C3

UNI VERSITY OF NEW SOUTH WALES
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TUTORIAL INTRODUCTIONS TO CAD

AUTOCAD 2000 - Drawing the Granny Flat Plan

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In this tutorial we are going to produce a simple plan drawing of a "granny flat" (illustrated in Figure 1). In this exercise you will follow through one method of drafting using AutoCAD. *Although the tutorial is clearly directed towards architectural drawing, some attempts will be made along the way to suggest how these techniques can be applied to other disciplines.*

> *It is important that you don't just follow the instructions in a "cookbook" style, but that you observe the process, watching the AutoCAD prompts in the Command Window. You should gradually become sufficiently confident with the basic commands of AutoCAD to start trying things out for yourself: don't be afraid to try to do things a different way to that described in these notes!!*

Using the Undo command ...

Undo – Redo command tools

Note that you can always use the *Undo* command to recover from errors made: simply click the *Undo* tool button (illustrated) on the *Standard* toolbar or type **u** ↵ in response to the "Command:" prompt. This command reverses the effect of the last command executed. You can use it as many times as you like to "undo" back through your drawing session (at least as far back as the last time you "saved" the drawing to file). Note that the *Redo* command only reverses the most recent undo operation.

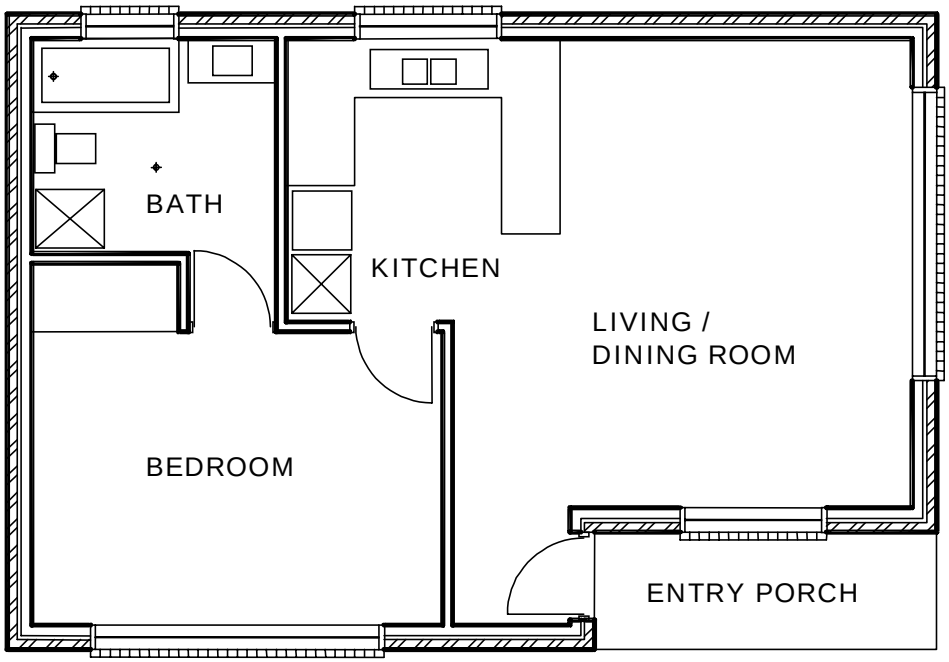


Figure 1 - The completed "Granny Flat" Drawing

GETTING STARTED

Assigning a file name to your new drawing ...

To begin this tutorial, fire up AutoCAD (using *Architectural Desktop*) in the way described in the first tutorial. Select the *Start from Scratch* button using the *metric* option. Once AutoCAD is loaded, it is prudent to begin by telling it where you want to store this drawing: select *File* > *Save As* and, on drive S: (the student storage folder) and in your own user's folder, enter any name of your own choice for the drawing file.

Setting up this drawing ...

Don't neglect to go through this step!!

