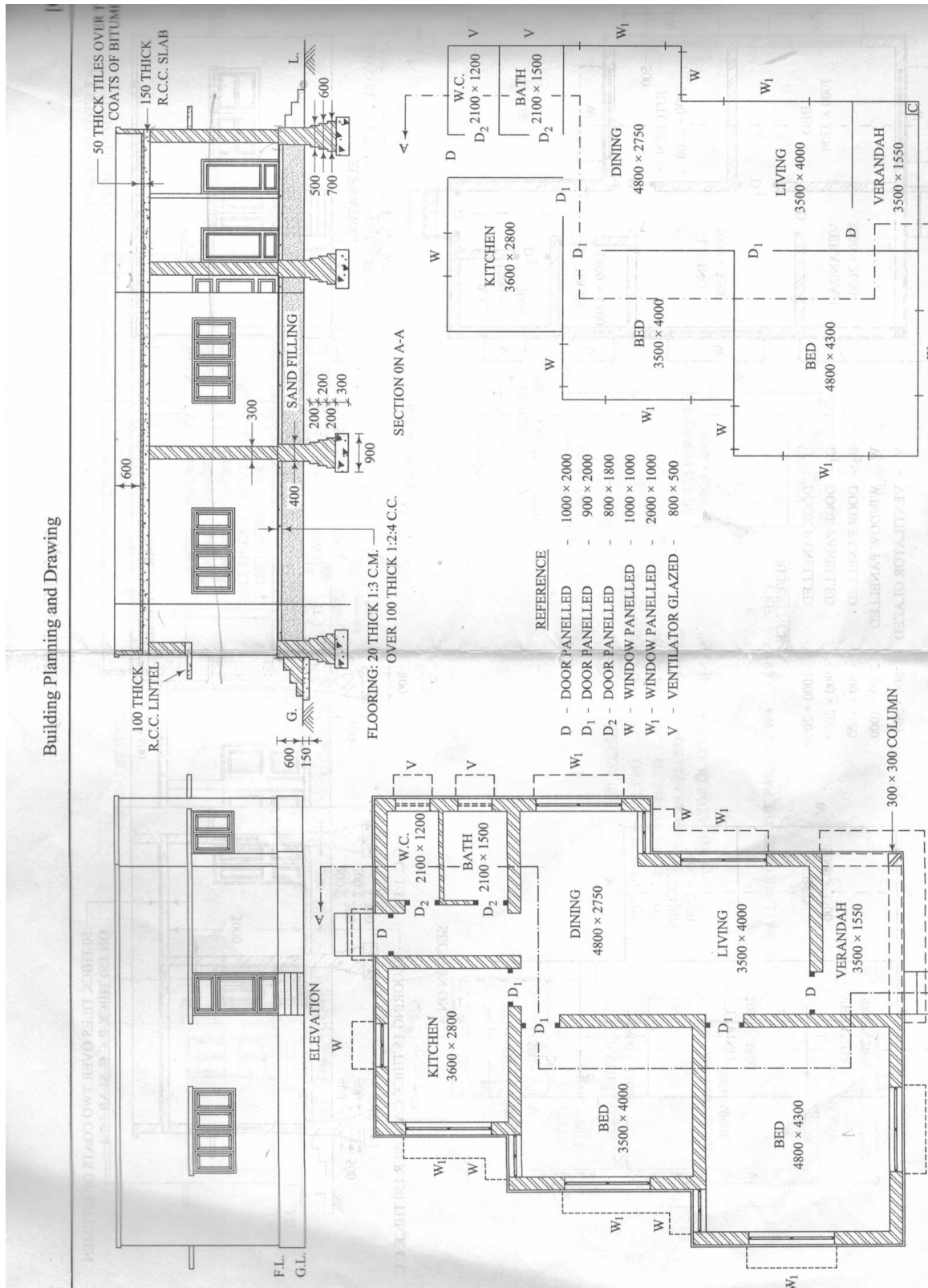
PLATE NO. 13: PANELLLED DOOR



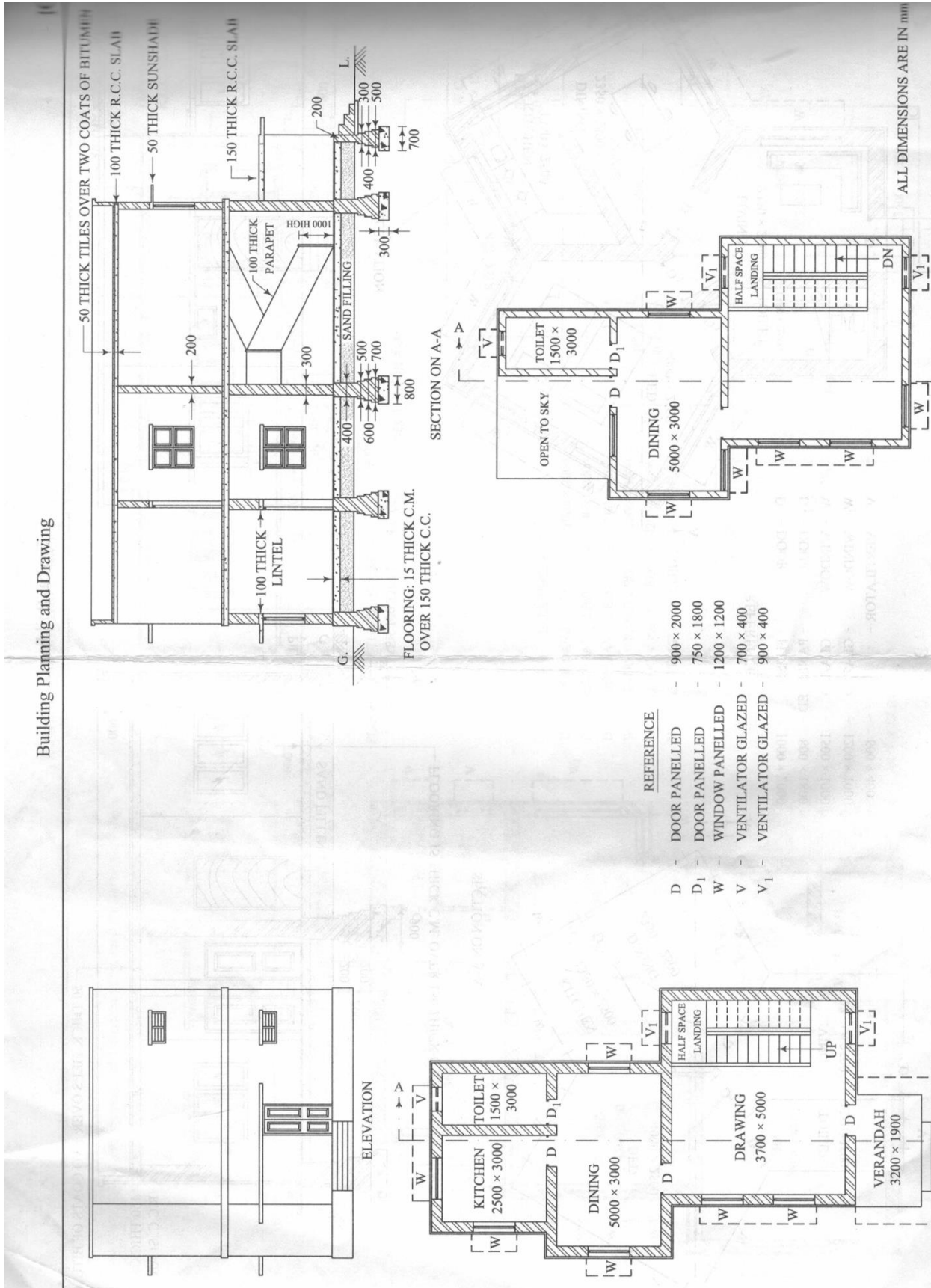
ALL DIMENSIONS ARE IN mm

