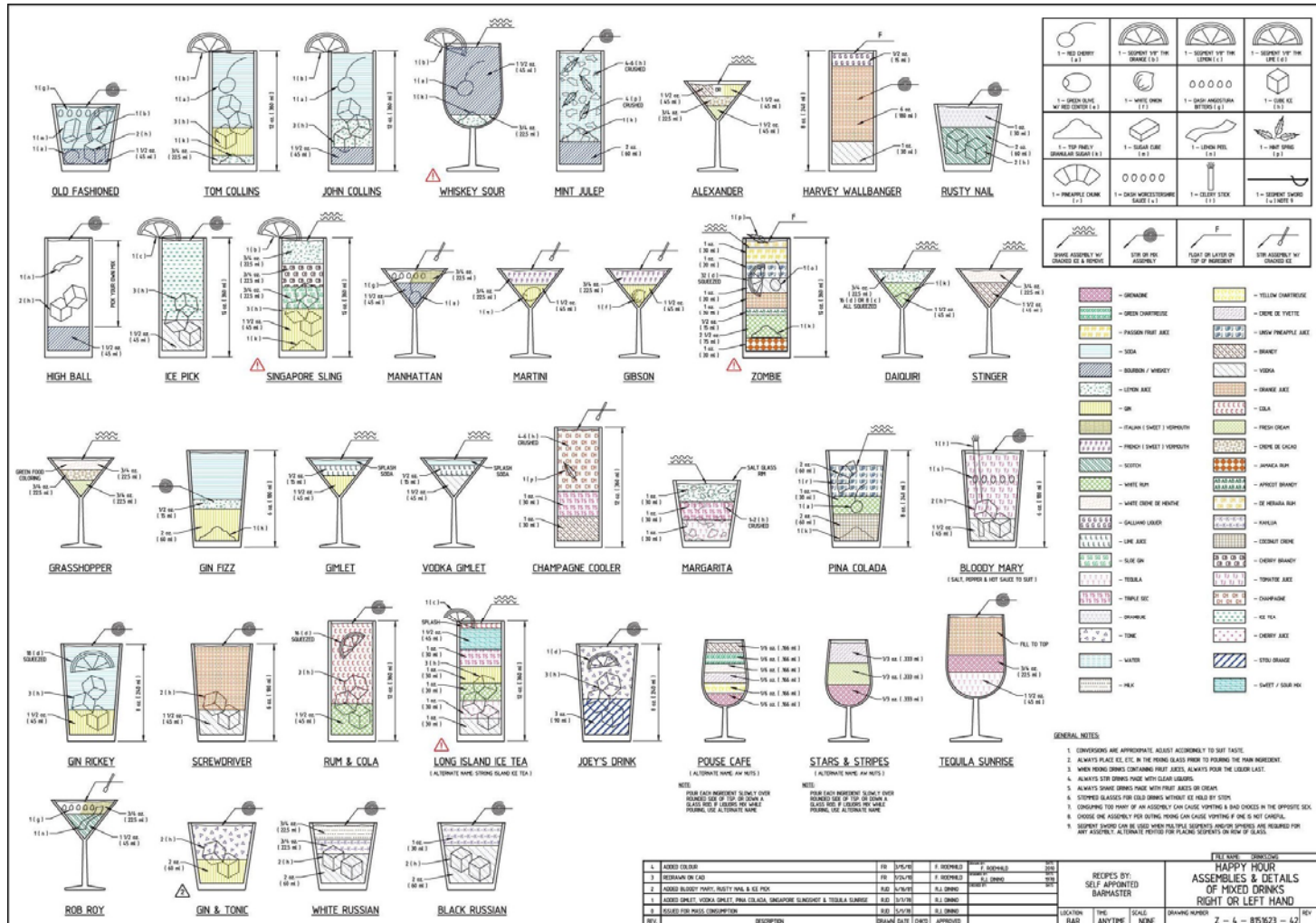


Session 7: Working with Digital Technologies & BIM



<http://www.arch2o.com/wp-content/uploads/2016/07/Architects-Guide-to-Drinks-Blueprint01.jpg>

Gavin M Traylor RIBA

Assessment 1

**Submission
deadline:**

9th December

Return date of provisional marks &
written feedback:

27th Jan 2020

There are two parts to be considered for the assessment and these are to be approached in the following way.

PART 1: 1000 word Essay (weighting 20%)

1000 word Essay:

Explain your understanding of drawing conventions and their importance as a form of communication within the construction industry.

Give three examples of technical drawings and explain an appropriate level of detail and scale for each.

The essay can incorporate the use of diagrams and figures to illustrate the text.

A list of references is required and all referencing is to be clearly indicated throughout the essay.

Assessment 1

**Submission
deadline:**

9th December

Return date of provisional marks &
written feedback:

27th Jan 2020

PART 2 Drawings, A1 Digital Submission: (weighting 80%)

Scenario:

The university is collating presentation posters of 20th Century Architecture and you have been asked to prepare a synopsis of a selected piece of work.

From the dimensioned sketch drawings provided, you shall prepare the following drawings to represent the building.

- General Arrangement Plan, Elevation and Section.
- Detailed Section (1:10)

Drawings must include text (250 words) describing the building that includes: the date of construction, the designer, the construction method and importance in the history of 20thC design. This should also include and an image of the building.

Drawings must be appropriately scaled at A1 size and presented in the uwtsd titleblock format, and should follow industry standard drawing conventions and layering techniques.

Digital Submission required in both 'DWG' and 'PDF' format.

Assessment 1

**Submission
deadline:**

9th December

Return date of provisional marks &
written feedback:

27th Jan 2020

List of Buildings and Numbers

1. Glass Pavilion, Bruno Taut
2. Schroder House, Gerrit Rietveld
3. Tugendhat House, Mies Van Der Rohe
4. Villa Savoye, Le Corbusier
5. Muller House, Adolf Loos
6. Casa Del Fascio, Terrangi
7. Falling Water, Frank Lloyd Wright
8. Villa Mairea, Alvar Aalto
9. Guggenheim Museum, Frank Lloyd Wright
10. Hallen Housing Estate, Atelier 5
11. Maison Jaoul, Le Corbusier
12. Tjibaou Centre, Piano
13. Milam Residence, Rudolph
14. Vanna Venturi House, Robert Venturi

15. Dulles Airport, Saarinen
16. Kimball Art Museum Louis Kahn
17. Can Lis, Utzon
18. House VII, Eisenman
19. Gehry House, Frank Gehry
20. Koshino House, Tadao Ando
21. Ball Eastaway House & Studio, Murcutt
22. Graves House, Michael Graves
23. Jacobs House, Frank Lloyd Wright
24. Barnes House, Patkau
25. Saynatsalo Town Hall, Alvar Alto
26. Lever House, Bunshaft
27. Bordeaux Villa, Rem Koolhaas
28. Eames House, Charles Eames

Partially Dimensioned PDFs provided on Moodle

PREVIOUSLY . . .

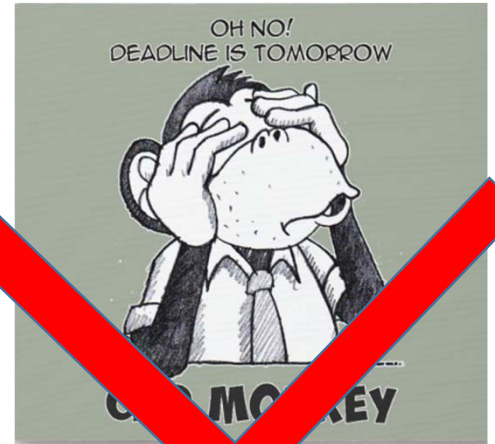


What is it all about?

Aim: To provide learners with the skills needed to produce two and three-dimensional drawings using industry-standard computer-aided design (CAD) software and to provide learners with an understanding of the information delivery cycle in Building Information Modelling (BIM).

Learning Outcomes

- Interpret data and produce 2D drawings using industry-standard CAD software applications.
- Produce 3D models using industry-standard CAD Software applications
- Evaluate different sources of information so as to prepare Building Information Models using industry standard software.



NO CAD MONKEYS NO BIM ROBOTS

What am I expected to do?

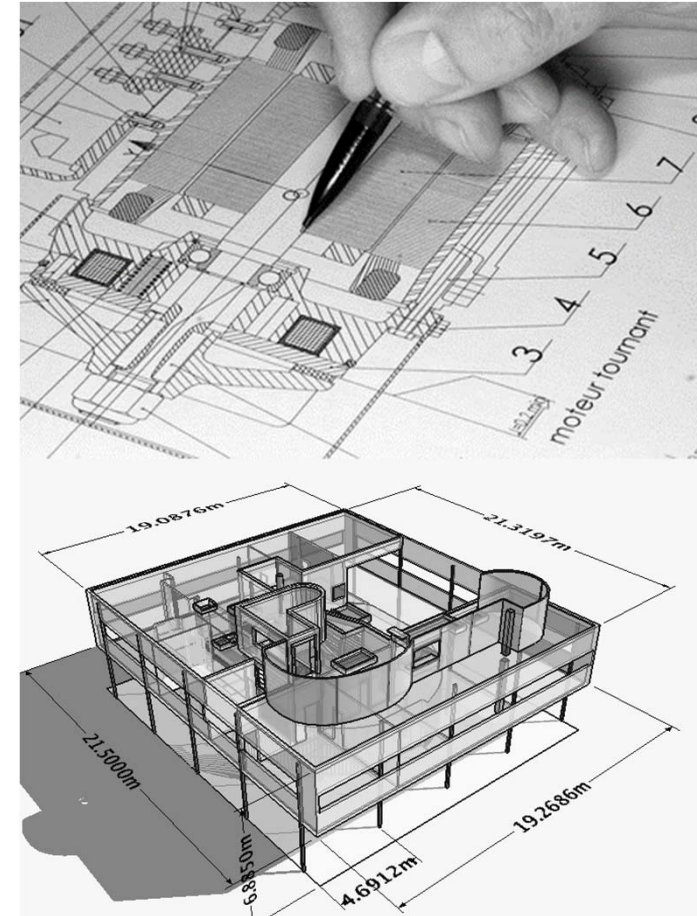
Predominately practical activities supplemented with lecture guidance over two semesters

General Overview (Me)

- Communication through draughting techniques
- Fundamentals of BIM
- 2D draughting
- 3D modelling

General Overview (You)

- You need to know how to use the Library and Online resources
- You need to attend all timetabled activities
- You need to manage your time and meet deadlines
- Ask Gavin if you have any problems regarding the module



Supplementary Reading List.

Drawing:

Francis Ching (2015) *Architectural Graphics*

Chudley, Greeno, Merritt (2016) *Building Construction Handbook*

Reid, E (2016) *Understanding Buildings*

2D CAD:

Guide to AutoCAD (moodle)

AutoCAD for Dummies

<https://academy.autodesk.com/>

3D Modelling:

Guide to Revit (moodle)

<https://academy.autodesk.com/>

Revit Tutorials - Youtube.

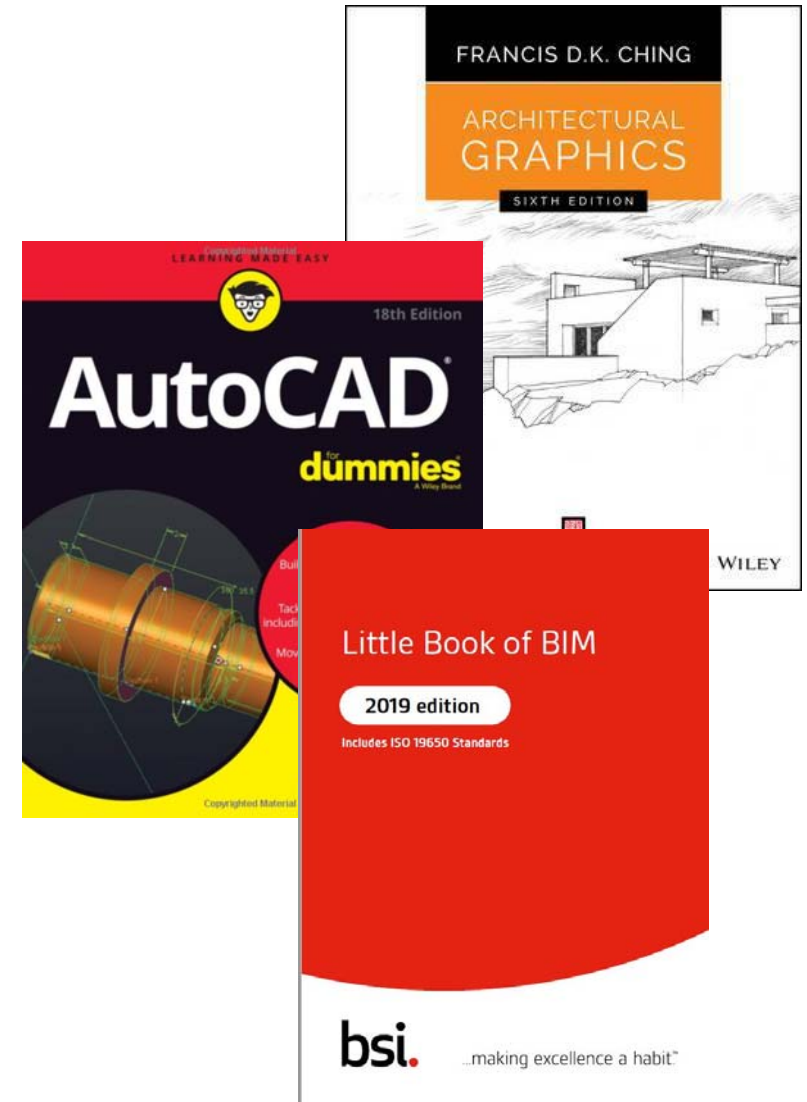
BIM:

Key BIM Standards, ISO and PAS – refer to 'Little Book of BIM' guide.

BSi (2019) *The Little Book of BIM*

BSi (2019) *Introduction to the New International Standard ISO 19650*

<https://bimblog.house/> Dan Rossiter (BSi)



Cave Paintings Argentina



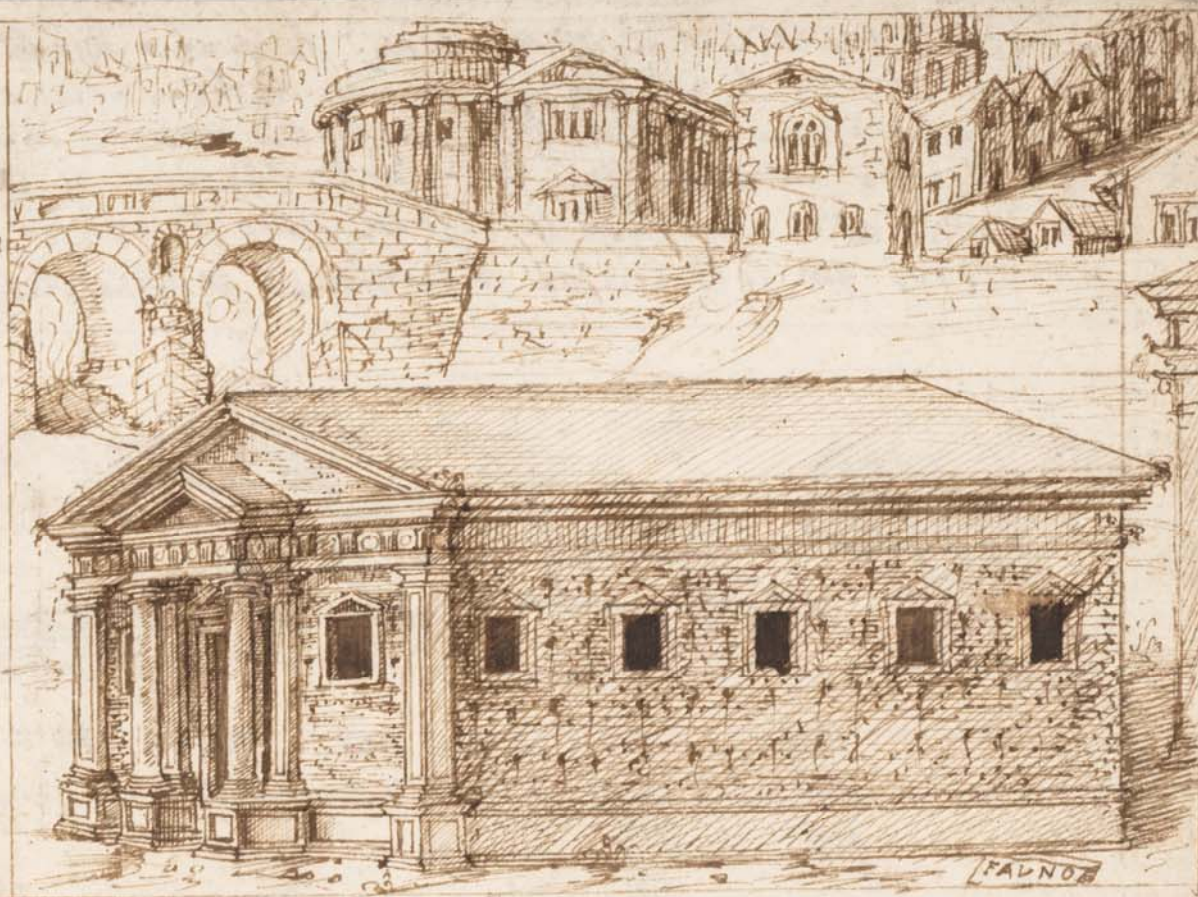
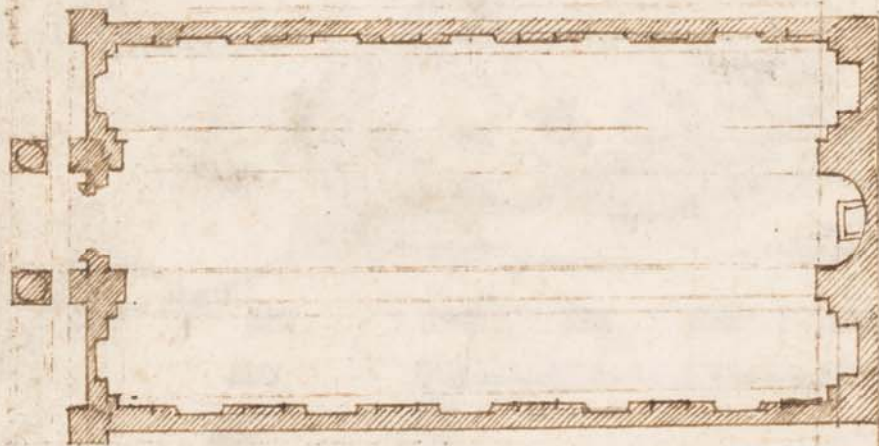
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Cave Paintings France