Note that, since we are about to begin a new drawing, you will need to set the *Units* and *Limits* for this new drawing. For this exercise, make your drawing size about **15,000 x 12,000**. Simply follow the same steps as you did during the last two tutorials: if you can, try to do it from memory by following the AutoCAD prompts (you'll find the commands in the *Format* menu). Don't forget to use *Zoom All* to view your whole drawing sheet before proceeding.

Precision Drafting ....

*... the **Object Snap tools**.*

Before proceeding with this tutorial, we need to say a few things about the Object Snap tools that were introduced in the last two tutorials. Whenever you are required to use object snap, I will indicate that by nominating which one should be used, as in the following examples: |ENDPoint|, to snap to the end point or corner of an entity; |MIDpoint|, to snap to the midpoint of an entity; or |PERpend|, to snap to a position so as to create an entity that is perpendicular to the selected entity; etc.

There are several ways to activate the object snap tools and I will leave it entirely up to you which one you use in each context:

- Generally, the simplest way is to use *Running Objects Snaps*, combined with *Polar Tracking* and *Object Tracking* as described in Tutorial C2. This allows you to pre-select the ones you are likely to use, and then let AutoCAD suggest them to you as you draw.
- Picked from the *Object Snap toolbar* (as illustrated, which you can have floating or docked all the time if you wish!).
- Picked from the *Object Snap flyout* located around the middle of the *Standard* toolbar (*hold down the mouse button over the flyout button and then move through the buttons slowly, reading the description of each on the status line*).
- Typed in at the *Command Window* prompt (using the capitalised letters only).
- Picked from the *pop-up cursor menu* (activated by holding down the <**Shift**> key and clicking the *right mouse button*).

Floating Object Snap Toolbar

You should feel free to experiment with these now if you wish. You will be expected to know how to activate them in different circumstances as you proceed.

DRAWING THE WALLS AND OPENINGS

A labelled plan of the granny flat is shown in Figure 1, serving as a guide for the following description. We will assume that north is up the page and refer to things like "NE corner of the living room", etc). We will start by drawing the external walls using *Multilines*, beginning at the SW corner of the bedroom.

How can we use multilines??

A *multiline* is simply a series of up to 16 parallel lines that are drawn as a single entity. Before using this entity, we have to define the *style* (number and spacing of the parallel lines) that we wish to use. AutoCAD's *standard* multiline style (the only one that is pre-defined) consists of two lines 1 drawing unit (in our case, mm) apart! We want the external wall to represent brick veneer construction, with an inner skin consisting of a 100 timber stud wall, a cavity of 40 mm, and a 110 outer brick skin. Further to that, we want to set out the multiline relative to

the inside face of the inner skin, so that as we draw the line, we are actually tracing the inside face of our little building.

Multilines are great for drawing walls in plan, but they are also useful for drawing paths, roads and kerbing on site plans. Their major limitation is that they cannot be curved.

Defining a Multiline Style ...

Format > Multiline Style	Begin by issuing the *Multiline Style* command from the pull-down menus ... AutoCAD will open the *Multiline Styles* dialogue box ... then follow the steps set up below ...

- highlight the existing entry in the text box labelled **Name:** (probably "STANDARD"), and then type **bv** (standing for "brick veneer") in its place;
- then go to the text entry box labelled **Description:** and enter **Brick Veneer Wall**;
- click the *Add* button … this adds the new style to the list of available styles and assigns it the properties of the *current style* (*standard*, in this case);

NOTE

Once you have used a multiline style to draw some multilines, you cannot go back and alter the properties of that style.

- next, click the *Element Properties* button to open the *Element Properties* dialogue box so that we can define the number and spacing of parallel lines for this style;
- in that dialogue box, highlight the first entry in the list and then double-click the number (probably "0.5") labelled **Offset** … type **250** in its place … then highlight the second entry and replace its offset with **140**;
- next, click the *Add* button to insert another offset … its value will be set to 0.0 … simply replace that value with **100**;
- Now click the *Add* button again, leaving the offset value as 0 …we have now defined 4 offset lines, the last positioned at 0.0 offset ... *I hope you can see how that defines a brick veneer wall in plan view!*
- click the *OK* button to return to the *Multiline Styles* dialogue box … do not be tempted to click the *Save* button … that button is only used if you want to save your multiline definitions in a file that can be loaded into another drawing;
- in the *Multiline Styles* dialogue box, make sure this new style is the one named in the *Current* box and click *OK* to return to your drawing!