PLATE NO. 14: GLAZED AND PANELLED DOOR

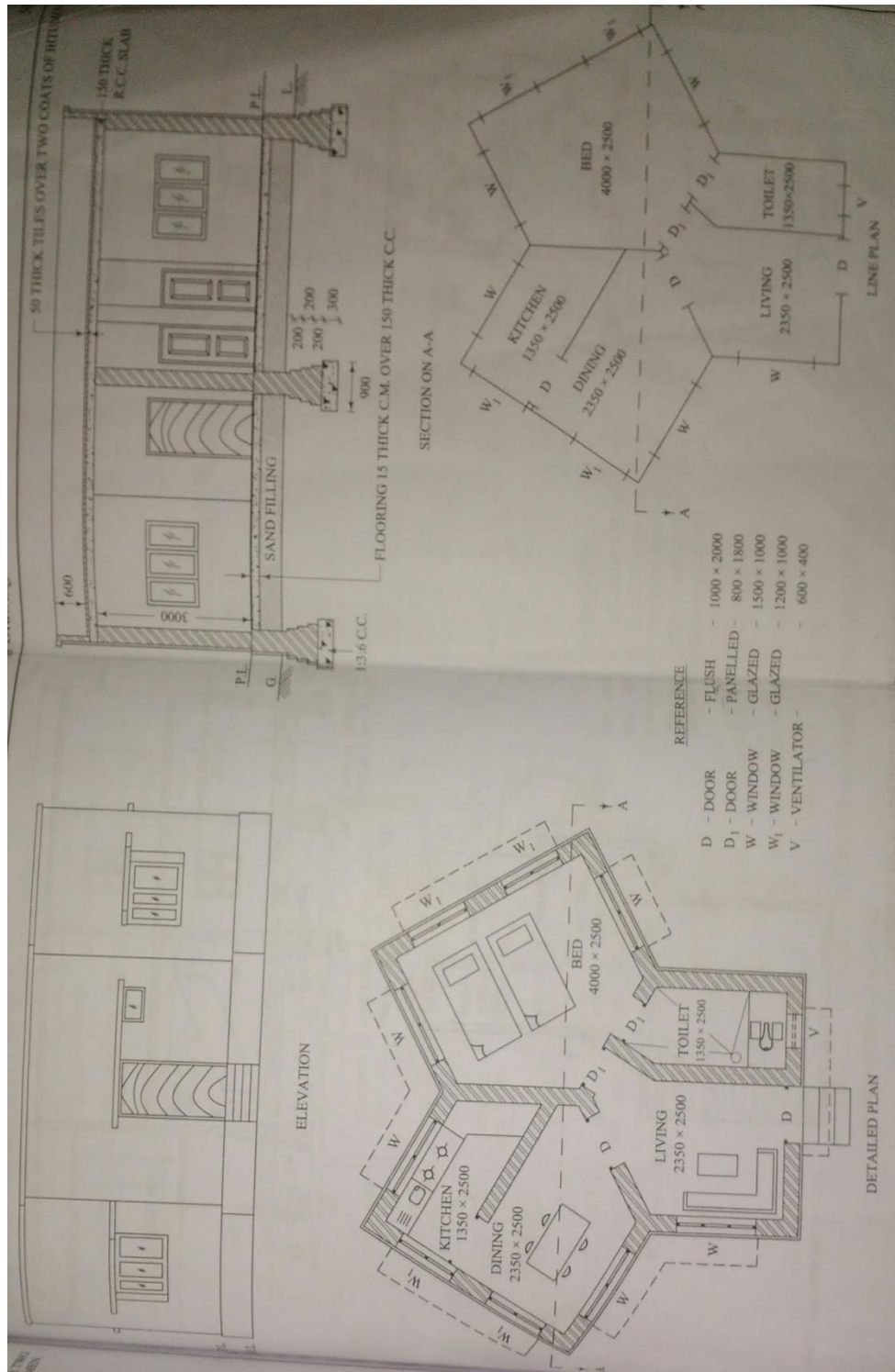
Exp 4 : Drawing plan, section and elevation for single storied buildings.



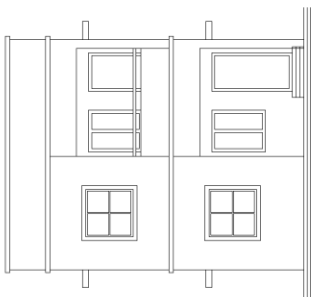
Exp 5: Drawing plan, section and elevation for a two storied buildings Display Commands.