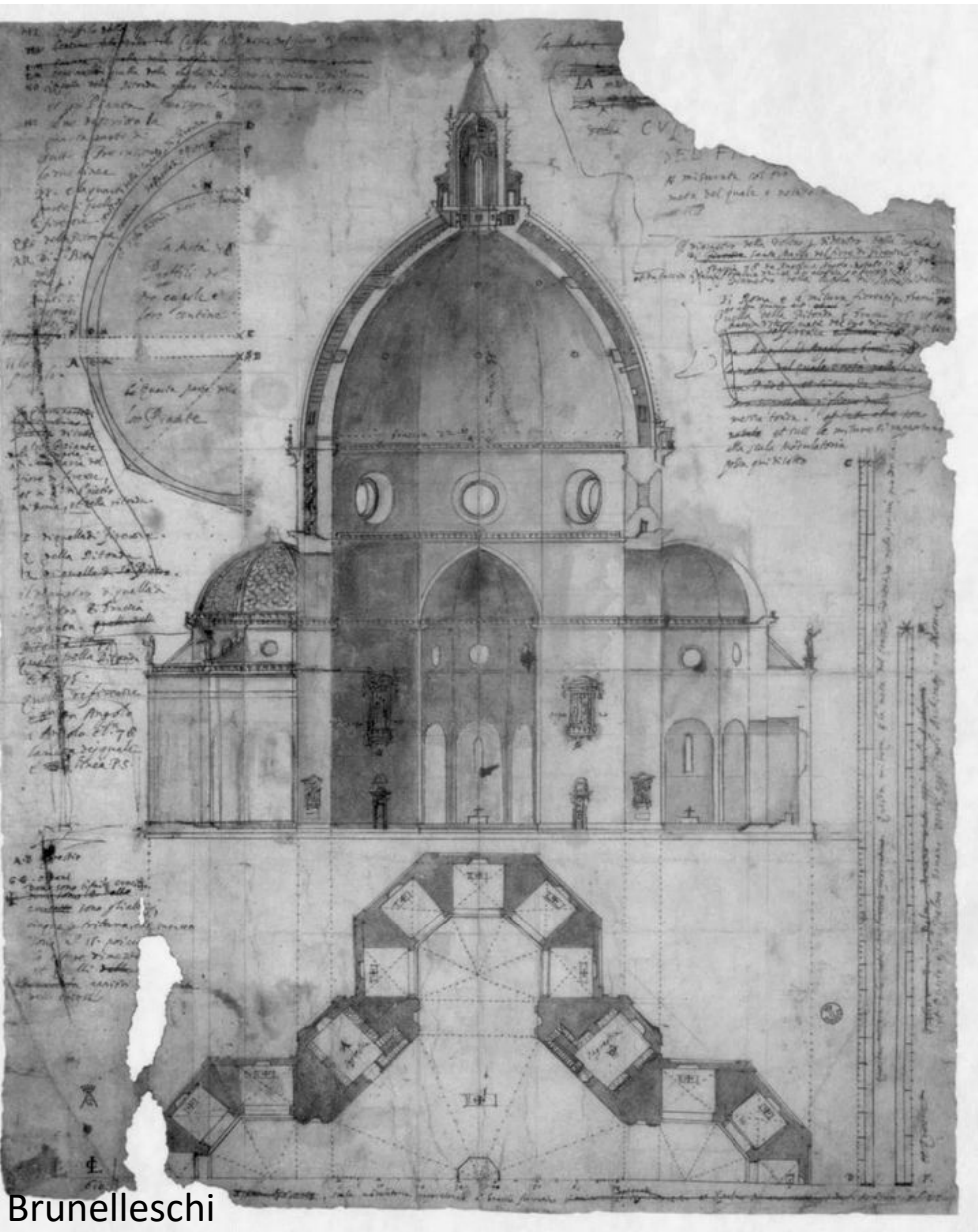
http://www.thalo.com/thumbnail/021913_58fc91b0-1528719715-5123c61c-fd3c-d91d32e8/o.jpg

La Antisima quando ha uera nella fronte le An-
te oltro facciate della mura le quali hanno
inorno la cella: e tra le Ante del mezzo so-
no due Coloni e sopra la porta al mezzo gli
quella Simulacra e misura: la quale qui sotto
si uede la pianta e nel profilo. E lo esem-
plo di questo Tempio era abbi tri for-
ma da tre parti la quale e uicina alla porta
Coloni romi



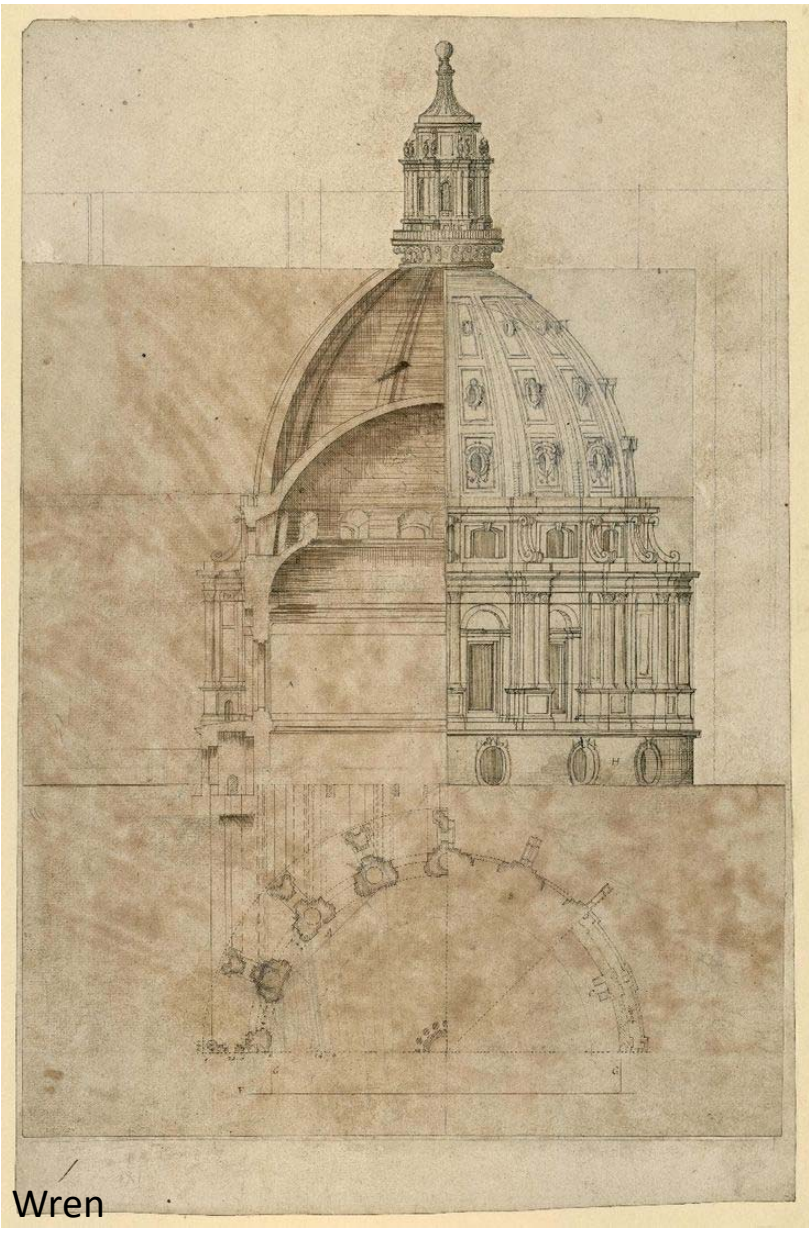
Prosopio: cio e contra colonna ha ogni cosa e nomi in Antisima ma la Coloni contra le due ante an-
te. E di sopra li i pilastri siccome ancora in Antisima c'ha scuma dalla destra e dalla sinistra
ma li angolari uisibili cio e negli angoli della fronte. Lo esemplare di questo e nel solo T. vi-
no nel Tempio di Giove e di Fauno. Siccome qui sotto si uede la pianta e il pro-
filo alla pagina di detti Tempi.

FALNO



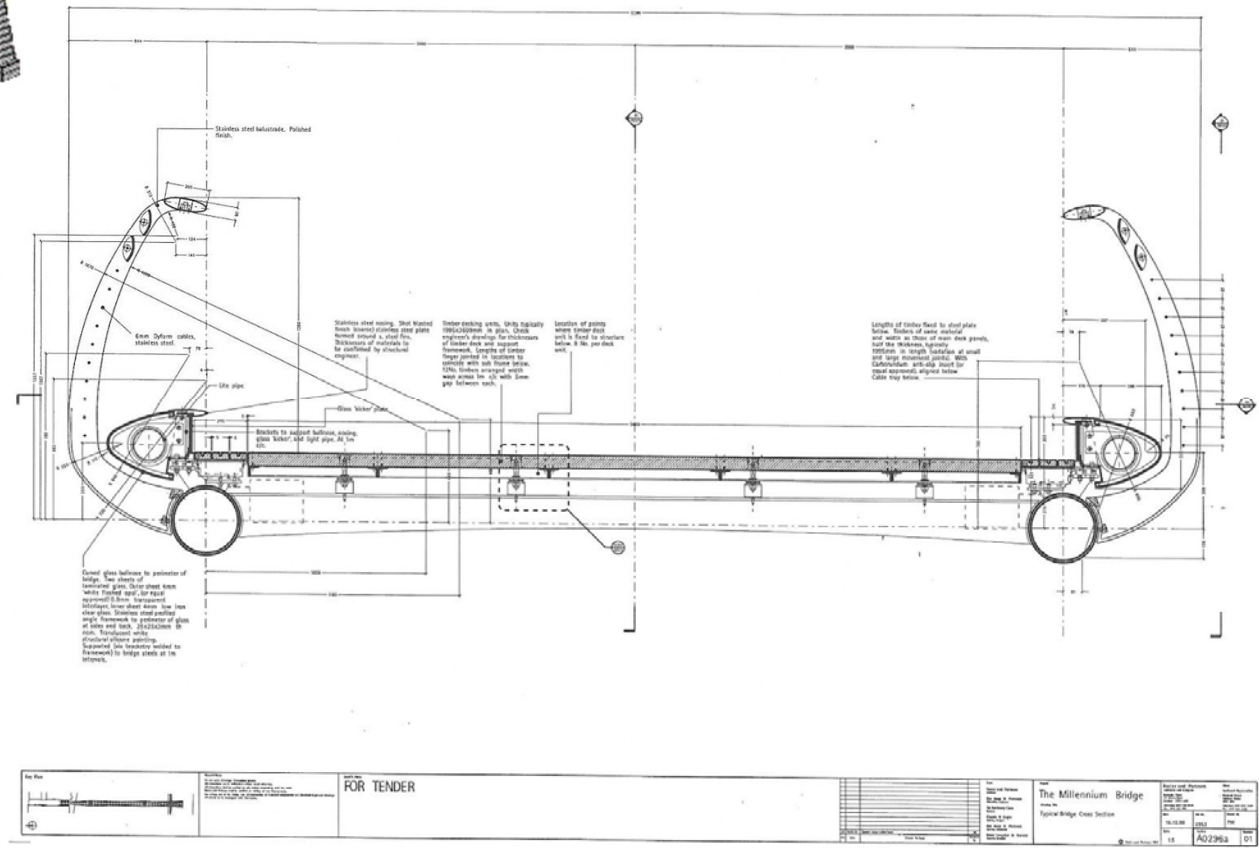
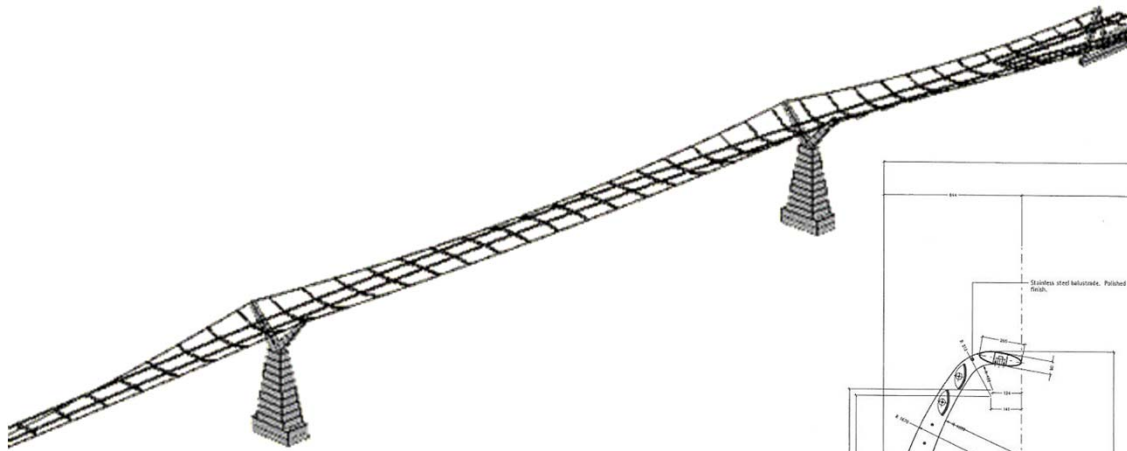
Brunelleschi

<https://i.pinimg.com/736x/01/8c/3c/018c3cd63084fa038882c6d9659dfff3.jpg>



Wren

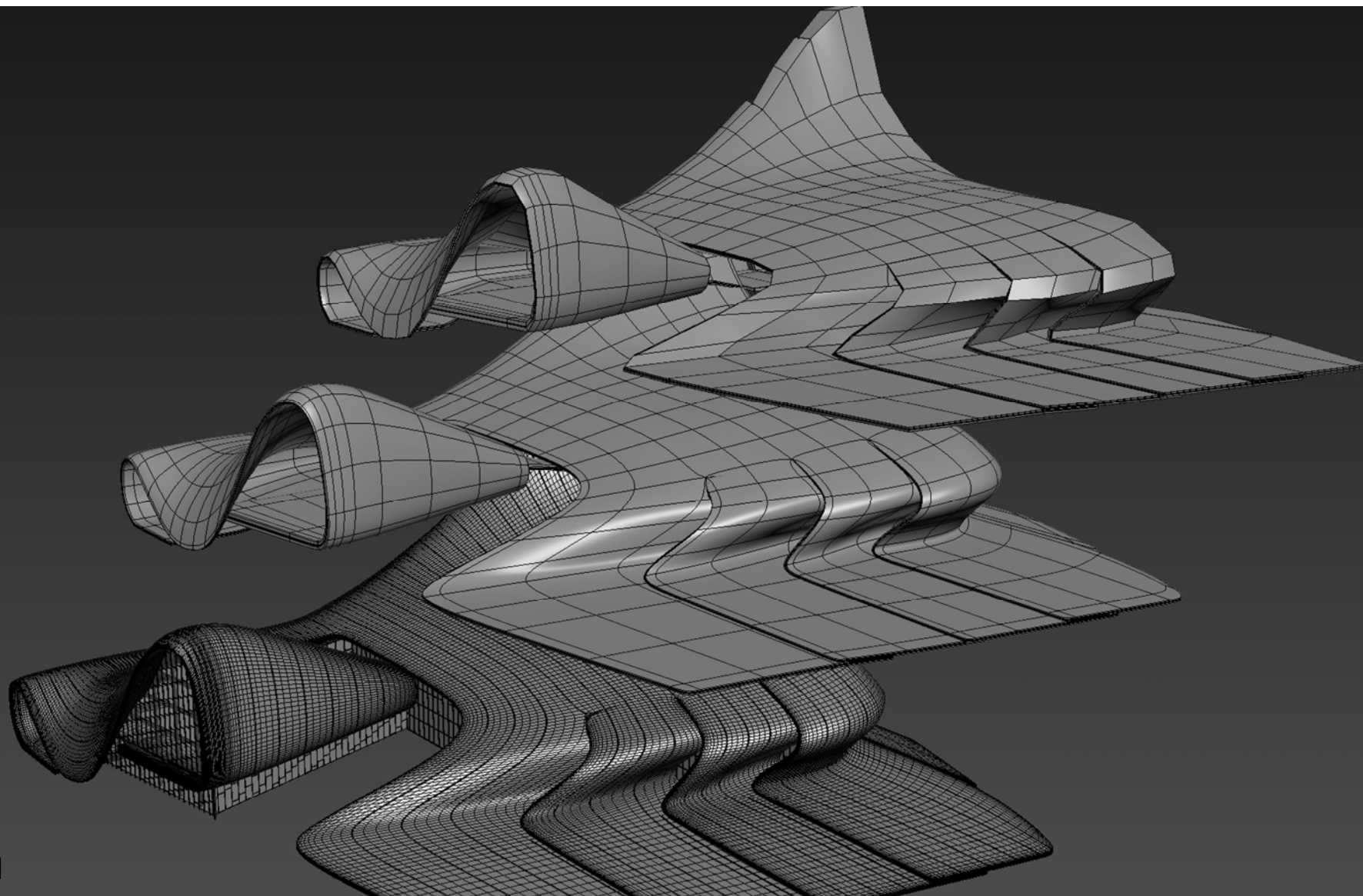
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Arup & Foster

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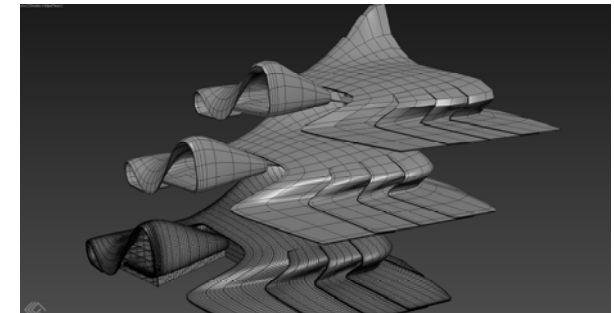
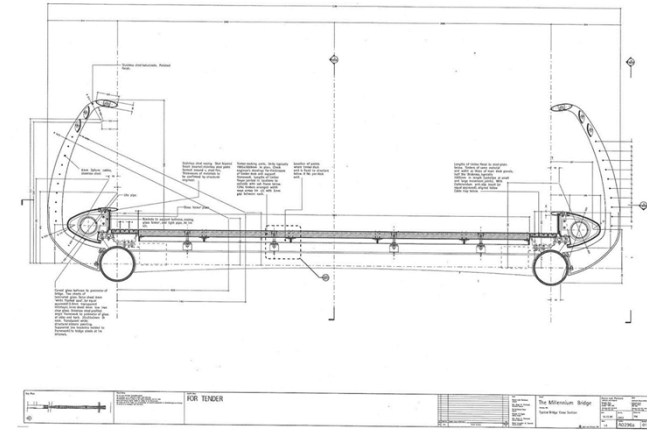
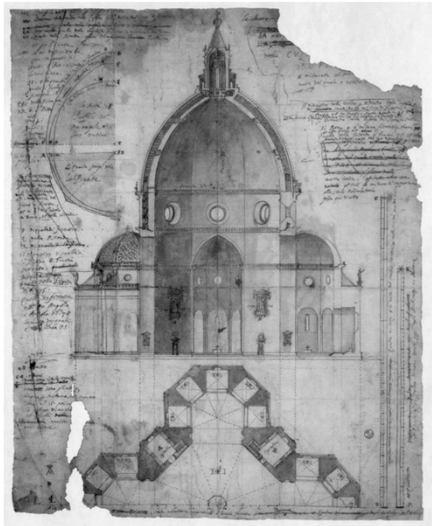
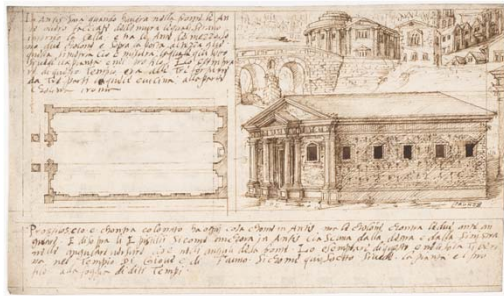
Active] [Shaded + Edged Faces]