Although that process was tedious to explain, it is really very simple and quick. You will have a chance to define your own multiline style in a few moments when it is time to draw the internal walls!

Now to start drawing the walls ...

To accurately draw the walls, we will type in the end point coordinates of each multiline relative to its start point. These are referred to as *relative coordinates*, and can be entered as either an *X/Y coordinate pair* or a *polar coordinate* ... we will use a mixture of both, explaining the syntax as we go along.

Multiline drawing tool.

[Draw.Multiline]	Issue the *Multiline* command …
s ↵	Select the scale option … in case the scale factor is set wrongly …
1 ↵	Set the scale as 1 … then select a starting point near the lower left corner of the drawing area (by moving the cross-hairs to that point and then clicking the left mouse button), then describe the internal dimensions of the flat thus …
@5500,0 ↵	"@" means a relative distance ... 5500 in the X direction and 0.0 in the Y direction in this case ... results in a horizontal line 5500 long.
@0,1200 ↵	Entry door.

Polar Tracking

Entering these lengths would be a lot simpler using Polar Tracking as explained in Tutorial C2 … you should use that method if you can recall how to do it!!

@3500,0 ↵	Wall adjacent to entry porch.
@4800<90 ↵	This is a *relative polar coordinate* (used here purely so that you can se how it works!) ... it means "4800 at 90° anti-clockwise from 0°" ... that is, UP!
@9000<180 ↵	Another *relative polar coordinate* ... 9000 at 180° anti-clockwise from 0° - ie LEFT.
c ↵	Closes the multiline by connecting it back to the starting point ... you should now have a simple plan outline!

Zooming in to get a larger view of the drawing ...

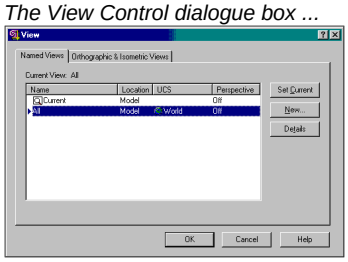
Zoom Window tool.

Click on the *Zoom Window* tool (*Standard* toolbar) and point to two positions just outside opposite corners of your "granny flat" to define a rectangle (referred to as a "window") around it - AutoCAD will redraw your drawing showing only the part defined by the window.

Saving a displayed view by giving it a name ...

Since this is a convenient "view" of the drawing (that we will probably want to come back to time and time again), we are going to save it as a *named view* ...

The View Control dialogue box ...



View > *Named Views*	Or click the button illustrated … calls up the *View* dialogue (illustrated at the left) ... click the *New* button...
All	Enter the name "All" in the *View Name:* slot of the *New View* dialogue box … leave the *Save UCS* option selected and then click the *OK* button … in the *View* dialogue, click the *Set Current* button followed by *OK*.

Drawing the Internal Walls

We are going to use a similar method now to create the internal walls. These are single-skin timber walls 100 mm wide. *You need to begin by creating an appropriate multiline style (let's call it "ts", for timber stud wall) using the technique described earlier ... see if you can do that by yourself without having to get help from a tutor!*

Once you have created the new multiline style for the internal walls, proceed as follows to create the internal wall that begins as the north wall of the bedroom (at the back of the built-in wardrobe).