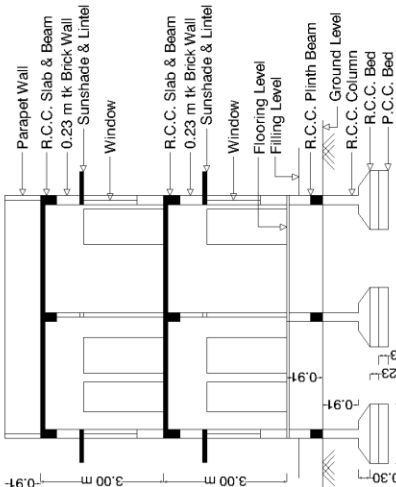
Exp 6: Drawing different layout diagrams using CAD software.



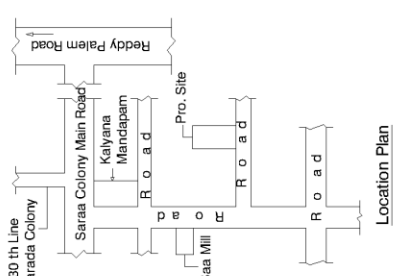
Exp 7: Drawing diagrams by using different layers in CAD software



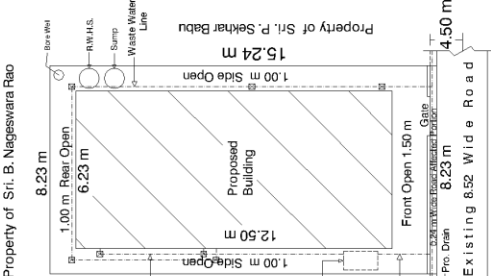
Front Elevation



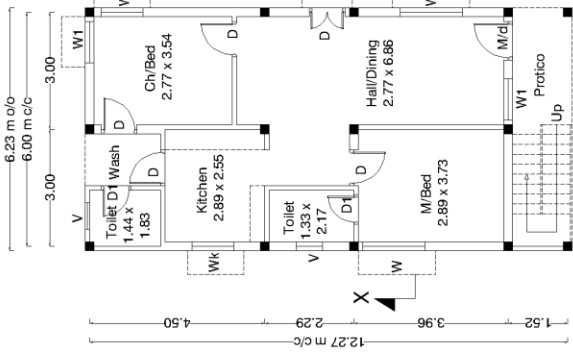
Section at "X-Y"



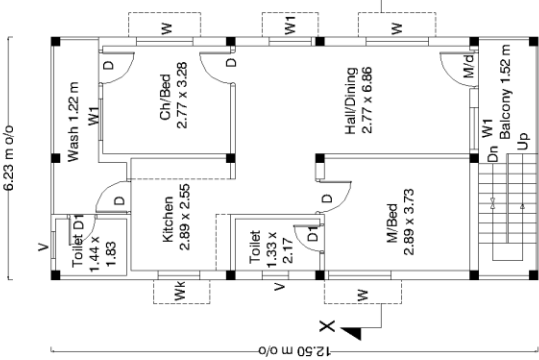
Location Plan
Not to Scale



Site Plan
Scale :- 1:200



Ground Floor Plan
Scale :- 1:100



First Floor Plan
Scale :- 1:100

Area :-
 Ground Floor Plinth Area = 77.87 Sq.mt
 First Floor Plinth Area = 77.87 *
 155.74 Sq.mt

Floor Space Index :-
 Total Site Area = 125.42 Sq.mt
 Road Affected Area = 1.98 Sq.mt
 Net Site Area = 123.44 *
 Total Covered Area = 77.87 *
 Open Site Area = 45.57 *