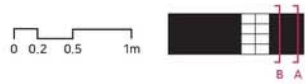


Zaha Hadid

https://evermotion.org/files/publications_images/nr_00414_9.jpg

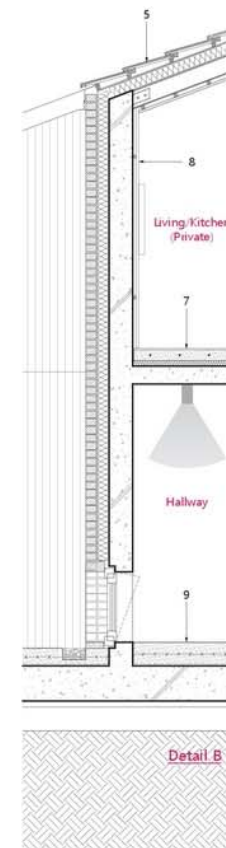
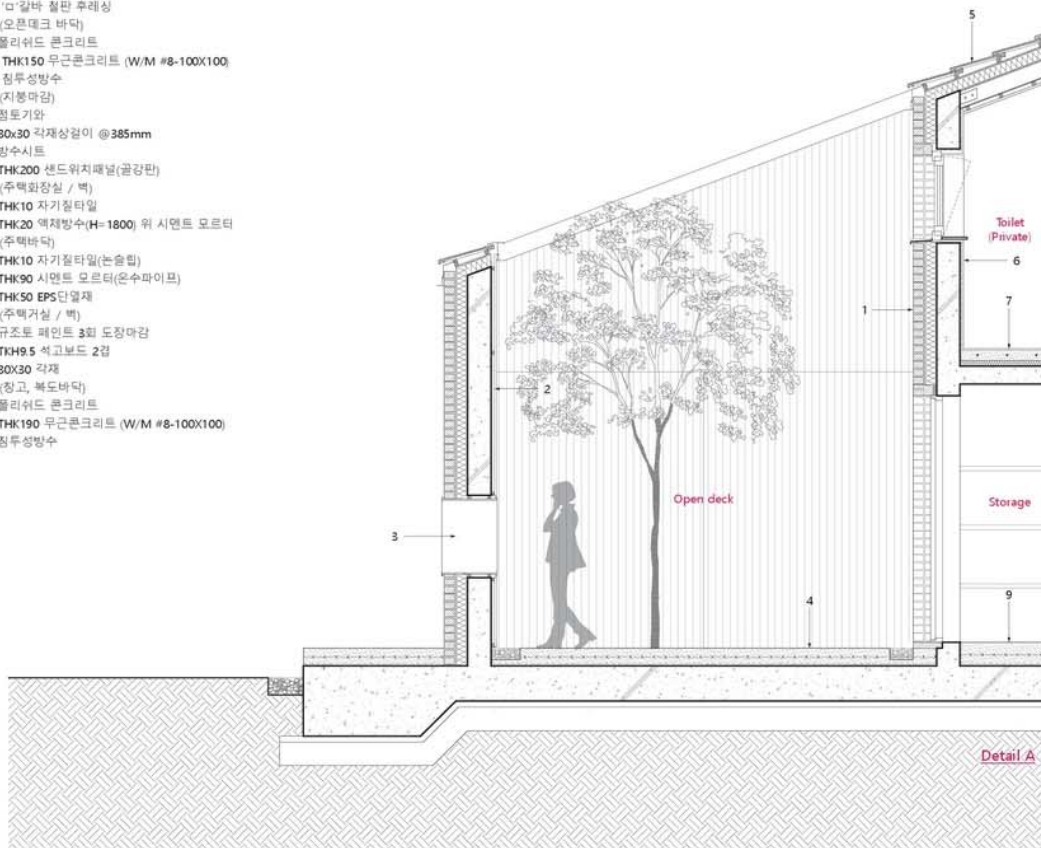
A picture is worth a thousand words





detail A_B

- 1 (외장재)
57X90X230 전벽돌 0.58받기
THK120 단열재
- 2 (오픈데크_벽)
별바우목재 마감
THK9.5 합판 1겹
30X30 각파이프 @600
- 3 (막창마감)
물소도창
'모'갈바 철판 후레싱
- 4 (오픈데크 바닥)
폴리워드 콘크리트
THK150 무근콘크리트 (W/M #8-100X100)
점투성방수
- 5 (지붕마감)
점토기와
30x30 각재상철이 @385mm
방수시트
THK200 샌드위치패널(골강판)
- 6 (주벽화장실 / 벽)
THK10 자기질타일
THK20 액체방수(H=1800) 위 시멘트 모르타
- 7 (주벽바닥)
THK10 자기질타일(눈솔림)
THK90 시멘트 모르타(운수파이프)
THK50 EPS단열재
- 8 (주벽거실 / 벽)
규조토 페인트 3회 도장마감
THK9.5 석고보드 2겹
30X30 각재
- 9 (창고, 복도바닥)
폴리워드 콘크리트
THK190 무근콘크리트 (W/M #8-100X100)
점투성방수



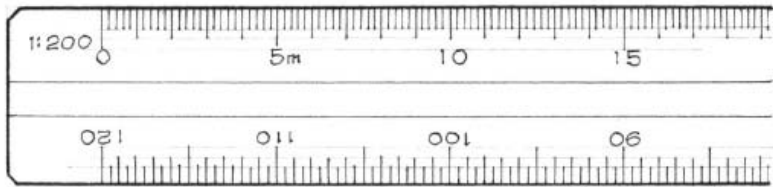
Drawings prepared in the Construction Industry

Must:

- Convey a message
- Read with understanding
- Demonstrate Knowledge
- Convey Ideas
- Explain a Narrative / Story

Industry conventions assist in the legibility of drawn information.

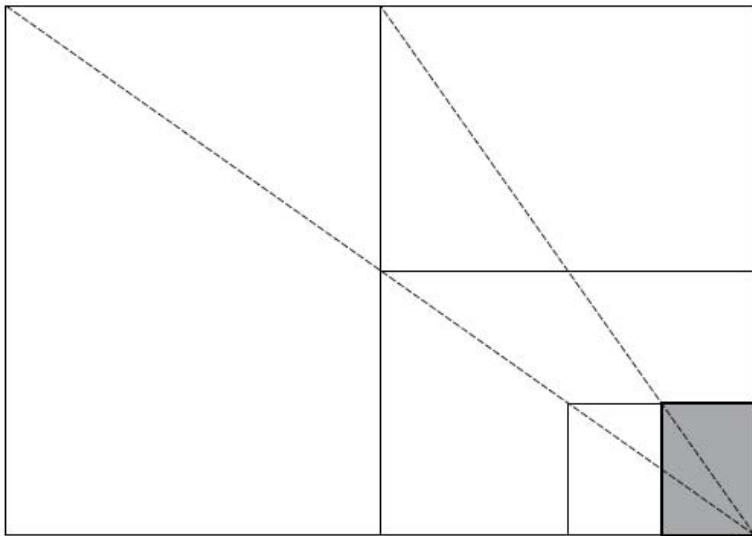
Appropriate Scale Drawings



Metric Scales

Metric scales consist of one or more sets of graduated and numbered spaces, each set establishing a proportion of one millimeter to a specified number of millimeters.

- Common metric scales include the following: 1:5, 1:50, 1:500, 1:10, 1:100, 1:1000, 1:20, and 1:200.



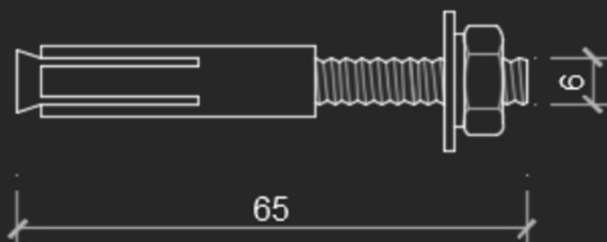
Digital Scale

In traditional drawing, we think in real-world units and use scale to reduce the drawing to a manageable size. In digital drawing, we actually input information in real-world units, but we should be careful to distinguish between the size of the image viewed on a monitor, which can be reduced and enlarged independent of its real-world size, and the scale of the output from a printer or plotter.

When hand drawing, scales are prescribed to the appropriate scale for the drawing.

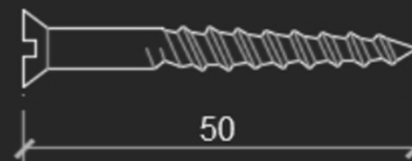
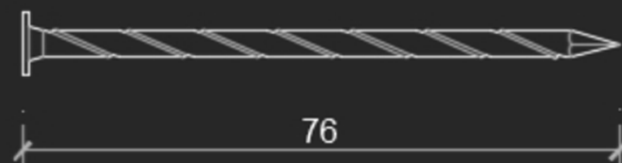
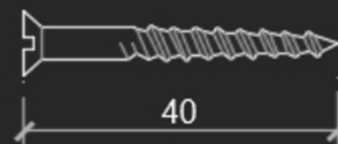
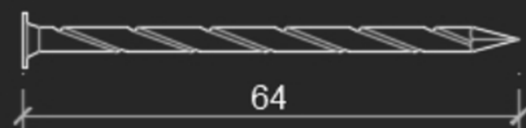
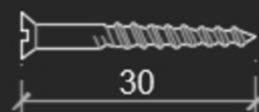
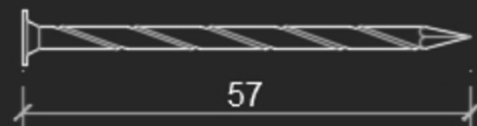
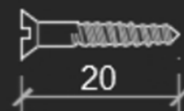
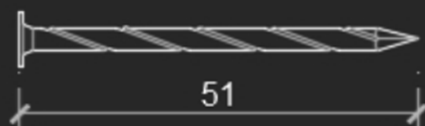
Eg. 1:1250 site plan for a Planning Application

When digitally drawing, software packages allow the designers to prepare information at 1:1 scale - real life dimensions. However, you should always consider the appropriate output scale each time you draw. **WHY?**



CADSsample.Com

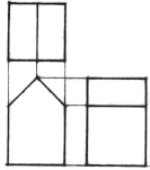
CADS - Electronic-Electrical-Arduino



Conventions

Projection Systems

Orthographic Projection



When we study how each projection system represents the same subject, we can see how different pictorial effects result. We categorize these pictorial systems into multiview drawings, parallel drawings, and perspective drawings.

Pictorial Systems

Multiview Drawings

- Multiview drawings consist of plans, sections, and elevations.
- The principal face in each view is oriented parallel to the picture plane.

Parallel Drawings

Isometrics: The three major axes make equal angles with the picture plane.

Dimetrics: Two of the three major axes make equal angles with the picture plane.

Trimetrics: All three major axes make different angles with the picture plane.

Axonometric Projection

Oblique Projection

Elevation obliques: A principal vertical face is oriented parallel to the picture plane.

Plan obliques: A principal horizontal face is oriented parallel to the picture plane.

Perspective Projection

Perspective Drawings

1-point perspectives: One horizontal axis is perpendicular to the picture plane while the other horizontal axis and the vertical axis are parallel with the picture plane.

2-point perspectives: Both horizontal axes are oblique to the picture plane and the vertical axis remains parallel with the picture plane.

3-point perspectives: Both horizontal axes as well as the vertical axis are oblique to the picture plane.

These pictorial views are available in most 3D CAD and modelling programs. The terminology, however, may differ from what is presented here.

Orthographic Projection

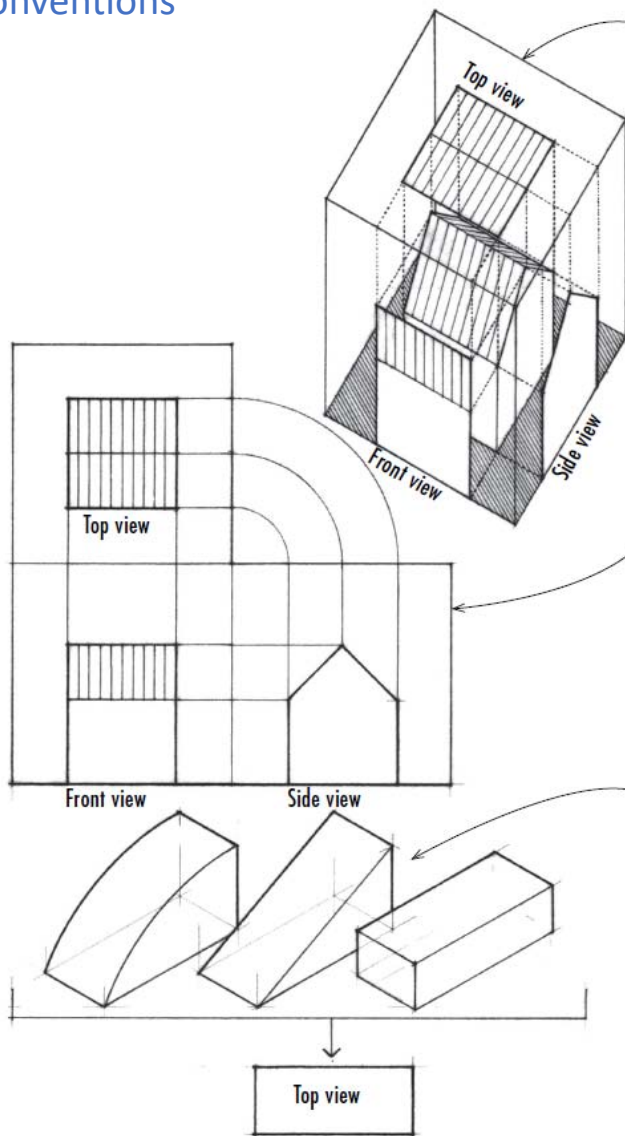
Drawings that can be prepared through orthographic projection to produce **WHAT?**:

PLANS

SECTIONS

ELEVATIONS

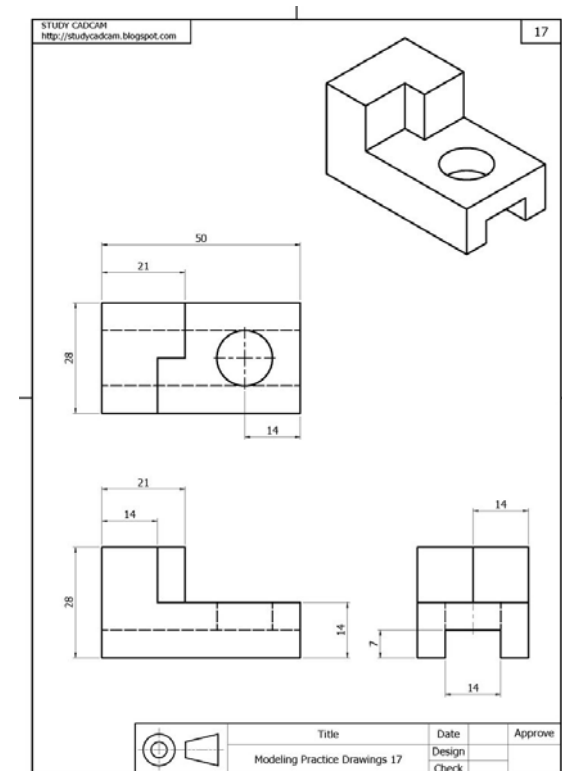
Conventions



- If we enclose an object within a transparent picture-plane box, we can name the images projected orthographically onto the principal picture planes.
- Top views are orthographic projections cast onto the horizontal picture plane. In architectural drawing, top views are called plans.
- Front and side views are orthographic projections cast onto the vertical picture planes. In architectural drawing, front and side views are called elevations.
- See Chapter 4 for floor plans and sections, which are orthographic projections of cuts made through a building.
- To make it easier to read and interpret how a series of orthographic projections describe a three-dimensional whole, we arrange the views in an orderly and logical fashion.
- The most common layout results when we unfold the transparent picture-plane box into a single plane represented by the drawing surface. The top or plan view revolves upward to a position directly above and vertically aligned with the front or elevation view, while the side view revolves to align horizontally with the front view. The result is a coherent set of related orthographic views.
- Although these three objects have different forms, their top views appear to be identical. Only by looking at related orthographic projections are we able to understand the three-dimensional form of each object. We should therefore study and represent three-dimensional forms and constructions through a series of related orthographic projections.
- The mind must be able to read and assemble a set of multiview drawings to fully understand the nature of the three-dimensional subject.

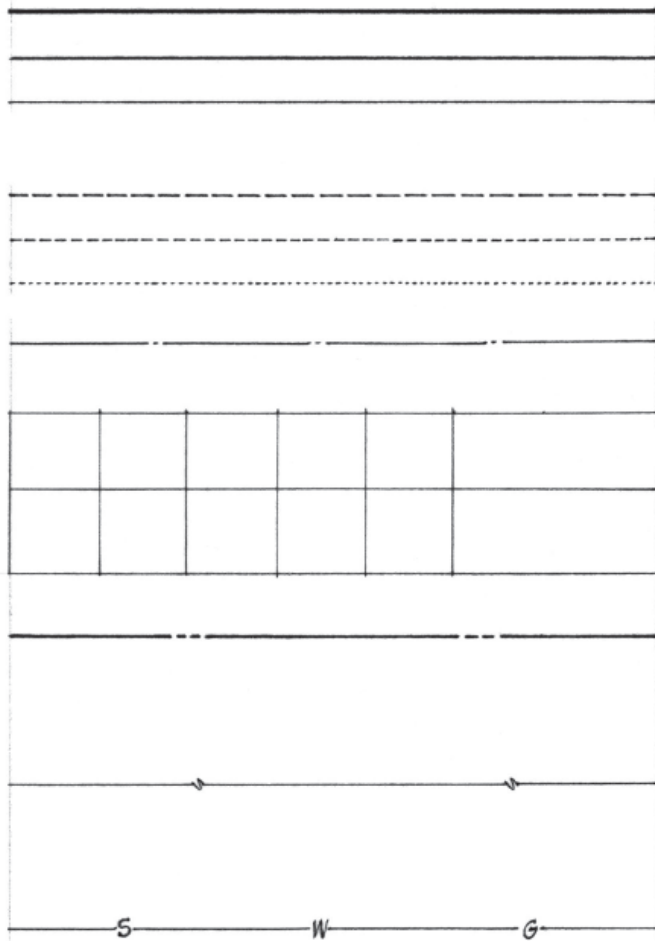
Orthographic Projection

CAD Packages can assist us to create multiple view of the same object through projection



<https://free-clipart-pictures.com/images/orthographic-drawing-mug-5.jpg>

Conventions - Lines



- Solid lines delineate the form of objects, such as the edge of a plane or the intersection of two planes. The relative weight of a solid line varies according to its role in conveying depth.
- Dashed lines, consisting of short, closely spaced strokes, indicate elements hidden or removed from our view.
- Centerlines, consisting of thin, relatively long segments separated by single dashes or dots, represent the axis of a symmetrical object or composition.
- Grid lines are a rectangular or radial system of light solid lines or centerlines for locating and regulating the elements of a plan.
- Property lines, consisting of relatively long segments separated by two dashes or dots, indicate the legally defined and recorded boundaries of a parcel of land.
- Break lines, consisting of relatively long segments joined by short zigzag strokes, are used to cut off a portion of a drawing.
- Utility lines consist of relatively long segments separated by a letter indicating the type of utility.

Line type conventions assist in the legibility of drawn information. The quality, thickness, scale and type of line can help communicate the importance of the line.

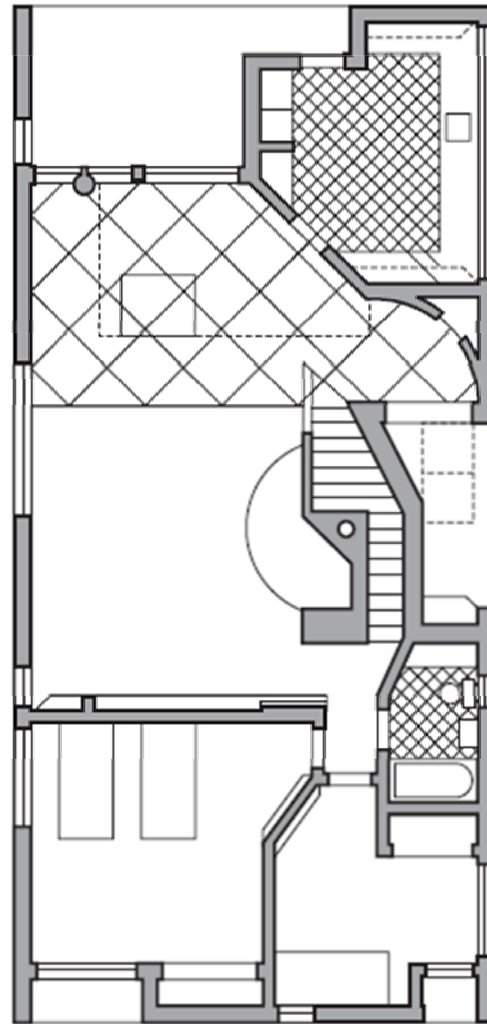
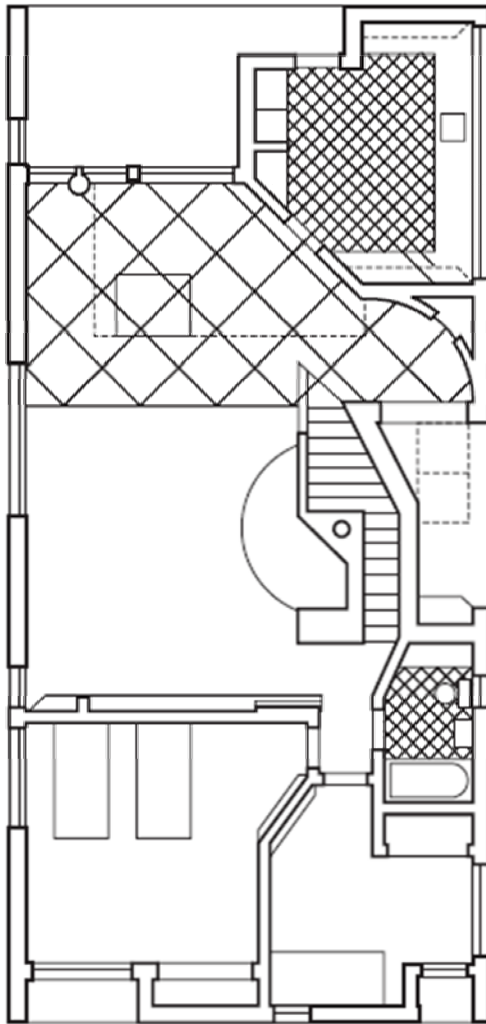
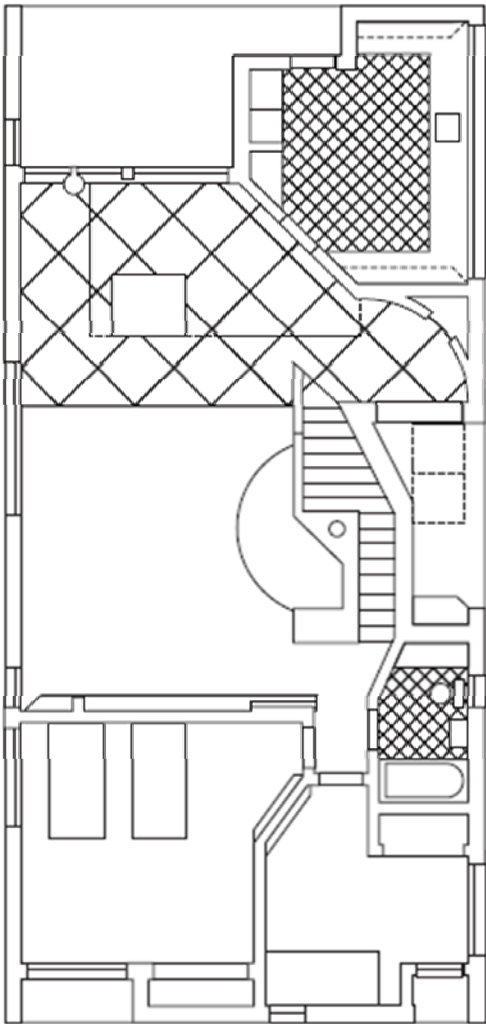
E.G

Thick Solid line depicting a section cut.