[Draw.Multiline]	Invoke the multiline drawing tool ... AutoCAD prompts for a starting point or to select one of the options ...
j ↵	Choose the *Justification* option ... AutoCAD normally draws the multiline below or to the right of the cursor position as we draw (as it did for the external walls) ... this time we want the line that we enter treated as the "bottom" of the multiline, that is, have the multiline constructed above and to the left of the cursor position ... to do that, proceed as follows ...
b ↵	Select the *Bottom* option ... now we are ready to enter the starting point, but we need to use a snap mode ...
|FROM|	Invoke the *FROM* object snap tool ... we do this because we want to start this wall at an exact measured distance (3700 mm) *from* the SW corner of the bedroom ...
|ENDPoint|	Invoke the *ENDPoint* object snap mode because we need to snap onto the SW corner of the bedroom ... use the mouse to position the object snap box over the inside SW corner of the bedroom.

Running Object Snaps …

You will find it useful in this section to set a few running object snaps …

From Object Snap Tool

@3700<90 ↵	A *relative polar coordinate*, meaning 3700 mm at an angle of 90^{o} relative to 0^{o} (taken as the "3 o'clock" direction and measured anticlockwise) ... this fixes the starting point of the multiline!
@1500<0 ↵	First segment of the multiline - north wall of wardrobe.
@700<270 ↵	700 mm "down" - east side of wardrobe.
@2700<0 ↵	Remaining north wall of bedroom ... note that to enter the last wall (east wall of bedroom) we use another object snap mode ...
|PERpend|	Use the *PERpendicular* object snap mode to select the internal face of the south wall of the granny flat - AutoCAD will snap to a point on that line such that the multiline segment being drawn is perpendicular to it.
↵	To terminate the command.

Now it's your turn again!

That completes the main internal wall. *Don't worry yet about cleaning up the junction where this wall abuts the external wall ... we will come back to that very shortly.*

Don't miss this step ...

Using similar techniques, you should now draw the east wall of the bathroom, beginning 2500 to the right of the inside top left corner of the plan. Note that you will again need to use the |FROM|, |ENDpoint| and |PERpend| object snap modes in order to construct that multiline.

Blips …

This section will be easier to understand if you turn on "blipmode" … in this mode, AutoCAD marks each point entered by you with a small cross known as a blip … this can be a helpful guide.

*Type **blipmode** ↵ and then type **on** ↵ to select that option …*

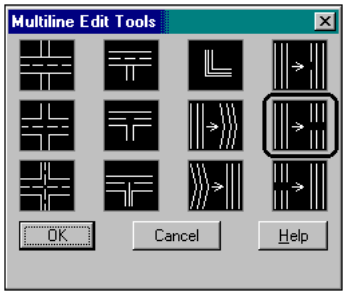
To remove blips from the screen, simply do a screen redraw …

Breaking Openings in the Walls

We now have to break openings into the walls for the windows and doors. There are (at least) two ways of doing that ... I'm going to show you both because that provides an opportunity to explore a range of AutoCAD tools.

The main one we will use is the *Multiline Edit* command, using that initially to create a 3000 opening in the south wall of the bedroom (see the completed plan). You will then use the same method on your own to create most of the other openings ... the two openings in the north wall of the plan will be done later using a different method that I will show you.

Multiline Editing ...



Multiline Editing Tool dialogue box

Begin by selecting *Modify* > *Multiline* from the pull-down menus. AutoCAD will open the *Multiline Edit Tools* dialogue box as illustrated in the left margin. Notice some of the tools available (each depicted by an "image tile" which operates a bit like a command button): you can clean up intersections where multilines cross or where they meet at a T-junction (first two columns); you can clean up corners and add/delete vertices (third column); and you can break or repair openings in multilines. Click on the *Cut All* option (as indicated in the illustration) and then click *OK* ... notice that AutoCAD prompts you to select the multiline that you want to cut ... *don't point to it just yet, but rather proceed as follows (we need to "pick" the multiline at the exact spot where we want the cut to be made!)*:

|FROM| *object snap tool.*

|FROM|	Activate the *FROM* object snap tool (by one of the methods described at the start of this tutorial) ... you'll see why we do this in a minute!
|ENDpoint|	Activate the *ENDpoint* object snap mode and pick the SW inside corner of the bedroom ... AutoCAD will prompt you for an *Offset* from that corner ...