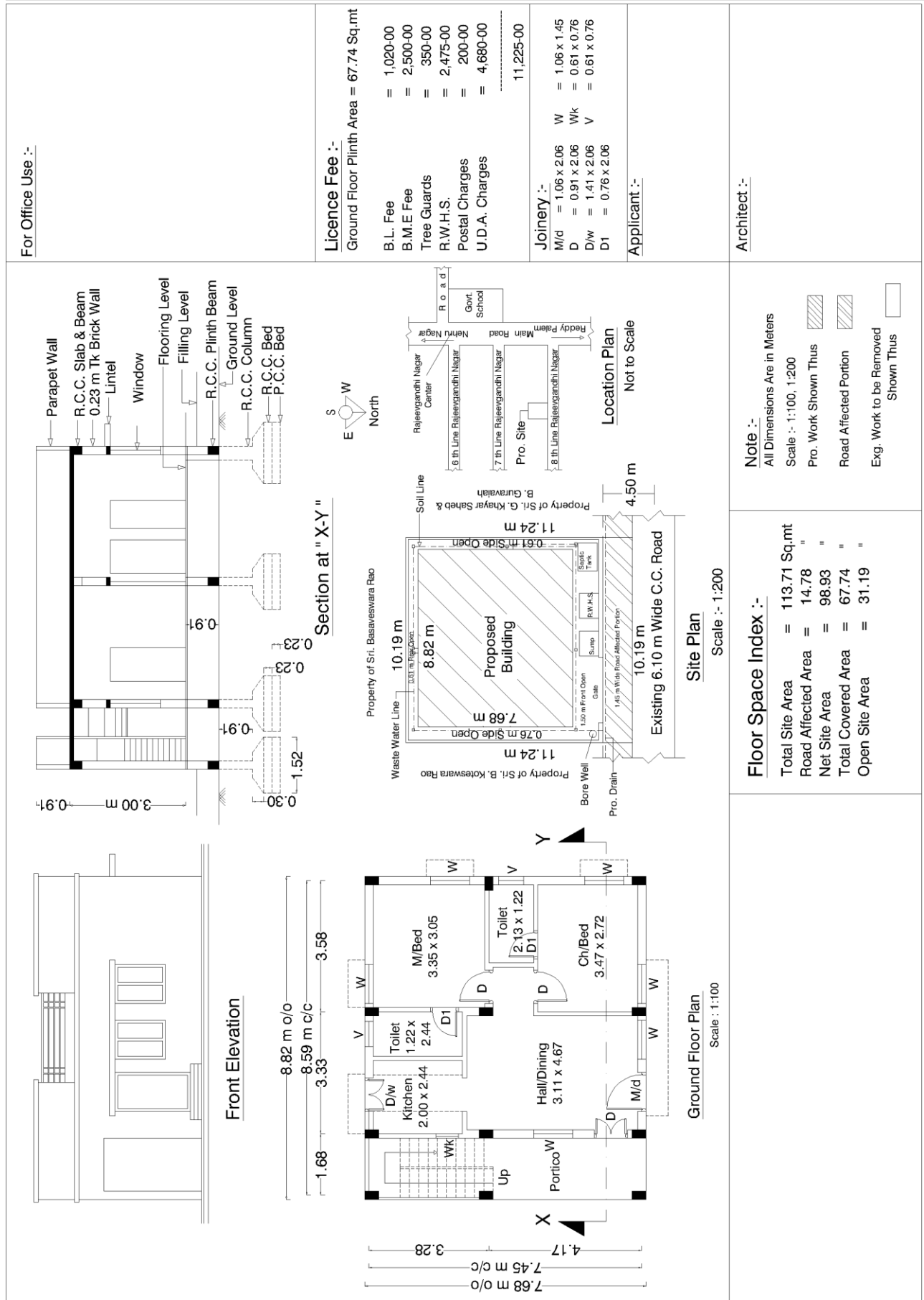
Note :-
 All Dimensions Are in Meters
 Scale :- 1:100, 1:200
 Pro. Work Shown Thus
 Pro. Road Affected Portion Shown Thus
 Exg. Work to be Removed Shown Thus

Applicant :-

Architect :-

Joinery :-
 M/d = 1.06 x 2.06
 D = 0.91 x 2.06
 D1 = 0.91 x 2.06
 W = 1.60 x 1.45
 W1 = 1.06 x 1.45
 Wk = 1.06 x 0.76
 V = 0.61 x 0.61

Exp 8: Drawing plan of single storied residential buildings



Exp 9: Drawing plans of commercial buildings.