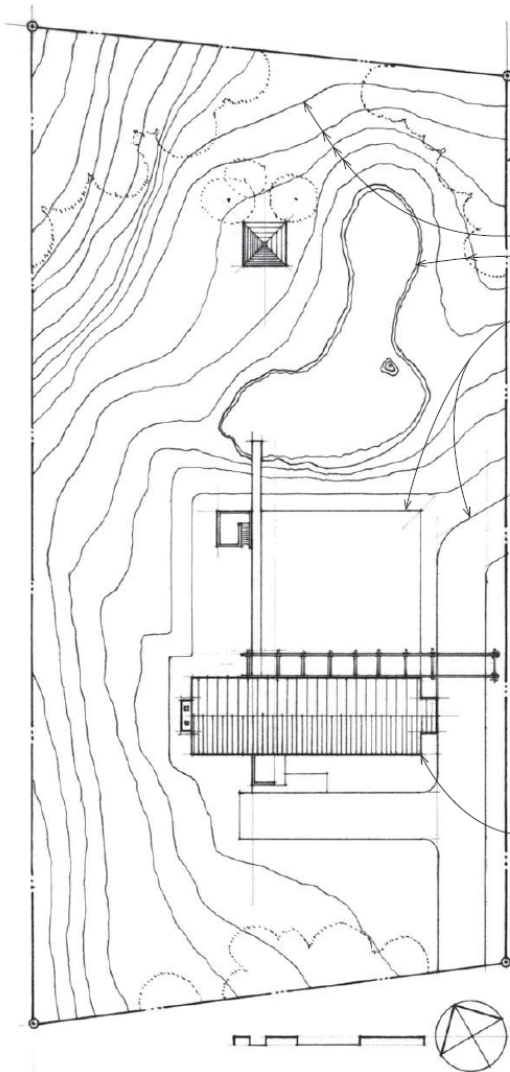
Dashed lines depicting something hidden from view.

Centre lines through steelwork allowing accuracy between column positions.

Conventions - Lines



Conventions - Plans



A site plan describes the location and orientation of a building or building complex on a plot of land and in relation to its context. Whether this environment is urban or rural, the site plan should describe the following:

- Legally recorded boundaries of the site, indicated by a broken line consisting of relatively long segments separated by two short dashes or dots
- Physical topography of the terrain with contour lines
- Natural site features, such as trees, landscaping, and watercourses
- Existing or proposed site constructions, such as walks, courts, and roadways
- Architectural structures in the immediate setting that impact the proposed building

In addition, a site plan may include:

- Legal constraints, such as zoning setbacks and rights-of-way
- Existing or proposed site utilities
- Pedestrian and vehicular entry points and paths
- Significant environmental forces and features

Roof Plans

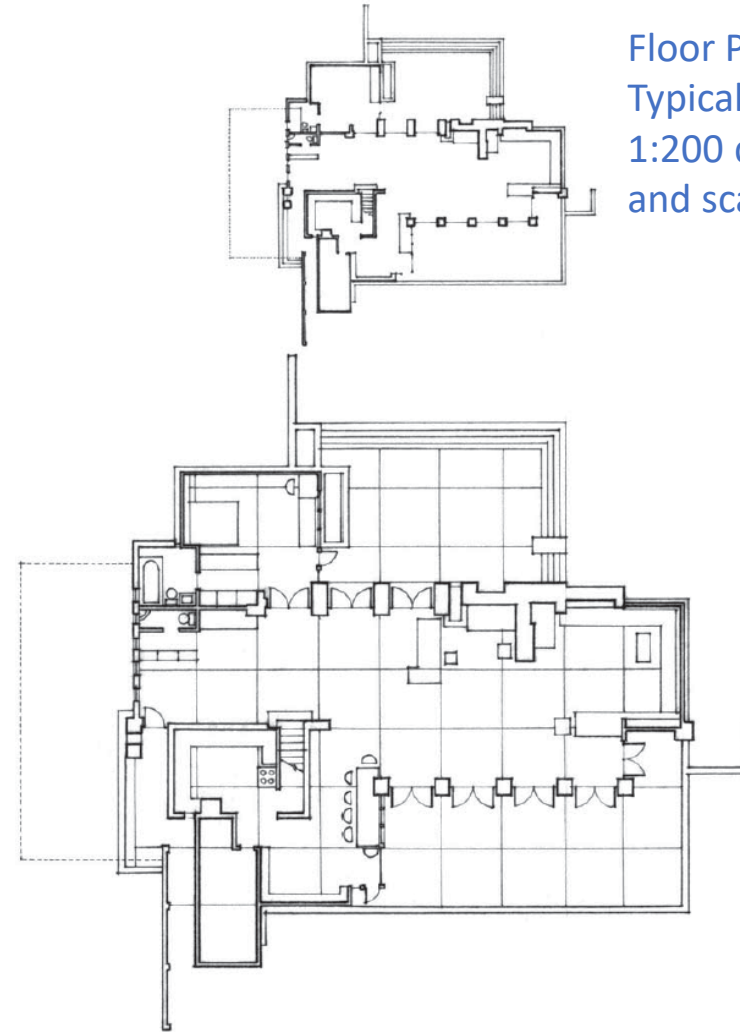
A roof plan is a top view describing the form, massing, and material of a roof or the layout of such rooftop features as skylights, decks, and mechanical housings.

- Roof plans are typically included in the site plan for a proposed building or building complex.

Site Plans

Typical scale 1:1250 / 1:500

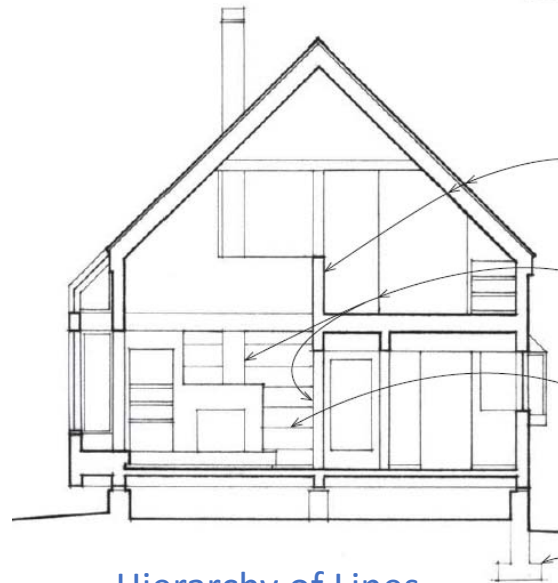
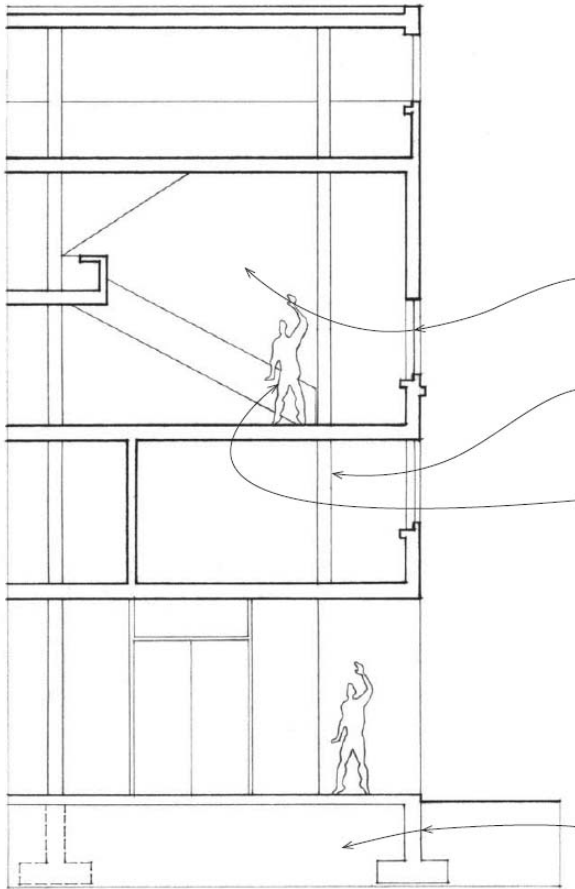
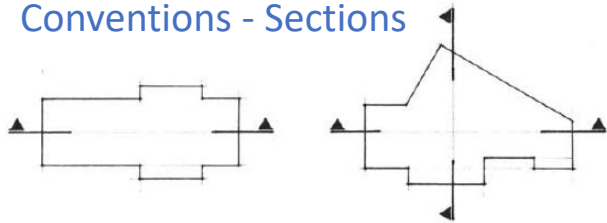
- Graphic scale designates the scale of the site plan and a north arrow indicates the orientation of the site.



Floor Plans

Typical scales 1:100 / 1:200 depending on size and scale of the building.

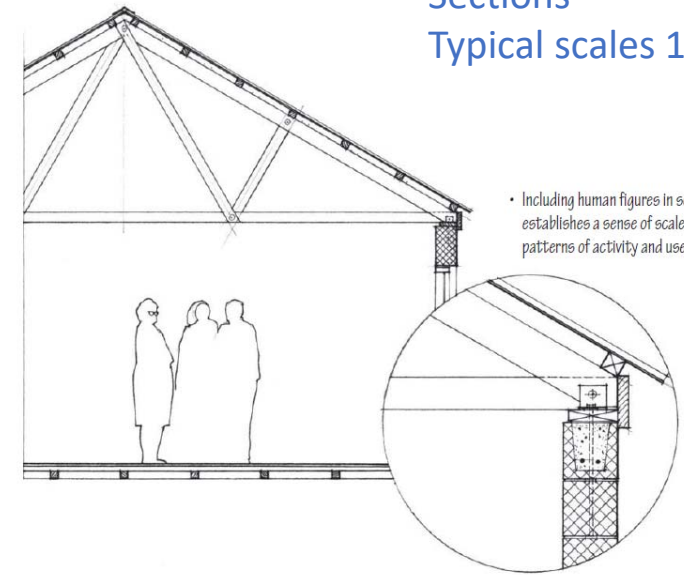
Conventions - Sections



Hierarchy of Lines

Sections

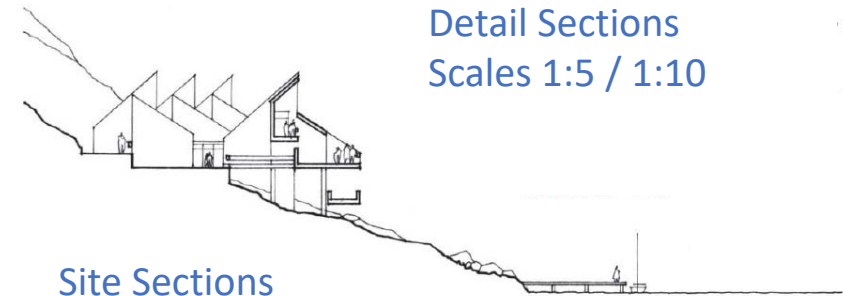
Typical scales 1:20 / 1:50



- Including human figures in section drawings establishes a sense of scale and reminds us of patterns of activity and use.

Detail Sections

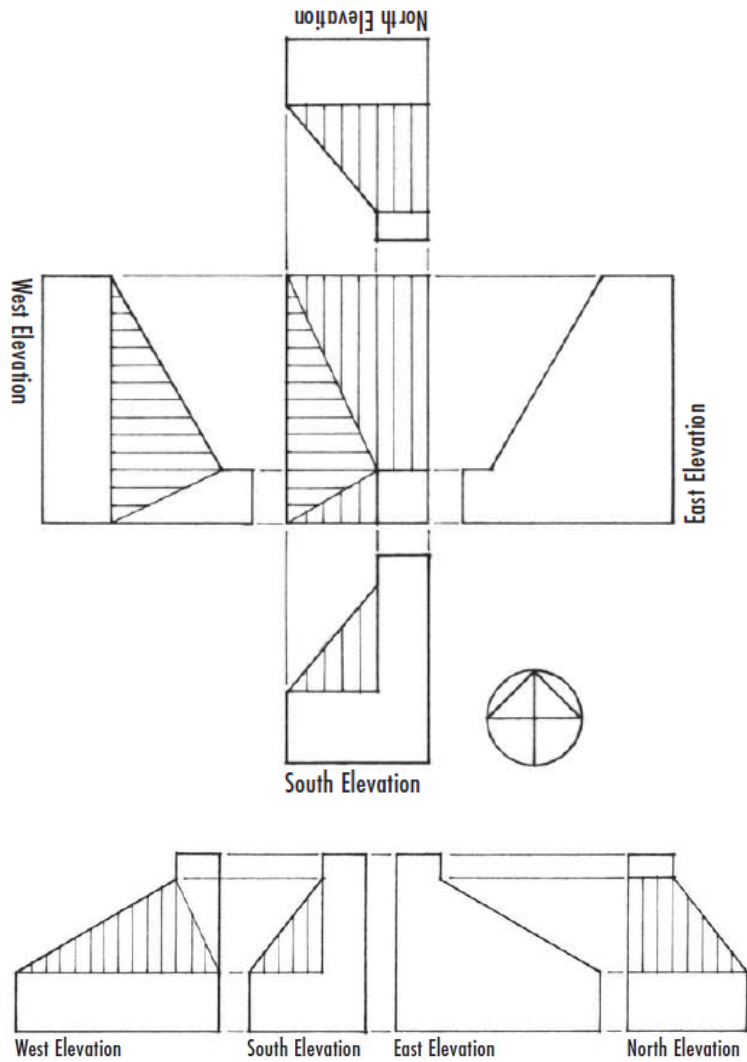
Scales 1:5 / 1:10



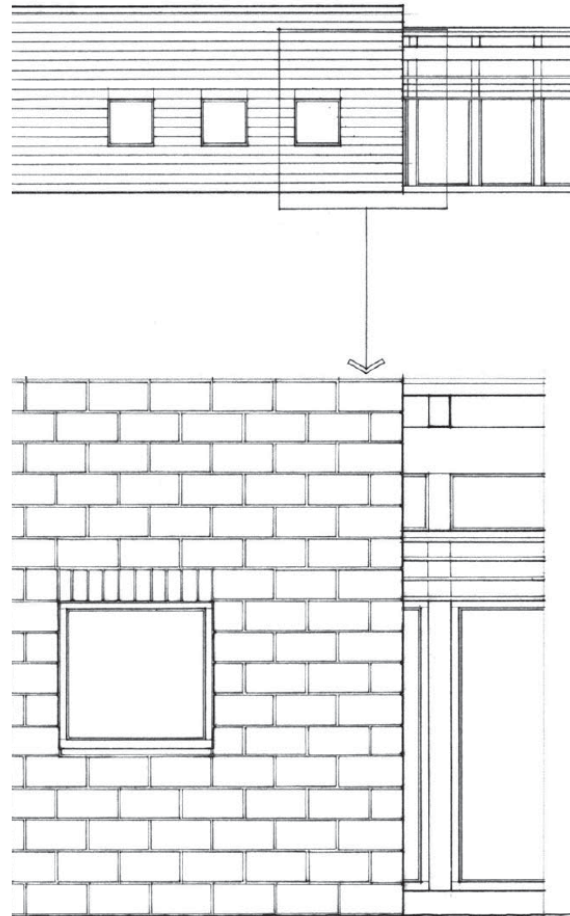
Site Sections

Scale 1:200 / 1:500

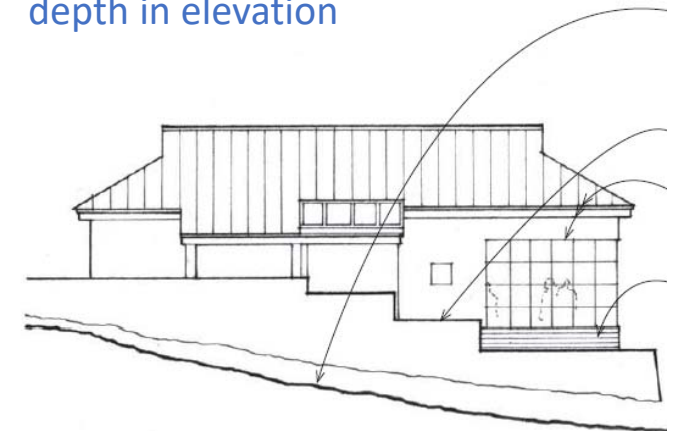
Conventions - Elevations



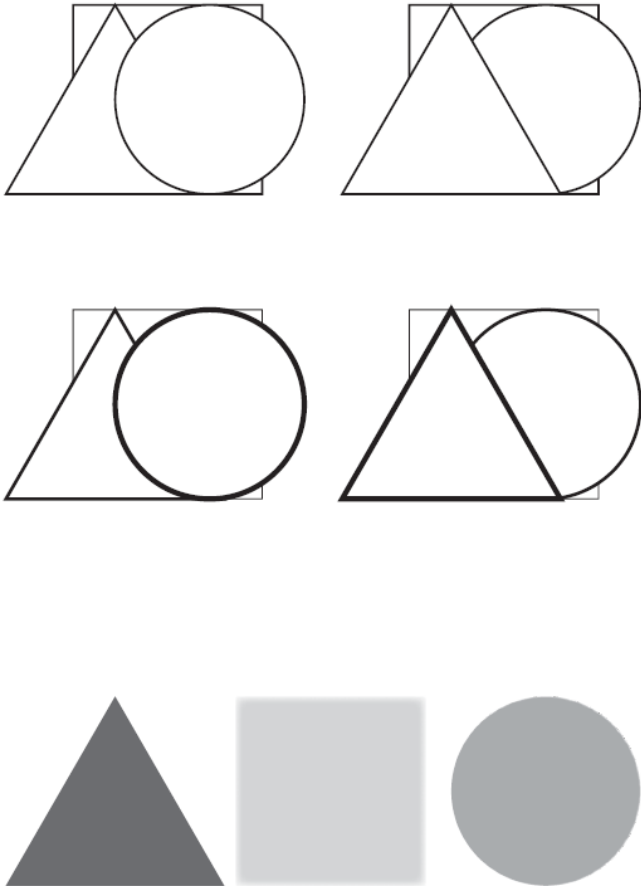
Elevations are normally drawn in a scale relative to the floor plans. 1:100
Further detail can be emphasised at a larger scale. (1:50)



Hierarchy of Lines, showing depth in elevation



Conventions - Depth

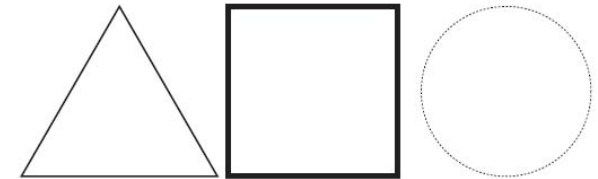


Spatial Depth Cues

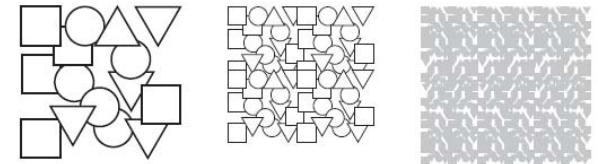
The examples on the previous two pages illustrate the use of varying line weights and detail to convey a sense of spatial depth in the drawing of building elevations. This series of drawings illustrates in a more discrete and abstract way how visual cues can enhance the sense of depth in any orthographic projection.