@600,0 ↵	Enter a relative coordinate to define the offset ... these three steps have accurately selected a point exactly 600 mm from the inside corner of the bedroom ... *AutoCAD will use that point to identify the multiline to be cut AND to specify the first cut point (or the beginning of our opening)* ... AutoCAD prompts for the second point (other end of the opening) ...
@3000,0 ↵	Locates second end of opening 3000 mm further along the multiline, leaving an opening of 3000 mm.

Notice that the prompt is ready for you to select another position for an opening (with *Cut All* still selected). You should be able to follow the same steps to cut each of the other openings in both the external and the internal walls ... the size and position of each is described in the following list (along with some hints where appropriate). ***Do not yet create the openings in the north external wall for the bathroom and kitchen windows ... although they could be done this way, I want to show you a different way, just for the record!***

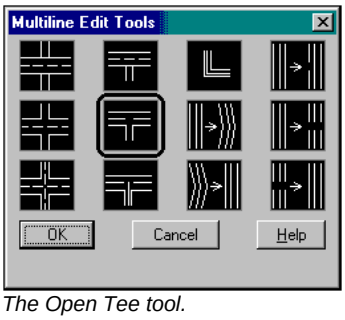
- the entry door opening is 900 wide, and positioned 50 up from the SE inside corner of the entry hall (use |FROM| and |ENDpoint| with an offset of either @50<90 or @0,50 ... *make sure you understand why both these offsets are equivalent!*);
- the opening in the south wall of the Living Room is 1500 long and positioned 875 back from the SE inside corner of that room (use |FROM| and |ENDpoint| again, but this time you are working backwards ... use an offset of @875<180 or @-875,0 and a similar expression for the second point);
- the window opening in the east external wall is 3000 long and positioned 500 down from the NE inside corner (work that one out for yourself!)
- the internal door opening to the bathroom is 900 wide, and exactly fits between the two walls (a bit tight for the builder, but who cares!) ... use |FROM ENDpoint| and specify its position from the corner of the wardrobe opening;
- the last door opening is the bedroom door ... it is 900 wide and is offset 50 from the NE inside corner of the bedroom.

When you have finished this section, it would be a good idea to save your work (if you have not already done so!)

Save Drawing tool.

Press ↵ when you have formed the last opening to terminate the command. I would also use the Redraw All tool to clear away the blips.

Cleaning up Multiline intersections



The Open Tee tool.

Now re-open the *Multiline Edit Tools* dialogue box and use the *Open Tee* intersection tool (circled in the adjacent illustration) to cleanup the four points marked in Figure 2. *The trick here is to always pick the multiline that forms the "leg of the Tee" first.* When you have finished the external wall junctions, your plan should match Figure 2 below.

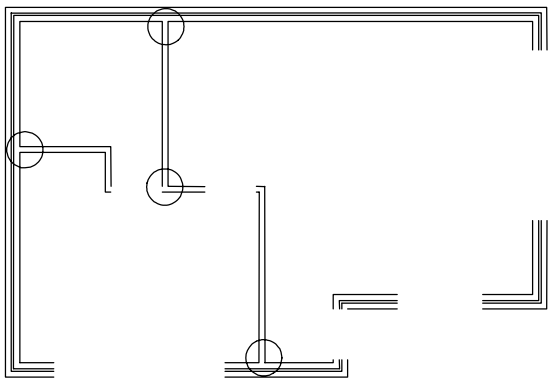


Figure 2
Drawing up to this point

It's been fairly quick and easy up to this point, but we now need to do a little housekeeping! The next section explains how to organise the drawing into layers for better drawing management. It also discusses some of the deficiencies of multilines and paves the way to introduce some other editing operations as we develop this drawing.

ORGANISING THE DRAWING INTO LAYERS

Describing the proposed layer structure for this drawing ...