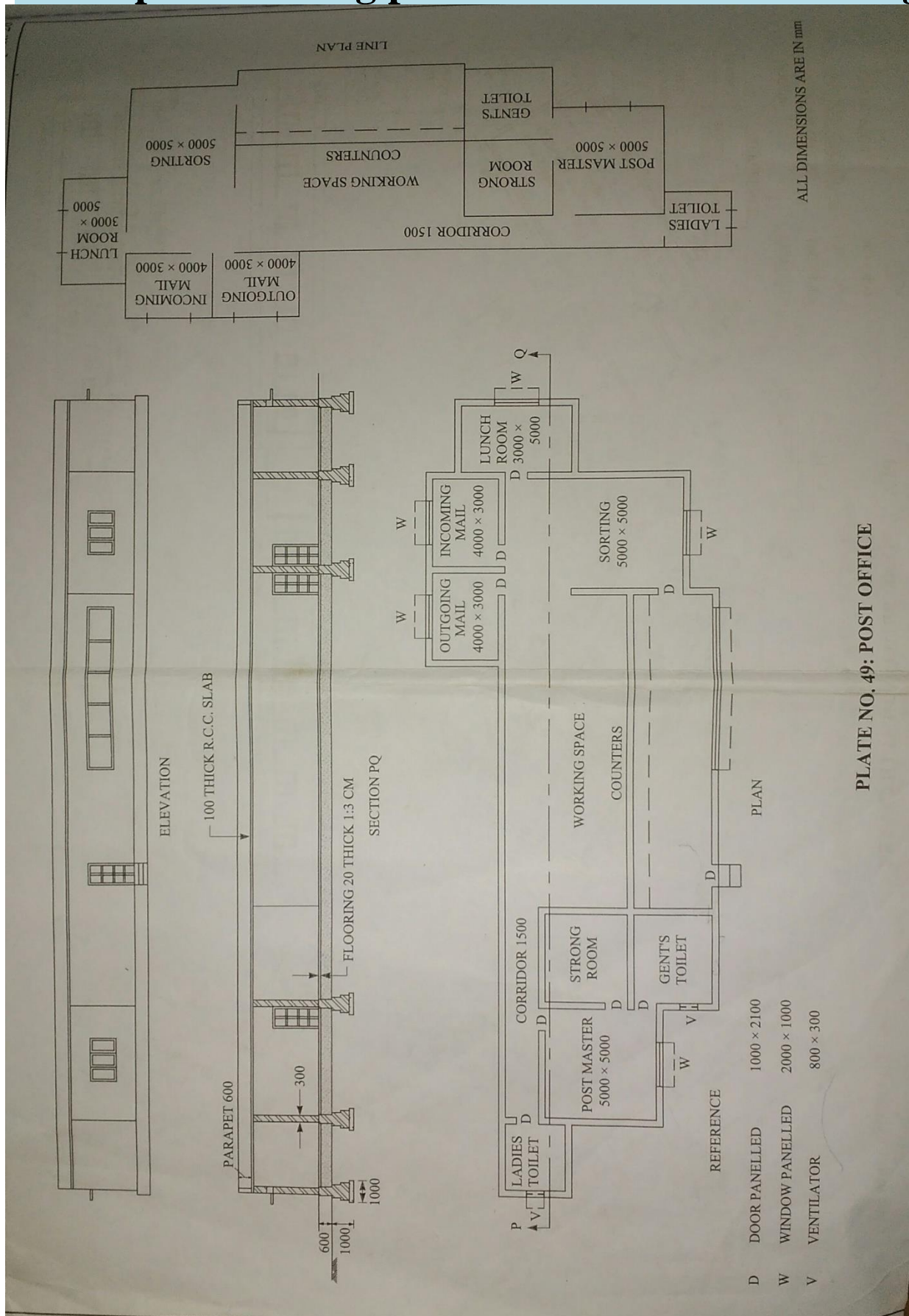


PLATE NO. 49: POST OFFICE

Exp 10: Drawing different aspects in 3D views

3D Modelling in AutoCAD - tutorial exercise

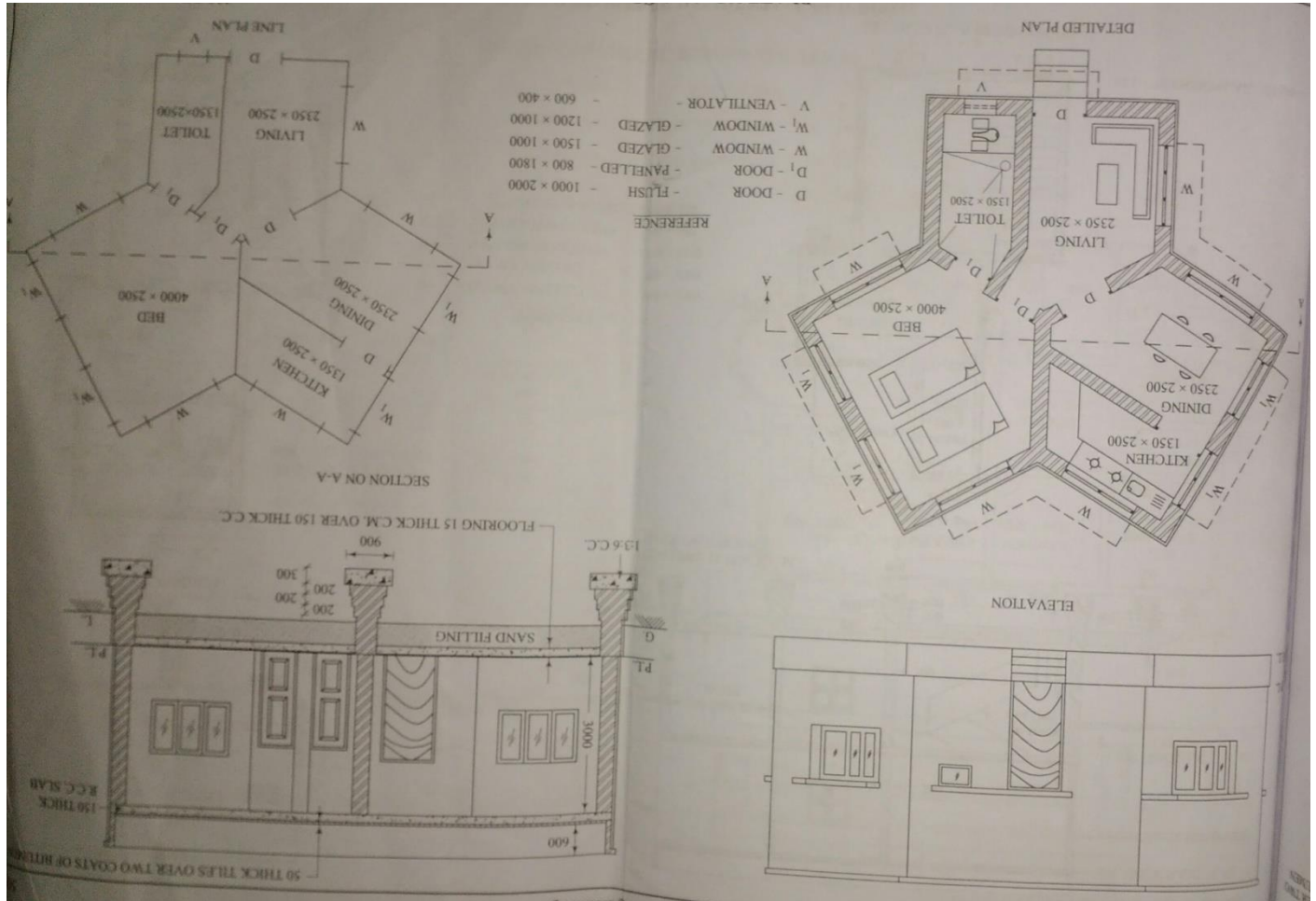
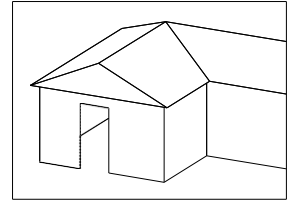
The screen

The graphics area

This is the part of the screen in which the drawing will be created.

The command prompt area

This area at the bottom of the scr



een gives you clues about your next action:-

Command:

means that AutoCAD is expecting a new command e.g. line, arc, erase

The status line

Located at the very bottom of the screen, indicating current information about your drawing. The function keys can toggle between the settings.