- **Continuity of Outline:** We tend to perceive a shape as being in front of another when it has continuity of outline and disrupts the profile of the other shape. Since this visual phenomenon relies on nearer objects overlaying or projecting in front of objects farther away, we often refer to this depth cue simply as overlap.
- **By itself, overlap tends to create relatively shallow intervals of space.** However, we can achieve a greater sense of intervening space and depth if we combine overlap with other depth cues, such as by varying the line weights of a pure-line drawing. Darker and thicker profile or contour lines tend to advance and appear to be in front of lighter and thinner outlines.
- **Atmospheric Perspective:** A progressive muting of hues, tonal values, and contrast occurs with increasing distance from the observer. Objects seen up close in the foreground of our visual field typically possess more saturated colors and sharply defined contrasts in value. As they move farther away, their colors become lighter in value and more subdued, and their tonal contrasts more diffuse. In the background, we see mainly shapes of grayed tones and muted hues.

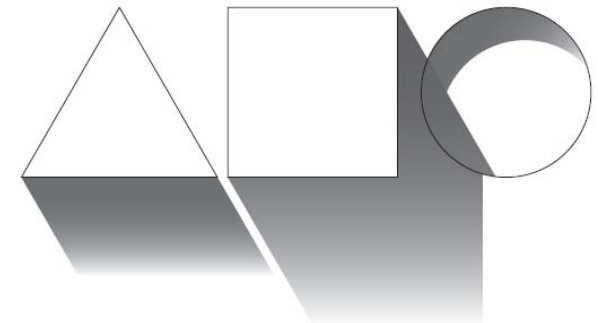
- **Perspective of Blur:** This depth cue reflects the fact that we normally associate clarity of vision with nearness and blurring of outlines with farness. The graphic equivalent of perspective blur is a diminishing or diffusion of the edges and contours of more distant objects. We can use either a lightly drawn line or a broken or dotted line to delineate these edges of shapes and contours of forms that exist beyond the focus of a drawing.



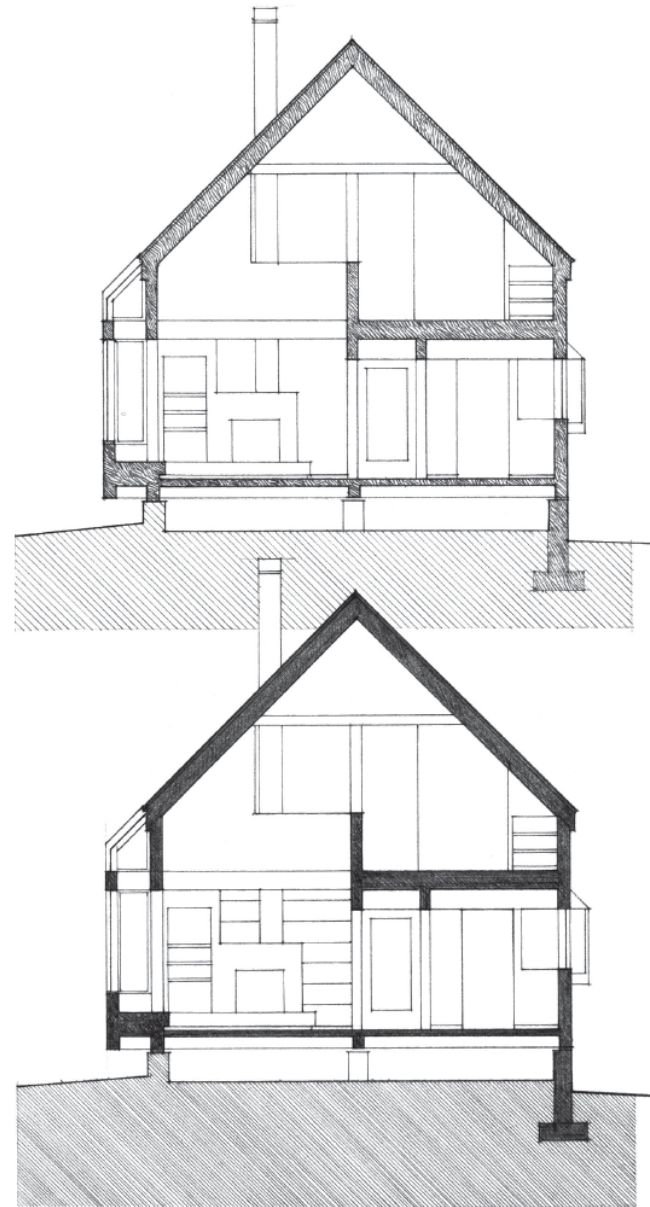
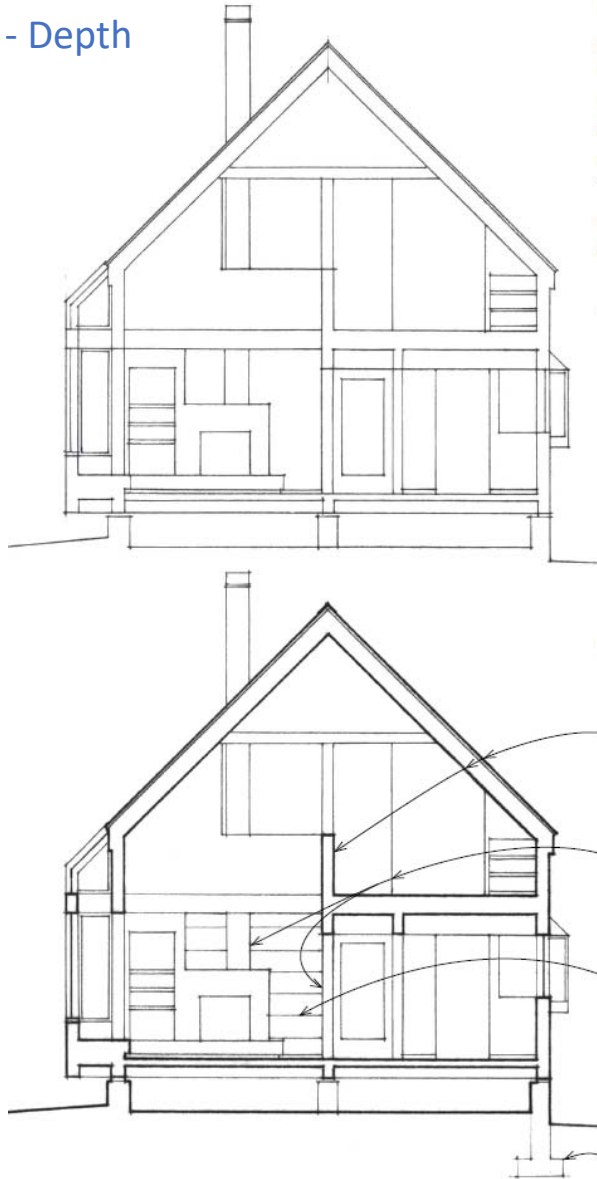
- **Texture Perspective:** The density of the texture of a surface gradually increases as it recedes into the distance. The graphic technique for depicting the visual phenomenon of texture perspective involves gradually diminishing the size and spacing of the graphic elements used to portray a surface texture or pattern, whether they be dots, lines, or tonal shapes. Proceed from identifying units in the foreground to delineating a textured pattern in the middleground and finally to rendering a tonal value in the background.



- **Light and Shade:** Any abrupt shift in brightness stimulates the perception of a spatial edge or profile separated from a background surface by some intervening space. This depth cue implies the existence of overlapping shapes and the use of contrasting tonal values in a drawing. See Chapter 7 for more information on the use of tonal values in architectural graphics.



Conventions - Depth



CAD Packages can assist in demonstrating spatial depth through hatching.

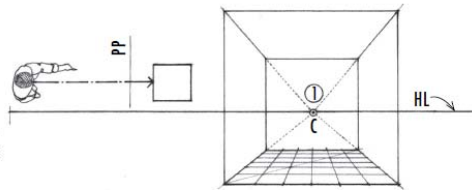
Other Drawing Types

TYPES OF PERSPECTIVE

In any rectilinear object, such as a cube, each of the three principal sets of parallel lines has its own vanishing point. Based on these three major sets of lines, there are three types of linear perspective: one-, two-, and three-point perspectives. What distinguishes each type is simply the observer's angle of view relative to the subject. The subject does not change, only our view of it, but the change of view affects how the sets of parallel lines appear to converge in linear perspective.

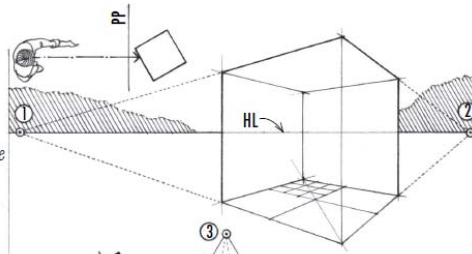
One-Point Perspective

If we view a cube with our central axis of vision (CAV) perpendicular to one of its faces, all of the cube's vertical lines are parallel with the picture plane (PP) and remain vertical. The horizontal lines that are parallel with PP and perpendicular to CAV also remain horizontal. The lines that are parallel with CAV, however, will appear to converge at the center of vision (C). This is the one point referred to in one-point perspective.



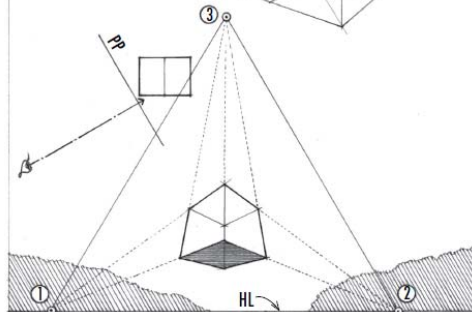
Two-Point Perspective

If we shift our point of view so that we view the same cube obliquely, but keep our central axis of vision (CAV) horizontal, then the cube's vertical lines will remain vertical. The two sets of horizontal lines, however, are now oblique to the picture plane (PP) and will appear to converge, one set to the left and the other to the right. These are the two points referred to in two-point perspective.

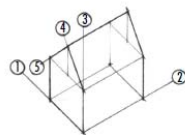


Three-Point Perspective

If we lift one corner of the cube off the ground plane (GP), or if we tilt our central axis of vision (CAV) to look down or up at the cube, then all three sets of parallel lines will be oblique to the picture plane (PP) and will appear to converge at three different vanishing points. These are the three points referred to in three-point perspective.



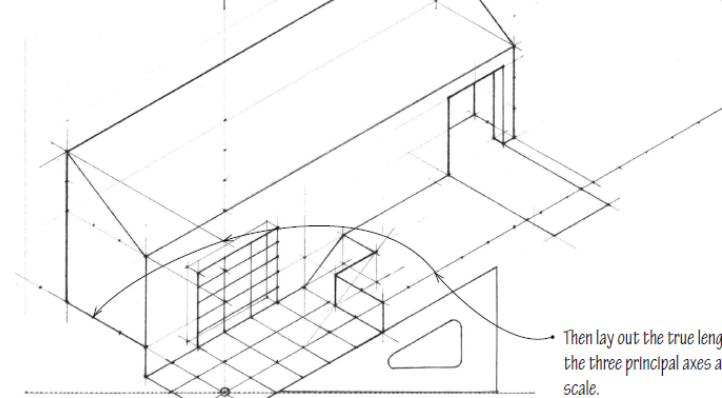
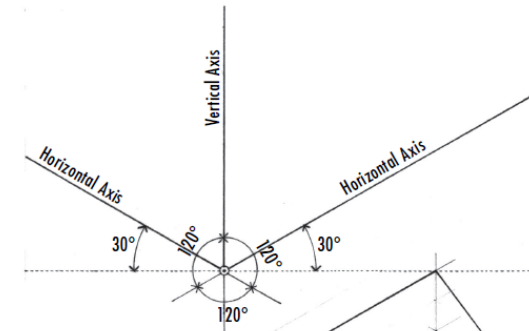
Note that each type of perspective does not imply that there are only one, two, or three vanishing points in a perspective. The actual number of vanishing points will depend on our point of view and how many sets of parallel lines there are in the subject being viewed. For example, if we look at a simple gable-roofed form, we can see that there are potentially five vanishing points, since we have one set of vertical lines, two sets of horizontal lines, and two sets of inclined lines.



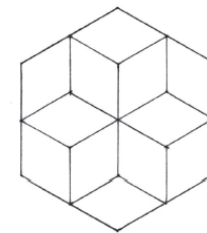
ISOMETRIC DRAWINGS

Isometric drawings establish a lower angle of view than plan obliques and give equal emphasis to the three principal sets of planes. They preserve the relative proportions of a subject or scene and are not subject to the distortion inherent in oblique views.

- To construct an Isometric drawing, first establish the direction of the three principal axes. Because they are 120° apart on the picture plane, if we draw one axis vertically, the other two axes make a 30° angle with a horizontal on the drawing surface.



- Then lay out the true lengths of all lines parallel to the three principal axes and draw them to the same scale.



- Isometric drawings of forms based on the square can create an optical illusion and be subject to multiple interpretations. This ambiguity results from the alignment of lines in the foreground with those in the background. In such cases, a plan oblique might be a better choice.

CAD packages can assist in preparing views through snap grids and dynamic 3D modelling.

Typical CAD packages



AUTODESK
AUTOCAD
2020



VECTORWORKS®
A NEMETSCHEK COMPANY

GRAPHISOFT®
ARCHICAD



Rhinoceros®



AUTODESK
CIVIL3D



SketchUp

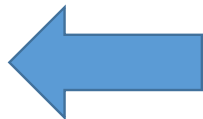
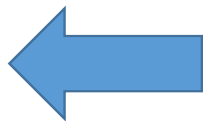
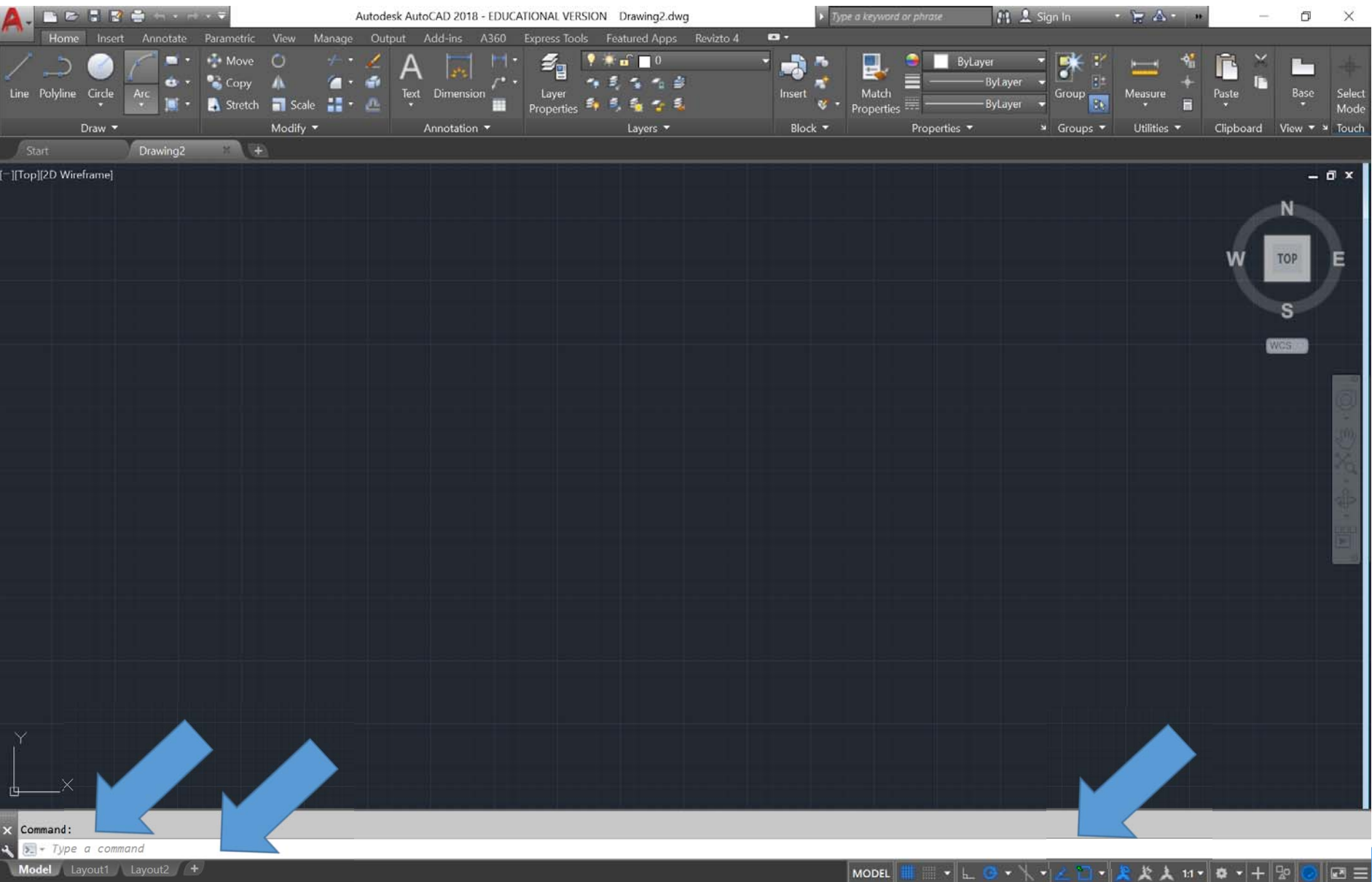


AUTODESK®
REVIT®

Working with AutoCAD 2020



AUTODESK
AUTOCAD
2020



UNITS

BASIC
COMMANDS

Supplementary Reading List.

Drawing:

Francis Ching (2015) *Architectural Graphics*

Chudley, Greeno, Merritt (2016) *Building Construction Handbook*

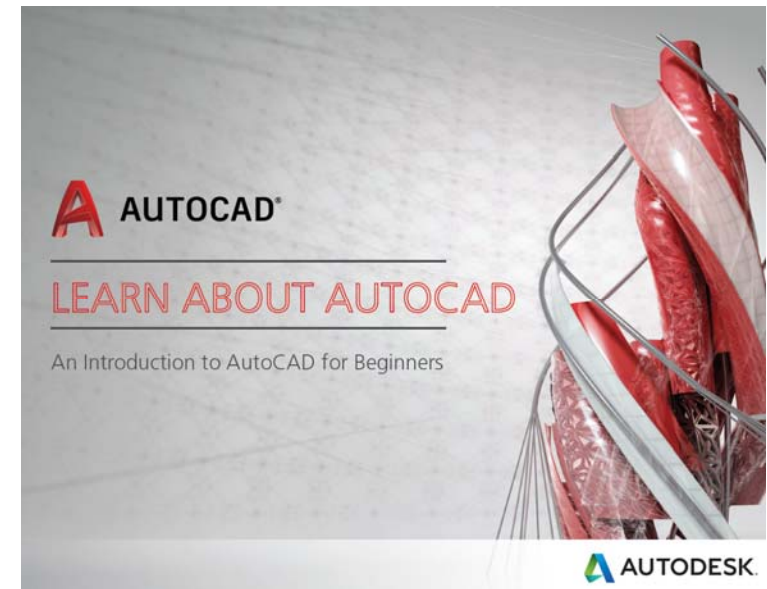
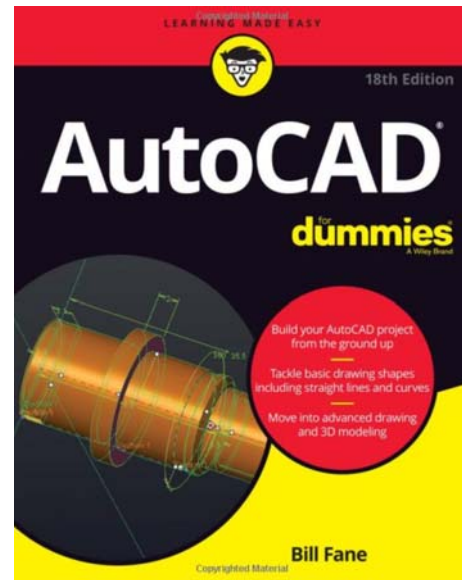
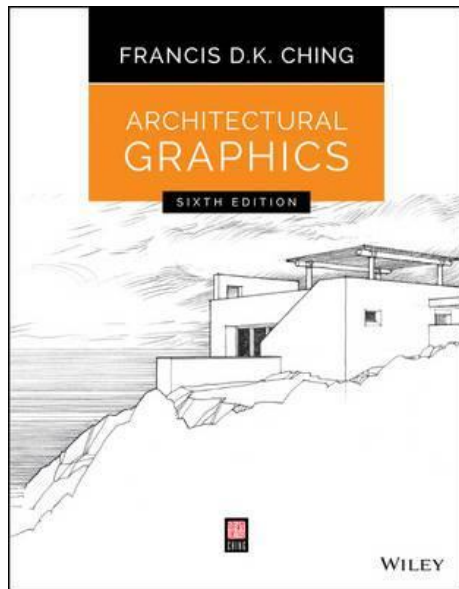
Reid, E (2016) *Understanding Buildings*

2D CAD:

Guide to AutoCAD (moodle)

AutoCAD for Dummies

<https://academy.autodesk.com/>

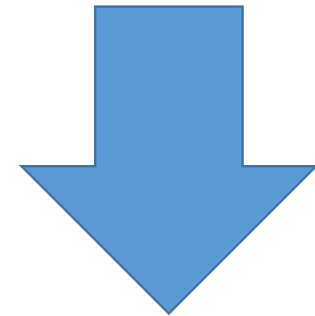




Q QSAVE / Saves the current drawing.
A ARC / Creates an arc.
Z ZOOM / Increases or decreases the magnification of the view in the current viewport.
W WBLOCK / Writes objects or a block to a new drawing file.
S STRETCH / Stretches objects crossed by a selection window or polygon.
X EXPLODE / Breaks a compound object into its component objects.
E ERASE / Removes objects from a drawing.
D DIMSTYLE / Creates and modifies dimension styles.