Your drawing will now be beginning to look (almost) like an architectural plan! We now need to start thinking about organising the drawing into layers: we will have 4 separate layers for timber walls, brick walls, windows & doors, and furniture. Note that the default AutoCAD layer is called "0", and that is where we are drawing at the moment. We want to re-organise our drawing so that the internal walls and the inner skin of the external walls are on a new "timber" layer, and the outer skin of the external wall is on a new "brick" layer. We will do this by first creating a "brick" layer and moving everything onto it. We will then create the "timber" layer and move only the inner walls onto it.

Problems with multilines ...

This highlights a difficulty with the multiline entities. Because they are single entities, they cannot be spread between two layers (so that the inner skin is on a separate layer to the outside skin). In general, multiline entities are very useful for initial, quick development of plan drawings (as we have used them here), but can become fairly restrictive at later stages of detailing and editing of a drawing.

To avoid those detailing problems later, we can now "explode" these multiline entities to convert them into separate simple line entities. That gives us the best of both worlds: a quick tool for generating the plan layout (including openings); and sufficient flexibility to edit the drawing later. To issue the *Explode* command, proceed as follows:

Explode tool.

[Modify. Explode]	Issue the *Explode* command ... AutoCAD prompts you to select the objects to explode ... pick two points that define a rectangle that fully encloses all the multiline entities .. each entity should then be highlighted ...
↵	Press <**Enter**> to complete the selection process ... all the multilines will become simple lines ... there will no visible difference, except that if you pick one, only the individual line segment will be highlighted.

The next step is to create two new layers for this drawing and assign each a distinguishing colour. This is done through the *Layer Control* dialogue box ...

Layer Control tool (left end of the Object Properties Toolbar)

[Object Props. Layer Control]	Open the *Layer Control* dialogue box (illustrated in Figure 3) - this is used primarily for creating new layers and changing the properties (linestyle and colour) of existing layers - it can also be used to manipulate layers (freeze/thaw, on/off, lock/unlock, etc), but that is more conveniently done through the *Layer List* on the *Object Properties* toolbar (to be explained later).

The Layer Control dialogue box is vastly improved from earlier AutoCAD versions. Notice the filtering options available at the top of the dialogue.

Notice that the dialogue box displays a list of layers (initially only one, called 0) and a number of buttons. Click the *Show Details* button to expand the dialogue. Begin by clicking on the *New* button and typing the name of the layer that you wish to create, in this case **Brick**. To set the colour of the new layer, single-click on the colour box adjacent to that layer and select the colour red from the resulting colour dialogue box and click *OK*. Finally, create another new layer

called **Timber** and assign it the colour yellow. Once you have done that, dismiss the *Layer Control* dialogue by clicking the *OK* button.

NOTE: Filtering Layers

Clicking the button shown allows you to filter the layers that are listed in this dialogue or in the pull-down list on the Object Properties toolbar. In the Filter dialogue, set one or more criteria that identify the layers you wish to retain in the list. For example, you could list the layer names (separated by commas with no blanks) that you wish to include, or you could list one or more colours and have only layers of that colour(s) included in the list.

Show/Hide Details Option

The dialogue illustrated has the details shown (using the Show/Hide Details button). Showing the details only makes it a little easier (or provides an alternative way) to change the properties of selected layers ...