Screen Menu

This can be made to run down the right hand side of the screen, echoing the commands or options of commands chosen from the icons. It also provides the entire range of commands available. Highly recommended for beginners.

Object Snaps

An example of a parked toolbar. Snaps help you to find exact points on the drawing.

Properties Menu

All elements of the drawing have properties which may be edited at any time from this menu

The Keyboard

To Cancel Press ESCAPE

Escape will also remove the GRIPS (the blue squares which appear for simple editing)

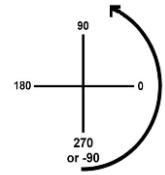
To Undo Press U followed by the Return (or Enter J) key or Space

The Enter key J is used to:

finish off commands (e.g. Line)

accept "selection sets" for Editing commands or <contents> in <>

repeat the last command



Function keys

F1 Help

F2 Text screen

F3 Object snap on and off

F7 Grid on and off

F8 Ortho on and off

F9 Snap to grid on and off

F10 Polar snaps on and off

F11 Object Snap tracking on and off

Measurement

Draw real sizes - scale will matter when putting your model onto paper. Think in metres or millimetres depending on what sort of object you are designing.

AutoCAD measures angles (and draws arcs) anticlockwise.

Step by Step Exercise

Setting up the drawing: Drawing Limits, Zoom All

How big is your site or object? Always consider the real sizes in metres (or mm or whatever) of the overall site, in plan, measuring width then height. (x,y dimensions). This house is small, we will be thinking in metres, so it should fit into an area of 15mx12m

Pick: Format, Drawing Limits

Accept the lower-left limit <0.0000, 0.0000> (Press Enter J) then type in 15,12J to define a new upper-right limit

Pick: View, Zoom, All *to stretch to the new limits*

this has provibeb you with a brawing area suitable to your project, but it will not stop you extenbing beyonb this area later

Check your status line. POLAR and OSNAP should be active



Pick: Line then a point near the lower left part of the screen

Move the mouse to the right birection

Type 6J

6 is the bistance in metres

4 J

4J

From the drop-down menus

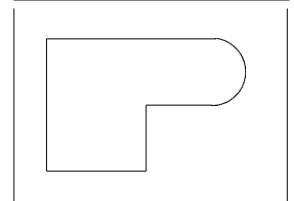
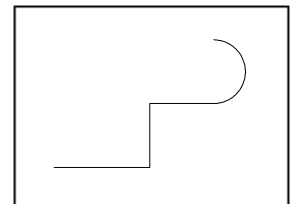
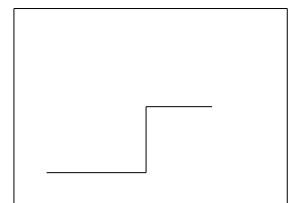
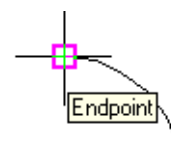
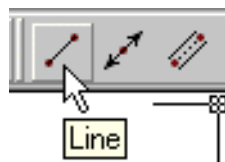
Pick: Draw, Arc, Start-End-Angle

Pick: point to the endpoint of the line to begin the arc.

Type @4<90 J (4 units straight up) Move the mouse until a full semicircle is displayed, then click again.

Pick: Line and snap to the Endpoint of the arc.

Complete the figure.

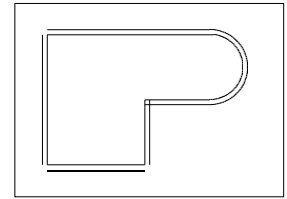


Offset the eaves)also useful for the leaves of a cavity wall)

Pick: Offset

Type .3 J

Point at a line, then point outside the figure. Repeat for each line and arc round the figure.



Fillet the corners

Pick: Fillet

Type: R J 0 J to set fillet to a sharp point ($R=radius$)

Pick: Fillet again

Point at two lines to make them meet neatly

Press Enter to repeat the Fillet command, and neaten the next pair. Repeat all round

Offset the Roof ridge

Pick: Offset

Type: 3.3 J

Point at the left, vertical line, then towards the right Pick: Offset

Type: 2.3 J

Point at top, horizontal line, then below it.