C CIRCLE / Creates a circle.
R REDRAW / Refreshes the display in the current viewport.
F FILLET / Rounds and fillets the edges of objects.
V VIEW / Saves and restores named views, camera views, layout views, and preset views.
T MTEXT / Creates a multiline text object.
G GROUP / Creates and manages saved sets of objects called groups.
B BLOCK / Creates a block definition from selected objects.
N NEW / Create a new drawing

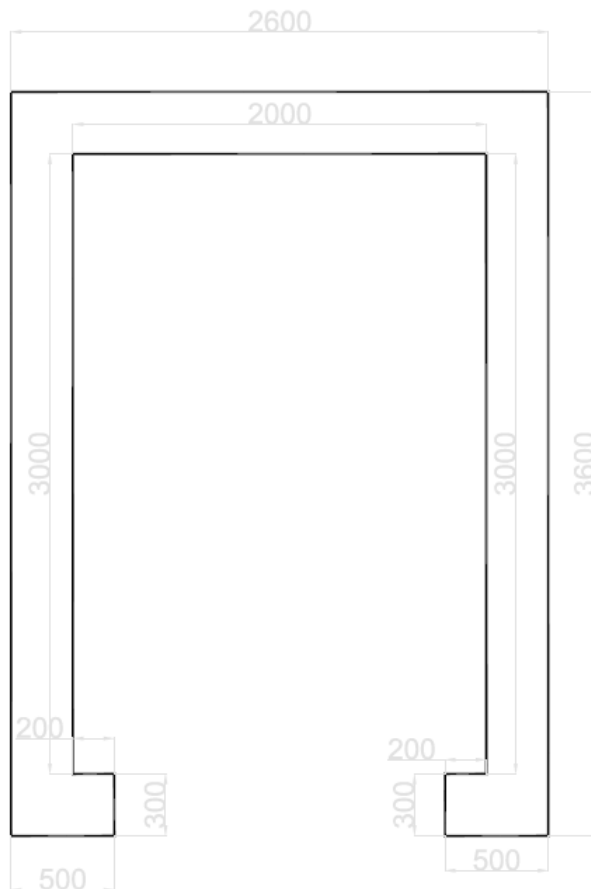
H HATCH / Fills an enclosed area or selected objects with a hatch pattern, solid fill, or gradient fill.
J JOIN / Joins similar objects to form a single, unbroken object.
M MOVE / Moves objects a specified distance in a specified direction.
I INSERT / Inserts a block or drawing into the current drawing.
O OFFSET / Creates concentric circles, parallel lines, and parallel curves.
L LINE / Creates straight line segments.
P PAN / Adds a parameter with grips to a dynamic block definition.



<https://www.autodesk.com/shortcuts/autocad>

PL Polyline
CO Copy
REC Rectangle
MO/PR Modify Properties
Pallet
LA Layer Pallet

Task 1



Starting from point 0,0 draw a Polyline to depict walls to the dimensions shown.

To start type PL or select Polyline from the Ribbon.

type 0,0 and press enter

now use the coordinates system to enter the next point (s) of the polyline pressing enter after each until you Close the polyline

@500,0 (enter)

@0,300 (enter)

@-200,0 (enter)

and so on.

remember the @ symbol means you are moving in a direction.

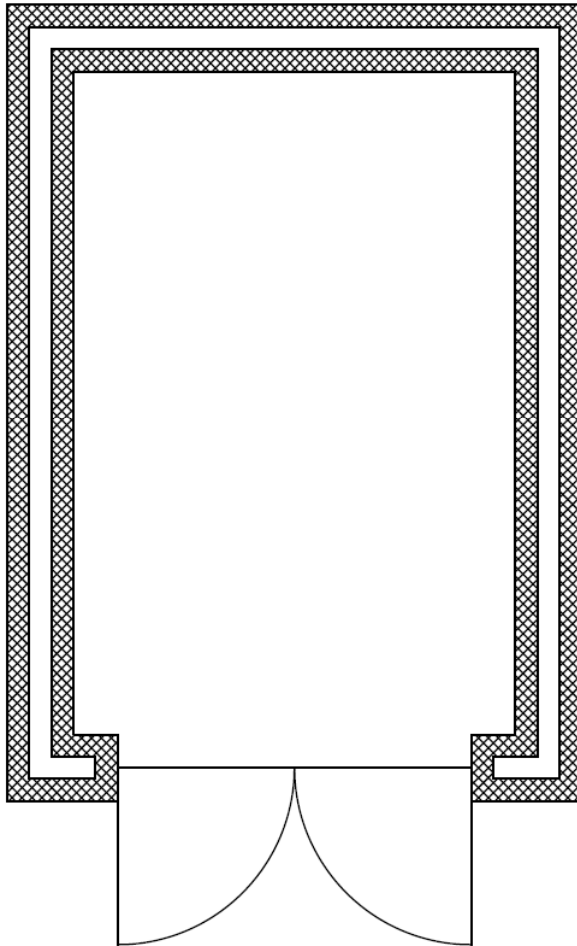
the first distance value before the comma are along the 'x' axis

the second distance value after the comma are along the 'y' axis

adding a minus before an x distance will move a the line from right to left direction

adding a minus before a y distance will move the line down the Y axis.

Task 2



Find your way around the Draw and Modify options on the Ribbon.

Use 'Offset' command to offset the walls by 100mm (under Modify in the Ribbon or type 'o')

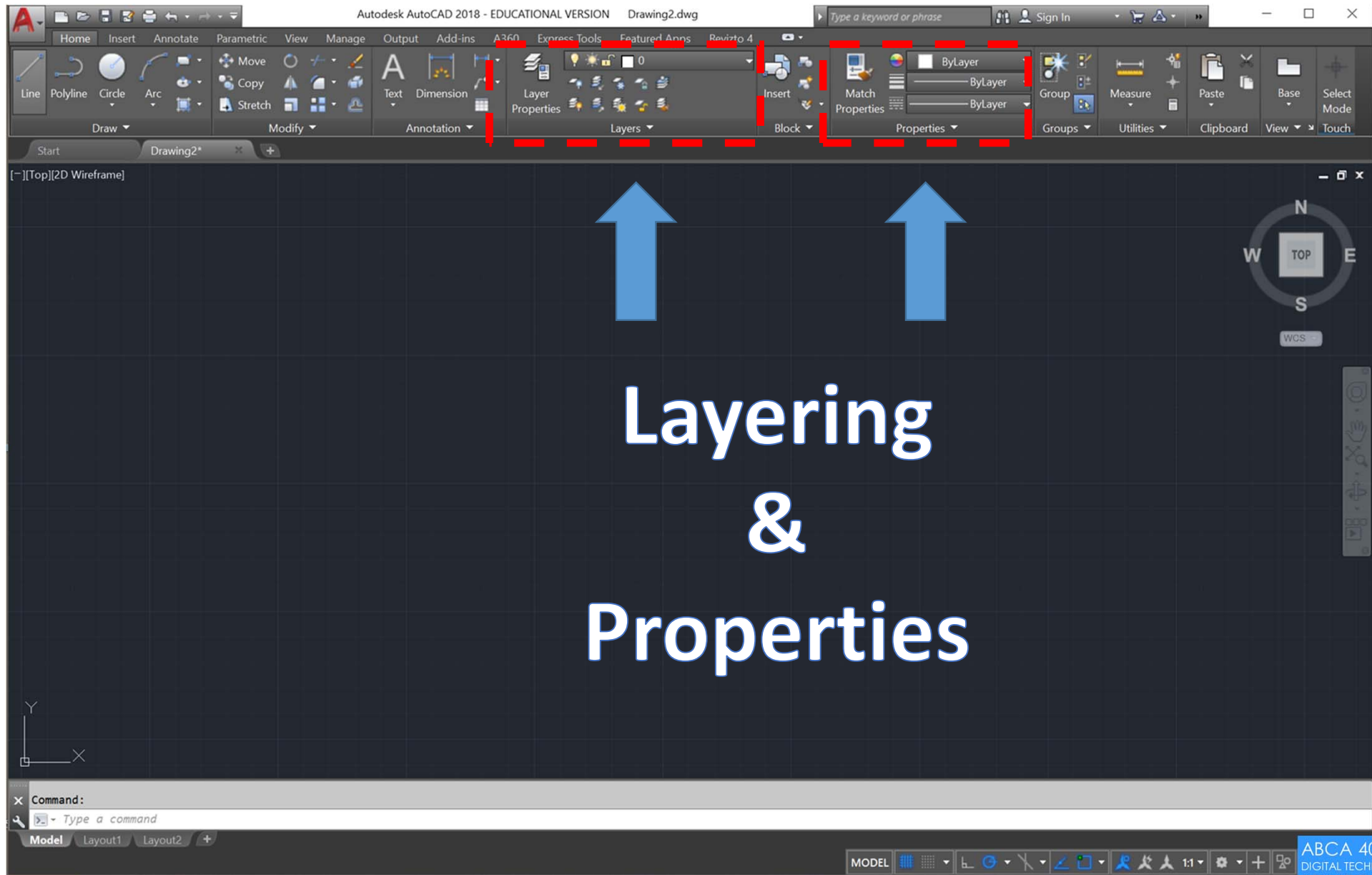
Use 'Hatch' command to hatch in the Blockwork change the scale in the hatch editor to 10

Draw a 'Line' from midpoint to midpoint of the doorway. (check your object snap settings)

Draw a 'Circle' from the midpoint of the door return to the midpoint of the doorway opening.

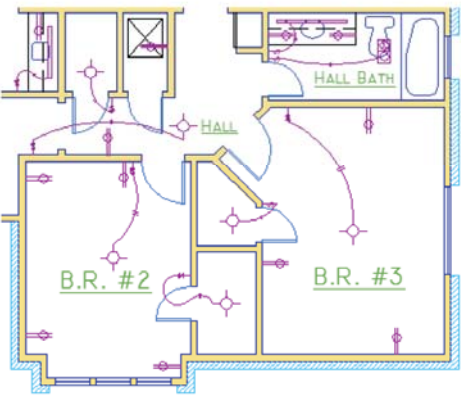
Use 'Trim' command to trim the circle to create a quarter circle (i.e single door)

Use 'Mirror' command to mirror the door leaf and create a double door. You must indicate the line / point of the axis to mirror.

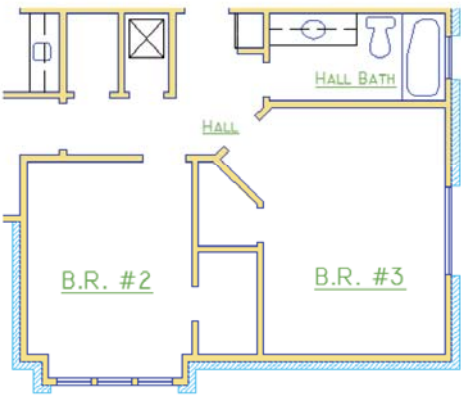


Layers

Organize your drawing by assigning objects to layers.
When a drawing becomes visually complex, you can hide objects that you currently do not need to see.

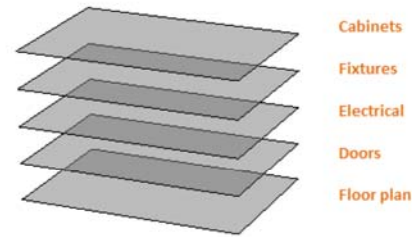


In the drawing below, the doors and electrical wiring were temporarily hidden by hiding their layers.



Layers (continued)

You gain this level of control by organizing the objects in your drawing on layers that are associated with a specific function or purpose. It might be helpful to think of layers as clear plastic sheets:



With layers, you can:

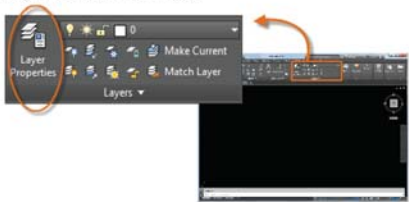
- Associate objects by their function or location
- Display or hide all objects related to a single operation
- Enforce linetype, color, and other property standards for each layer

Important:

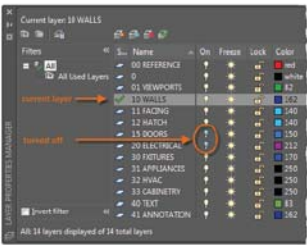
Resist the temptation to create everything on one layer. Layers are the most important organizing feature available in AutoCAD drawings.

Layer Controls

To see how a drawing is organized, use the **LAYER** command to open the Layer Properties Manager. You can either enter **LAYER** or **LA** in the Command window, or you can click the Layer Properties tool on the ribbon.



Here's what the Layer Properties Manager displays for this drawing.



As indicated, layer 10 WALLS is the *current layer*. All new objects are automatically placed on that layer. In the list of layers, the green check next to layer 10 WALLS indicates that it is the current layer.

In the column labeled On, notice that the light bulb icons for two layers are dark. This indicates that these layers were turned off to hide the doors and electrical wiring in the floor plan.

Notice that each layer name starts with a two-digit number. This convention makes it easy to control the order of the layers because their order does not depend on the alphabet.

Layer Settings

The following are the most commonly used layer settings in the Layer Properties Manager. Click the icon to turn the setting on and off.

COMMONLY USED LAYER SETTINGS

Turn Off Layers: This will help reduce the visual complexity of your drawing while you work.

Freeze Layers: Freeze layers that you do not need to access for a while. Freezing layers is similar to turning them off, but improves performance in very large drawings.

Lock Layers: Locking layers prevents accidental changes to the objects on those layers. Also, the objects on locked layers appear faded, which helps reduce the visual complexity of your drawing.

Set Default Properties: You can set the default properties for each layer, including color, linetype, line weight, and transparency. New objects that you create will use these properties unless you override them. Overriding layer properties is explained later in this topic.

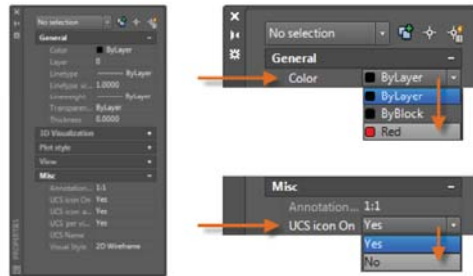


The Properties Palette

The Properties palette is an essential tool. You can open it with the **PROPERTIES** command (enter **PR** in the Command window), you can press **Ctrl + 1**, or you can click the tiny arrow in the Properties panel on the Home tab—whichever you prefer.

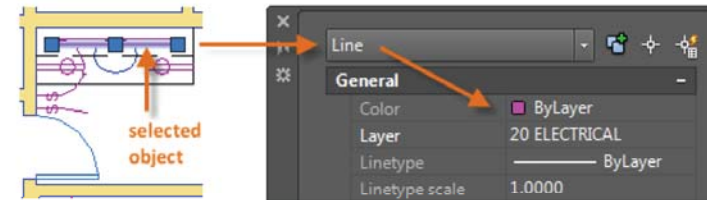


The Properties palette displays a list of all the important property settings. You can click any of the available fields to change the current settings. In the following example, if no objects are selected, the current color will be changed from ByLayer to Red and the UCS icon will be turned off.



Verify and Change Object Properties

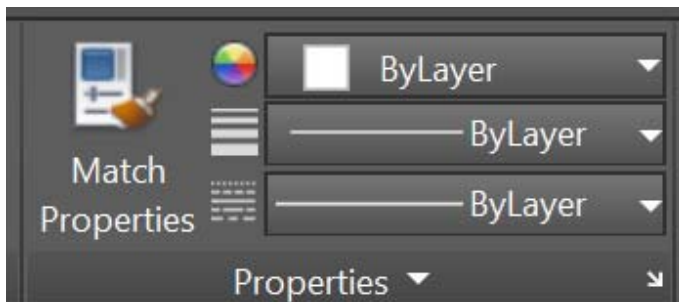
You can use the Properties palette to verify and change property settings for selected objects. If you click an object in your drawing to select it, here is what you might see in the Properties palette.

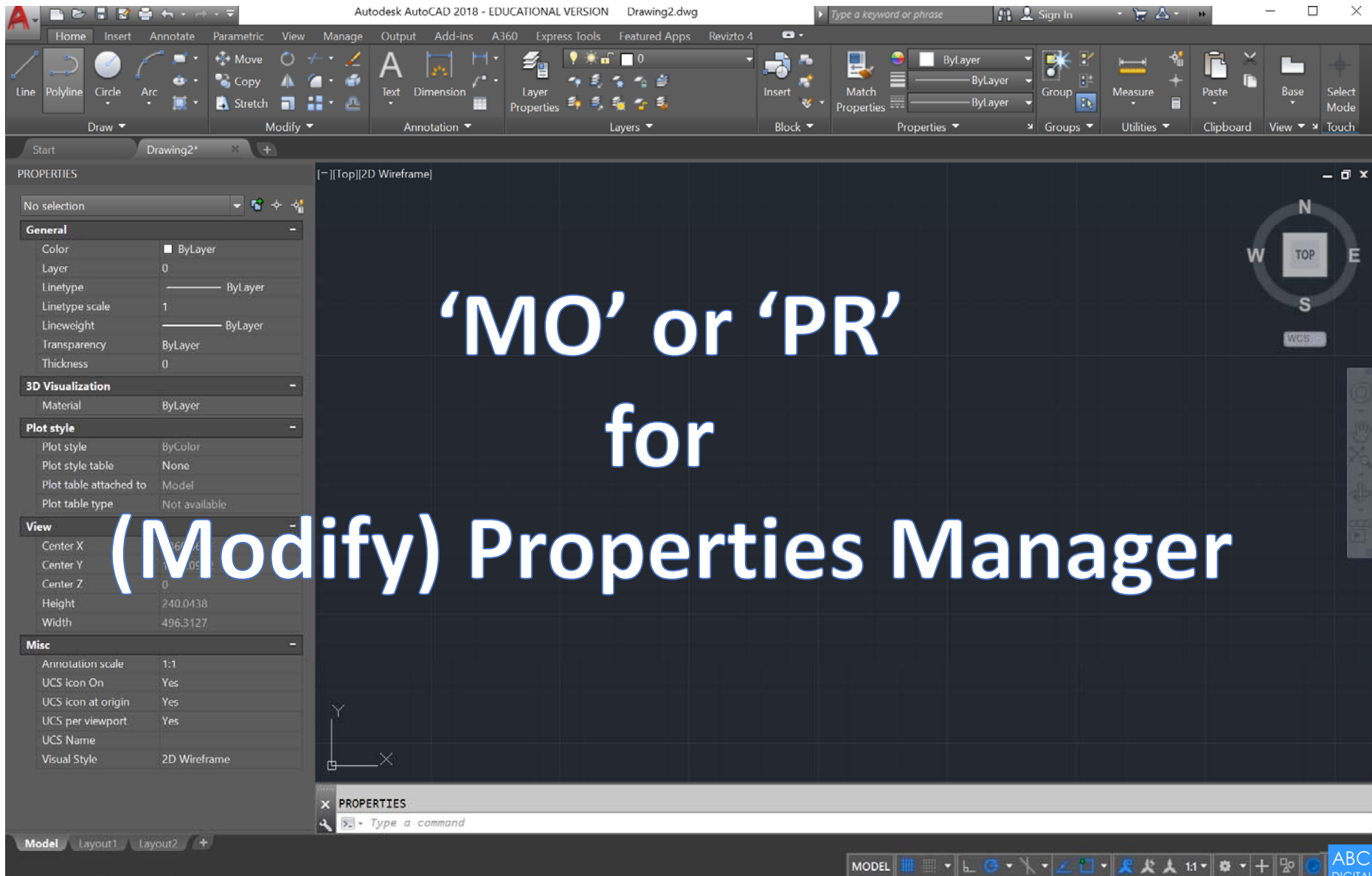


Notice that the current properties for the selected object are displayed in the palette. You can change any of these properties by clicking and changing the setting.

A property that is set to "ByLayer" inherits its setting from the layer. In the previous example, the objects that were created on the 20 ELECTRICAL layer are purple because that is the default color of the objects on that layer.

If you select several objects, only their common properties are listed in the Properties palette. If you change one of these properties, all the selected objects will change in one operation. Selecting objects is covered in more detail in the Modifying topic.





Exercise 1

Creating Layers

Walls - Cyan

Doors - Magenta

Text - White

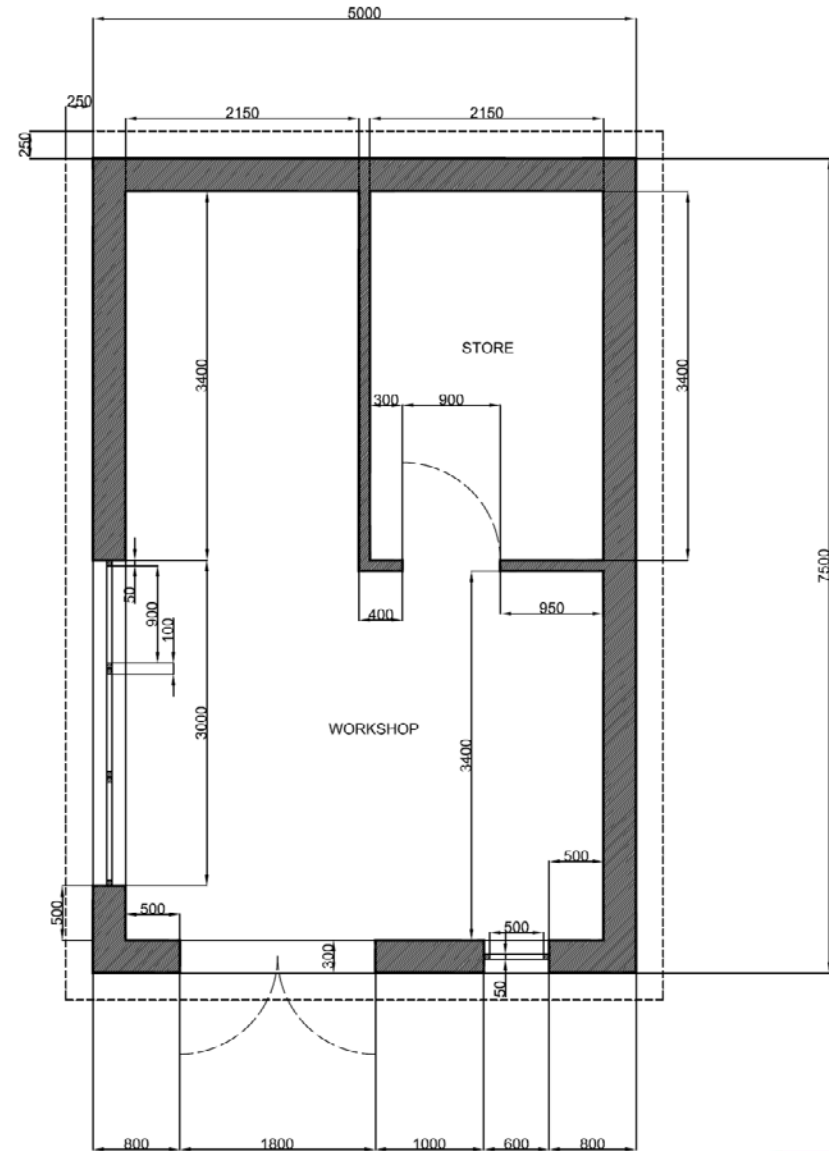
Hatching - Red

Draw it the building plan opposite, drawing the walls as a Polyline

Modify the thickness of the walls to show the cut plane.

Draw 6 no 200 x 2000mm rack shelving units in the workshop

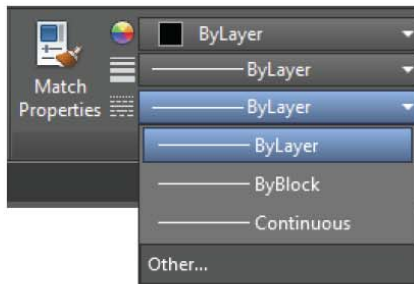
Create a new layer called Furniture and relocate to the layer.



Linetypes

Dashed and other non-continuous linetypes are assigned from the Properties panel. You must first load a linetype before you can assign it.

In the Linetype drop-down list, click Other.

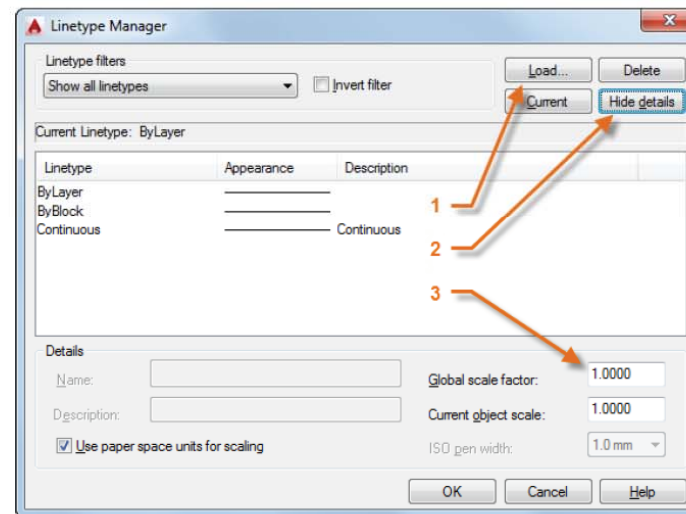


This action displays the Linetype Manager dialog box.

Perform the following steps in order:

1. Click Load. Choose one or more linetypes that you want to use. Notice that dashed (non-continuous) linetypes come in several preset sizes.
2. Click Show/Hide details to display additional settings.
3. Specify a different "global scale factor" for all linetypes—the larger the value, the longer the dashes and spaces. Click OK.

4. Once you've loaded the linetypes that you plan to use, you can select any object and specify a linetype from the Properties panel or the Properties palette. Alternatively, you can specify a default linetype for any layer in the Layer Properties Manager.



Exercise 2

Using Orthographic Projection

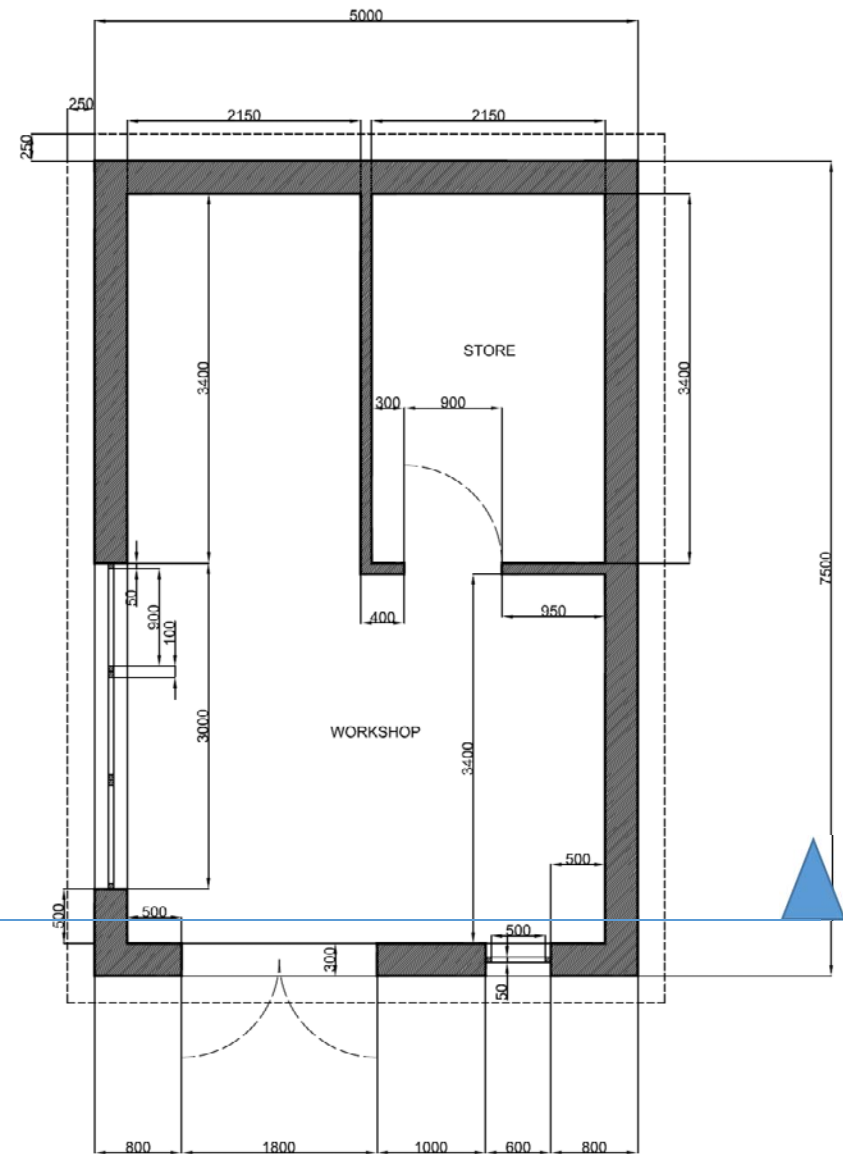
Prepare an Elevation and Section of the proposed building.

You will need to create a 'UCS'

Assume the following:

- High to Apex of roof is 5m
- Floor to ceiling height is 2.5m
- Floor slab is 300mm,
- Roof is 300mm thick
- Cill heights are 900mm

Create appropriate layers



User Coordinate System UCS can assist you to reorientation your drawing for orthographic projection.

Type UCS

'N' for Create New

'3' for New 3 point UCS

Click a positive point on the X axis

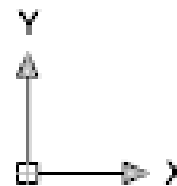
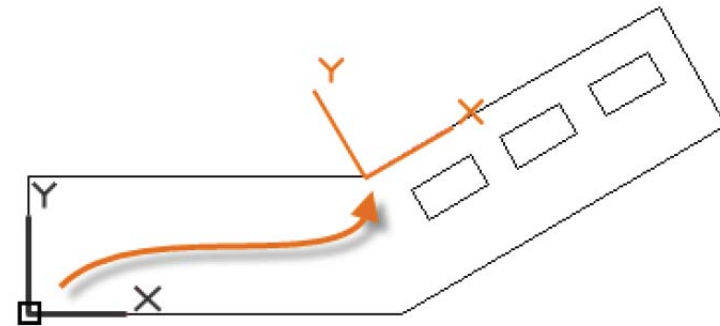
Click a positive point on the Y axis

Select '0' for Z axis

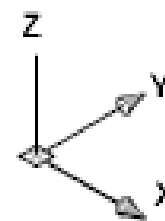
TYPE 'Plan' for reorientation your view to the new UCS

The User Coordinate System

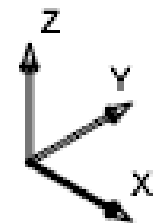
The user coordinate system (UCS) icon indicates the direction of the positive X and Y axis for any coordinates that you enter, and it also defines the horizontal and vertical directions in a drawing. In some 2D drawings, it can be convenient to click, drag, and rotate the UCS to change the origin point, and the horizontal and vertical directions.



2D UCS icon



3D UCS icon



shaded UCS icon

Exercise 3

Using Orthographic Projection

Prepare the remaining Elevations and Sections of the proposed building.

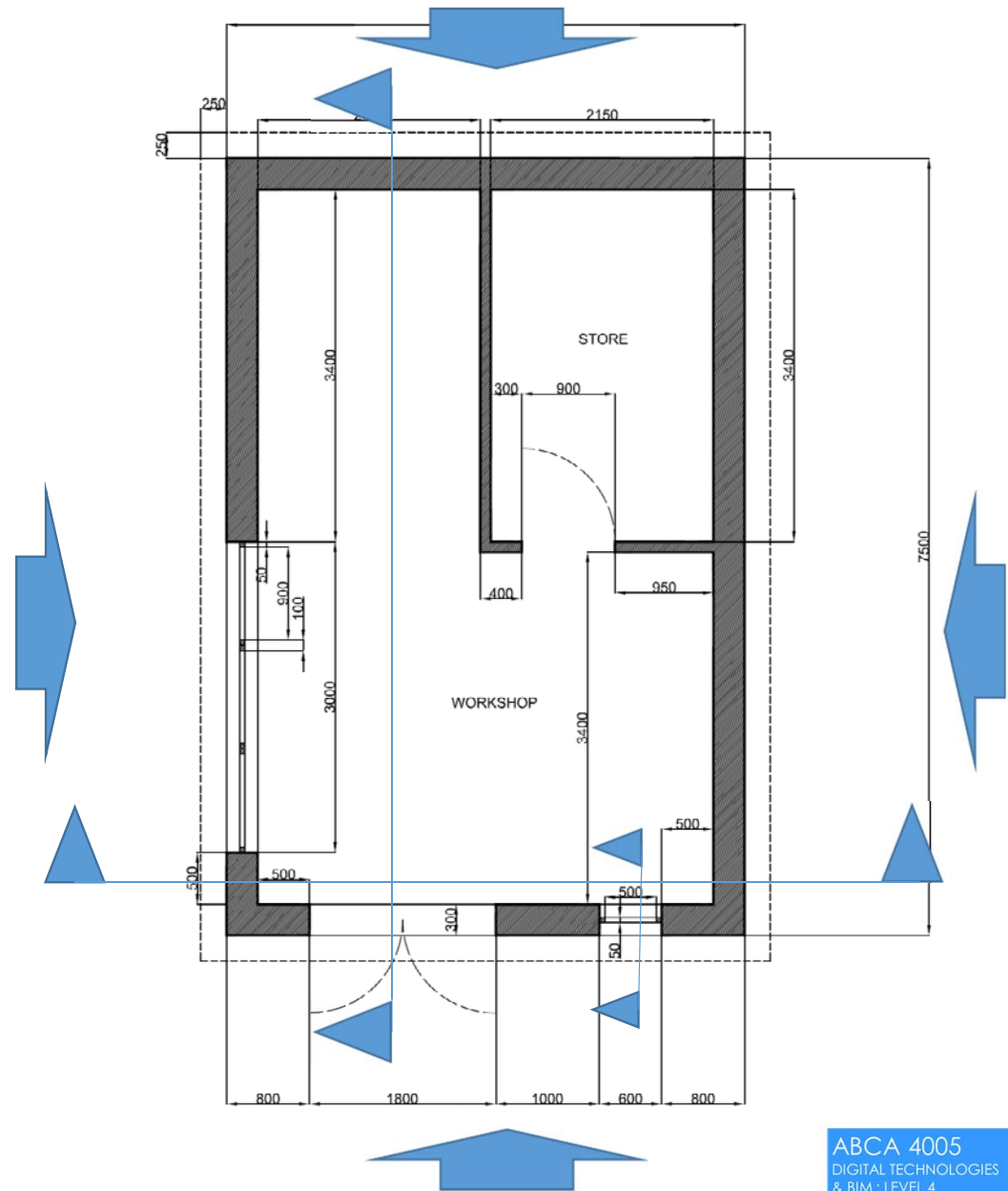
You will need to create a 'UCS' for each

Create appropriate layers

Prepare the detailed section through the window.

Wall construction:

- 100mm Brickwork
- 100mm cavity
- 80mm insulation
- 100mm blockwork
- 12mm plaster



Model Space and Paper Space – Layout and Scale

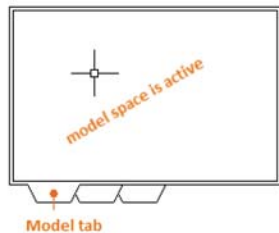
Layouts

Display one or more scaled views of your design on a standard-size drawing sheet called a layout.

After you finish creating a model at full size, you can switch to a *paper space layout* to create scaled views of the model, and to add notes, labels, and dimensions. You can also specify different linetypes and line widths for display in paper space.

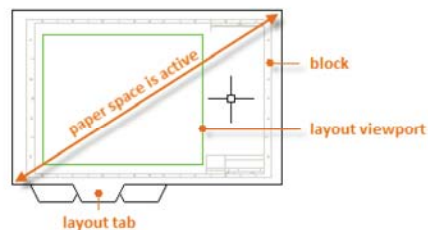
Model Space and Paper Space

As you know, you create the geometry of your model in *model space*.



Originally, this was the only space available in AutoCAD. All notes, labels, dimensions, and the drawing border and title block were also created and scaled in the model space.

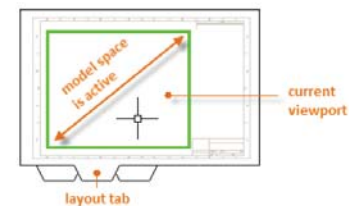
After *paper space* was introduced, you could click a layout tab to access a space designed specifically for layouts and scaling. In the following illustration, paper space is active. There are currently only two objects in paper space: a drawing border block, and a single *layout viewport*, which displays a view of model space.



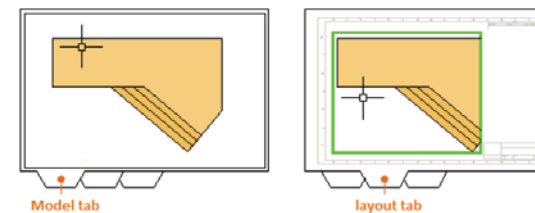
Working with layout viewports is described in more detail later in this topic.

Layout Viewports

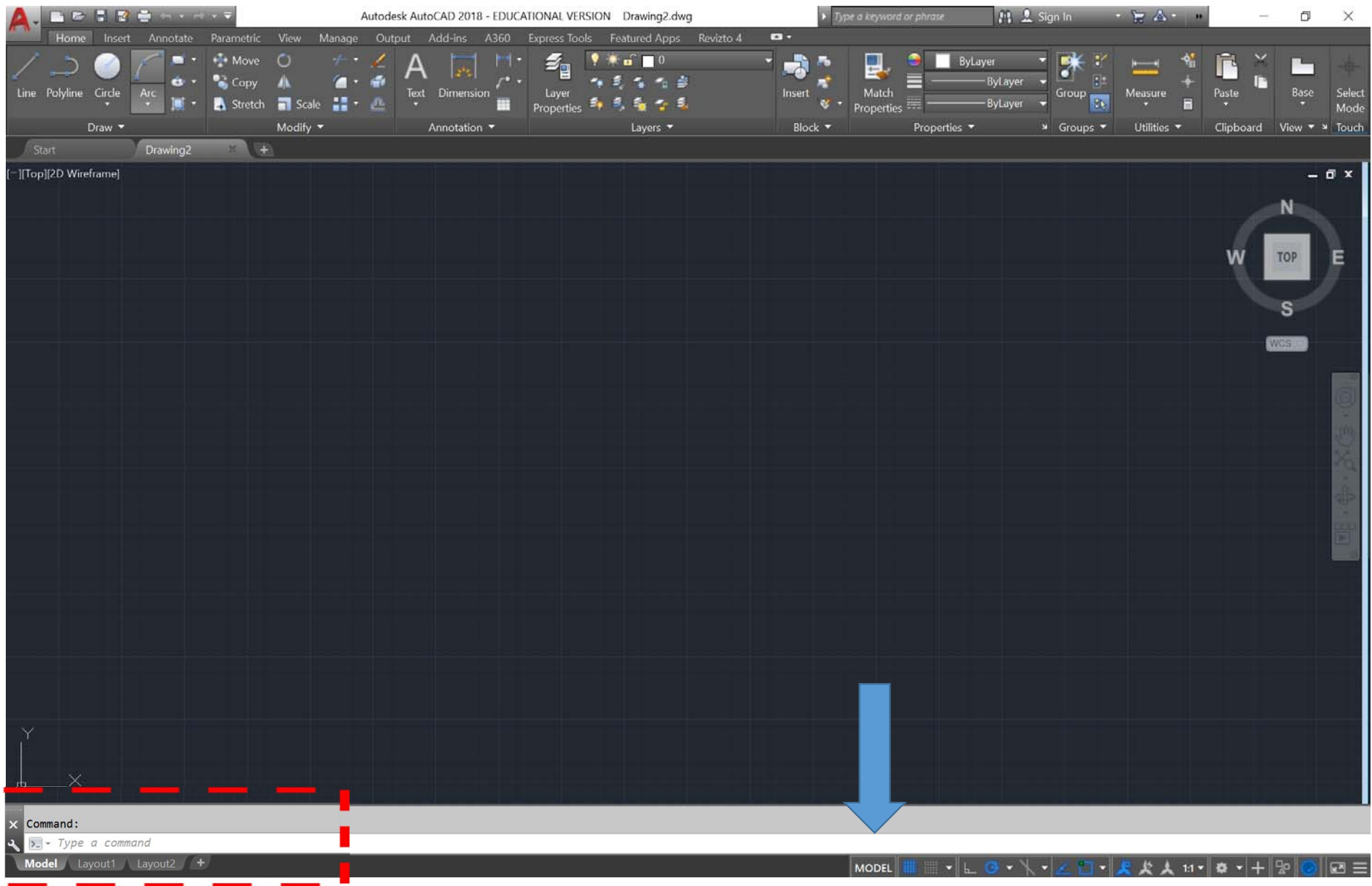
A layout viewport is an object that is created in paper space to display a scaled view of model space. You can think of it as a closed-circuit TV monitor that displays part of model space. In the illustration, model space is active and accessible from within the current layout viewport.



In a layout, when model space is active, you can pan and zoom, and anything else that you could do on the Model tab. For example, let's say that you created a backyard deck design in model space, and now you want to lay out and print your design from a layout tab.



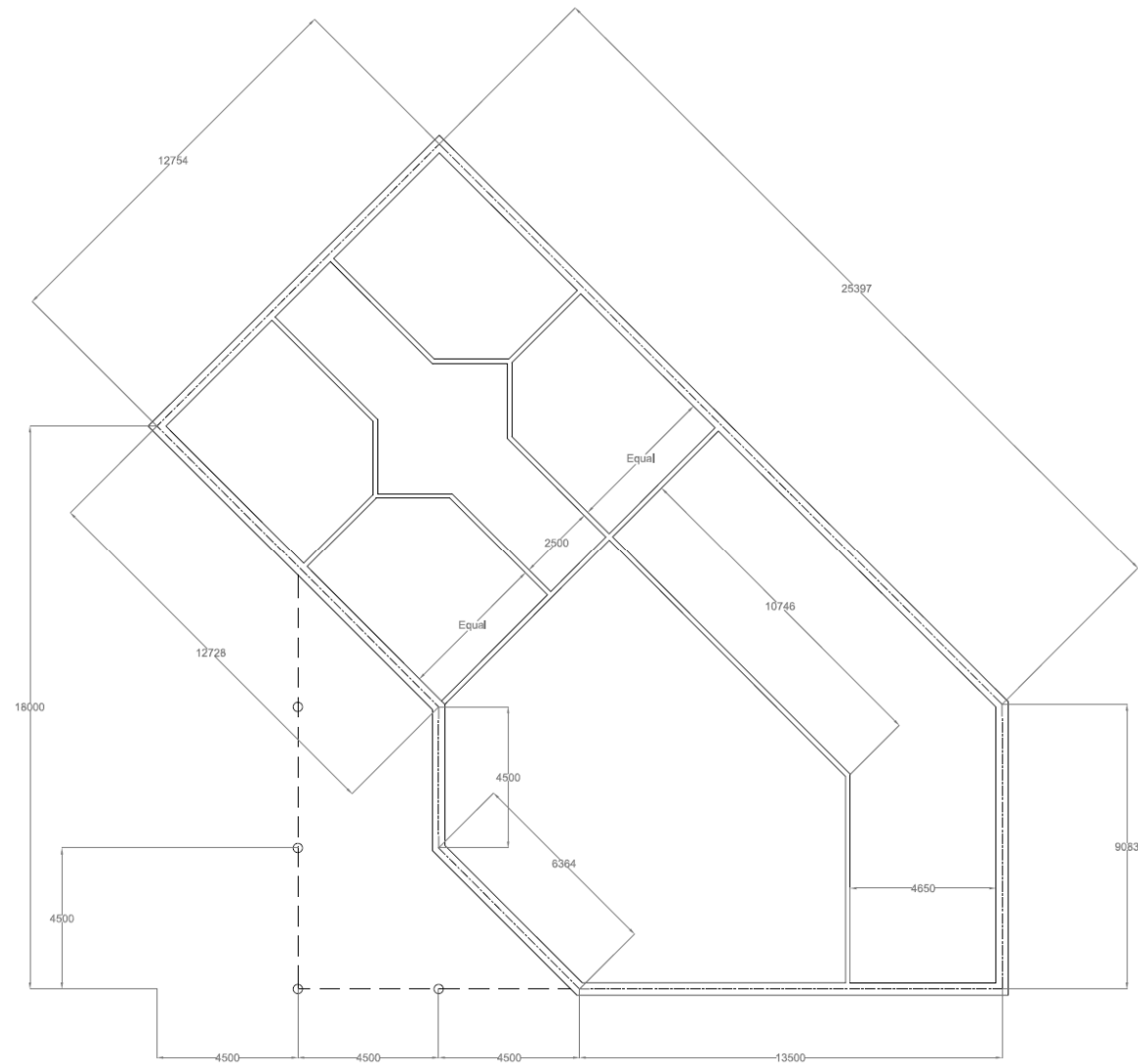
The view in the layout viewport is not yet set to the correct scale.



Exercise 4

Some sketch plans need to be drawn for a new office block. General dimensions are give opposite.

Download the file from Moodle and add the data required.



External walls 400mm thick
Internal Walls 150mm thick

Columns 300mm Ø

Create Layers,

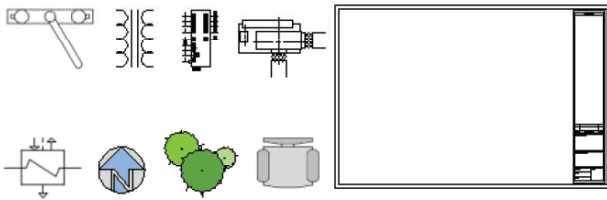
Add Windows to external walls
Add internal 900mm wide single doors
Add external 2000mm wide double doors

Working with Blocks

Blocks

Insert symbols and details into your drawings from commercial online sources or from your own designs.

In AutoCAD, a *block* is a collection of objects that are combined into a single named object. The following are some sample blocks at various scales.



Some of these blocks are realistic representations of objects, some are symbols, and one of them is an architectural title block for a D-size drawing.

Blocks can be used in your drawings to help simplify your CAD work and making it more efficient use of time. Typical blocks may be – Toilets, sinks, furniture, people, vehicles etc.

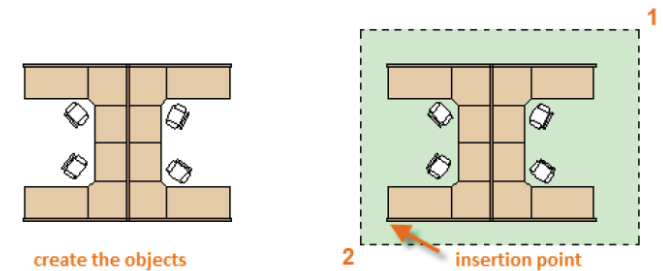
Create a Block Definition

Instead of creating a drawing file to be inserted as a block, you might want to create a block definition directly in your current drawing. Use this method if you do not plan to insert the block into any other drawing. In that case, use the **BLOCK** command to create the block definition.

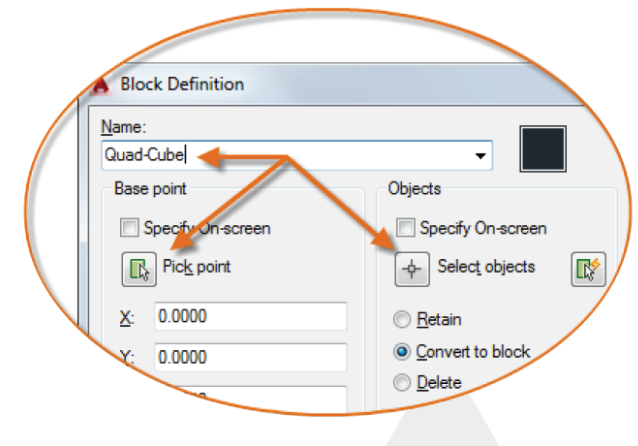


For example, this is how you could create a module for a cubicle design.

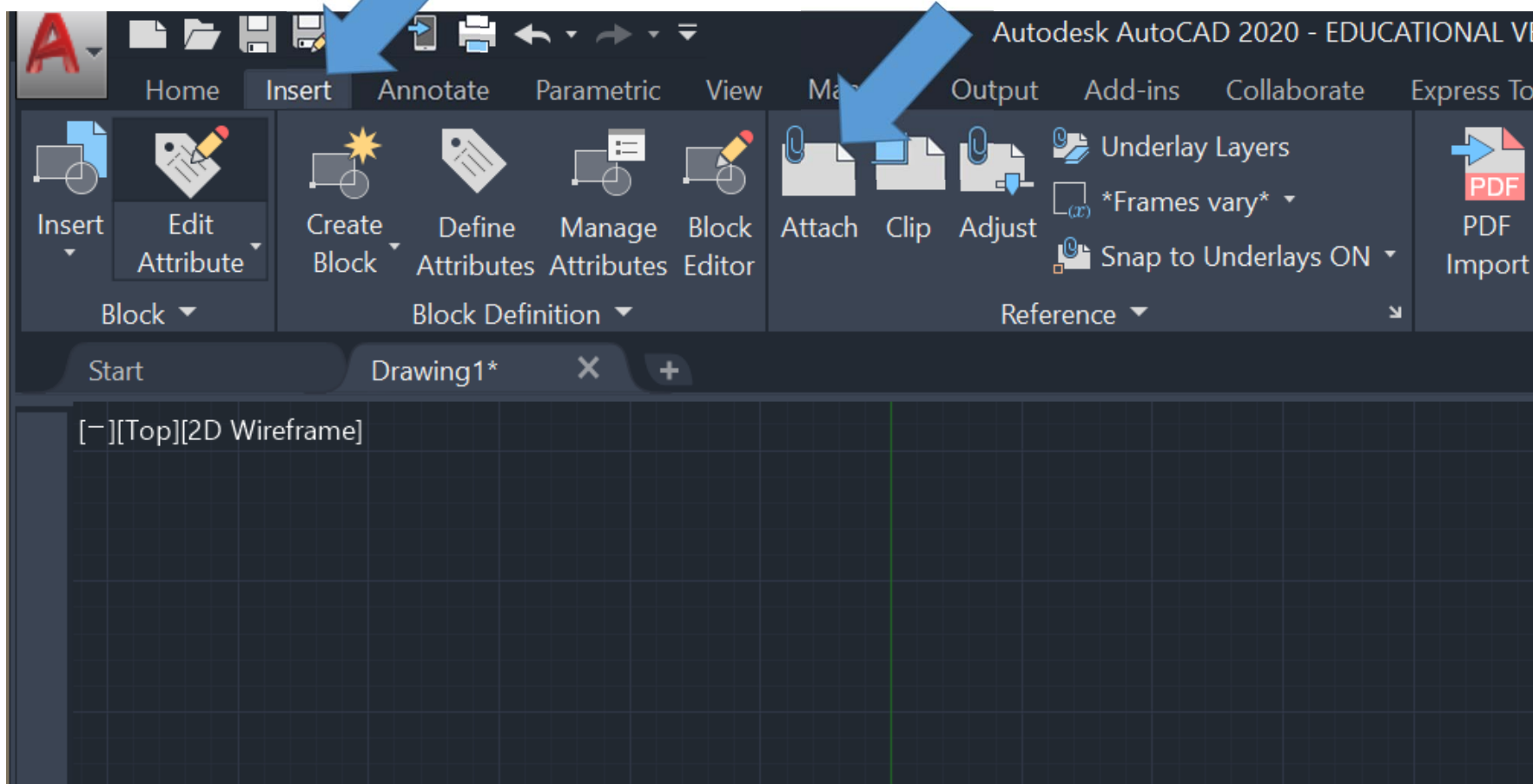
1. Create the objects for the block.
2. Start the **BLOCK** command.
3. Enter a name for the block, in this case Quad-Cube.
4. Select the objects that you created for the block (click 1 and 2).
5. Specify the block insertion point.



You can enter the information for steps 3, 4, and 5 into the Block Definition dialog box in any order.



Working with Images



Working with OS Maps

The screenshot shows the Digimap website interface. At the top, there is a navigation bar with the Digimap logo and links for Resources and Subscribing. Below this is a secondary navigation bar with links for various map types: Ordnance Survey, Historic, Geology, Marine, Environment, Aerial, Lidar, Global, and Society. The main content area displays a historical map of Edinburgh, showing streets, buildings, and landmarks like Castle Bannard and St. Andrew. A text overlay on the map reads: "Historic Collection gives rich historical mapping for multiple epochs dating back to the 1840s, invaluable for Digital Humanities and understanding change over time. Learn More".

OS Maps are drawn in Metres

Scale in AutoCAD by 1000 to convert into millimetres

Use 'SCALE' command

Using basepoint 0,0

What is Digimap?

Digimap is an online map and data delivery service, available by subscription to UK Higher and Further Education establishments. Operated by EDINA at the University of Edinburgh, Digimap offers a number of data collections, including Ordnance Survey, historical, geological, LiDAR and marine maps and spatial data.

What are we offering?

Digimap offers access to a range of datasets for the purposes of education and research. Create or interrogate a map online by selecting an appropriate base map, adding annotations and customising the content, use measurement and query tools to learn more about any study area. Download the raw spatial data in a wide range of formats for use in local GIS, CAD or image processing software.

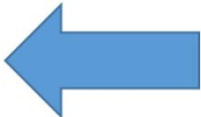
Subscription Information

Digimap is available to members of subscribing higher and further education institutions in the UK. Individual registration is required, but the service is free at the point of use. More information about subscription fees can be found on our [website](#).

<https://digimap.edina.ac.uk/>

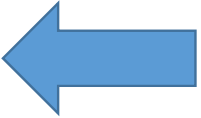
UWTSD Title Block / Template File

General	Architectural	Electrical	Interior Design	Landscape	Mechanical	Structural



Layering conventions
to British Standards.

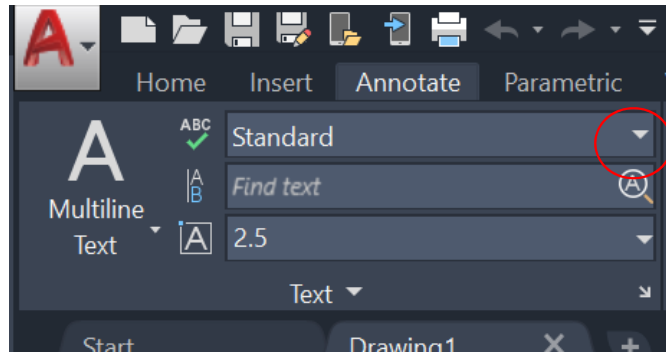
UNIVERSITY OF WALES TRINITY SAINT DAVID BIM NAMING CONVENTION GUIDE: All files: Models, Drawings & Documents									
File Code	Project	Originator	Zone	Level	Type	Role	Number	Description	Subtype
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Numbering to Building
Information Modelling
standards.

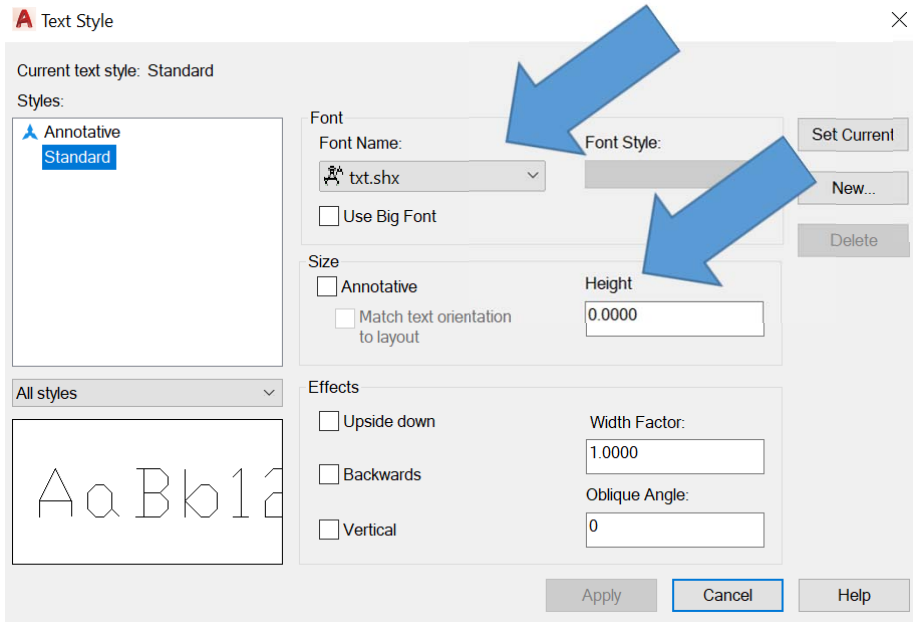
Property Name	Unnamed	UPRN - UWT SD - 0001	Prifysgol Cymru University of Wales	(S0) UNCONTROLLED ISSUE NOT TO BE USED AS A REFERENCE DOCUMENT CHECK STATUS BEFORE QUOTING
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Working with Text



Current
Text Style.

Current
Text Size
(height)



From the drop down arrow under Text Style
Select Manage Text Style

Dialogue box will open.

Text can be added to a drawing and
multiline text 'MTEXT' or Single line text
'TEXT'

Text height can be adjusted to suit your
output requirements.

EG. For 2.5mm height text on your drawing
when printed out. Multiply the text height
by the scale of the drawing.

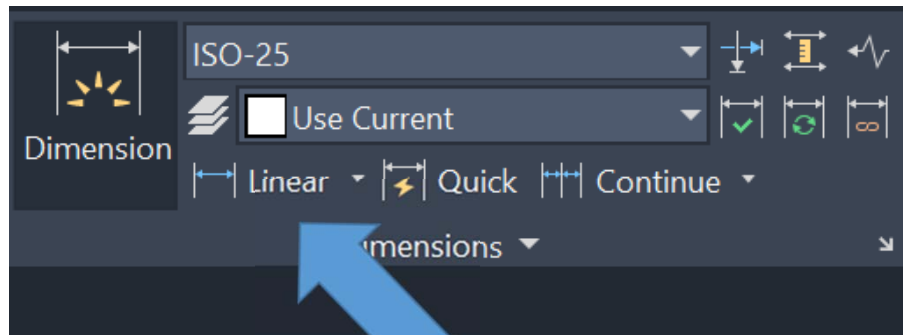
For 1:200 drawing

$2.5 \times 200 = \text{Text height of } 500\text{mm}$

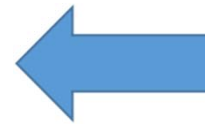
For 1:100 drawing

$2.5 \times 100 = \text{Text height of } 250\text{mm}$

Working with Dimensions



Dimension type



Current Dimension Style.

From the drop down arrow under Dimension Style Select Manage Dimension Styles

Dialogue Style Manager will open.

You can select the current Dim Style from preloaded styles / Modify a Style or Create your own style.

Consider the Output scale to determine the size of the dimension arrows and text.

EG. For a dim text height of 2.5mm on a 1:200 drawing.
 $2.5 \times 200 = 500\text{mm}$ (dimension text height)