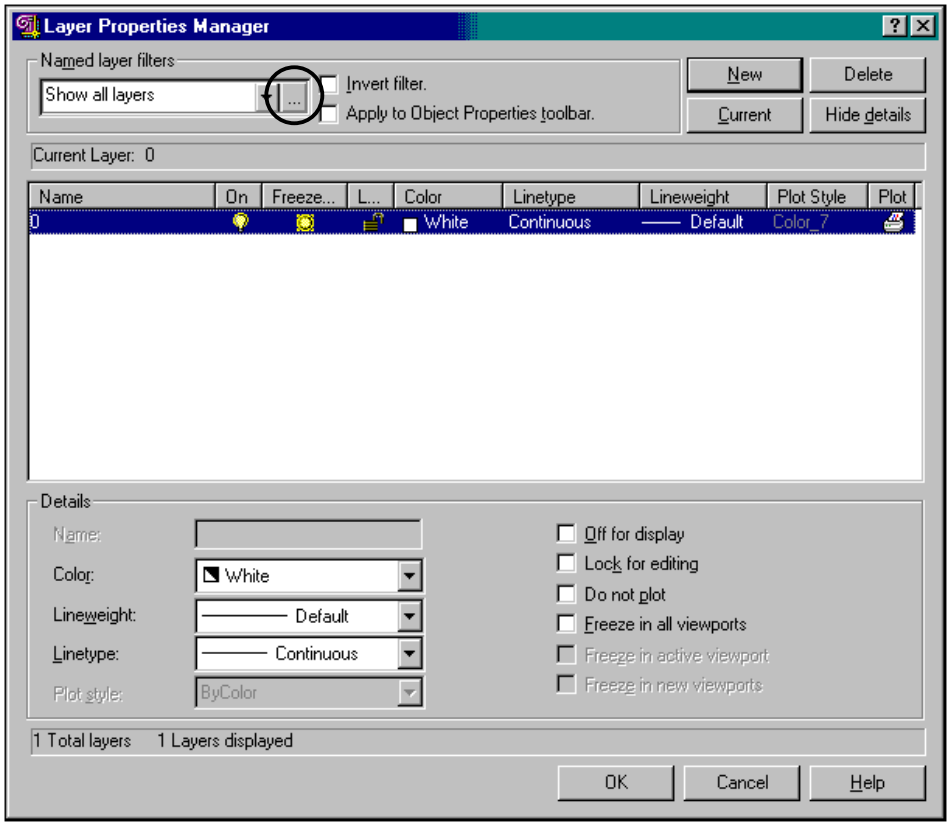
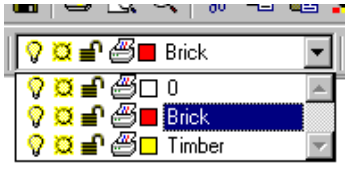


Figure 3 - The Layer Control Dialogue Box

Having created the new layers, we now have to change the lines on our drawing to lie on those layers. Proceed as follows ...

The first step is to select all the lines. That is easy in this case because we can use a selection window. Simply pick two points (*working from left to right*) that define a rectangle that fully encloses your plan. Pick the first point below and to the left of the SW corner of the plan, then pick the second point above and to the right of the NE corner of the plan. All the lines in your drawing will have been highlighted.

Note that you just used what AutoCAD calls a "Window Selection Rectangle" ... by working from left to right when constructing the selection rectangle, AutoCAD only selected the objects that were contained wholly inside it ... if you were to work from right to left, the rectangle would have been displayed dotted (known as a "Crossing Selection Window"), and all objects that either lie inside OR cross the rectangle would have been selected.

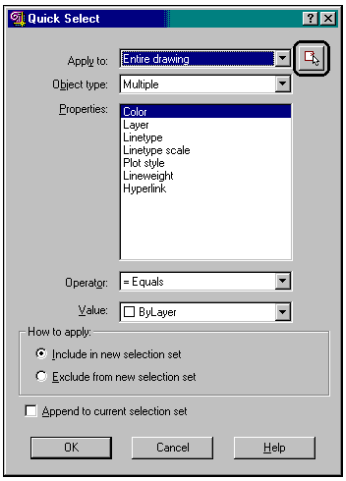


Layers Pull-Down Control list ..

Now pull down the list of layers on the *Object Properties Toolbar* and select the *Brick* layer. This will move all the selected objects to the selected layer. Press <**Esc**> twice to de-select the objects. All the lines in your drawing should now be on layer *Brick*, and therefore coloured red.

We now need to do the same thing with the internal walls to put them on the *Timber* layer. That is not as easy because they are harder to select. You could go through the tedious process of picking each one individually, but I will introduce the *Quick Select* command that will allow you to use two *Crossing*

Selection Windows (see note in the highlight box above) that will effectively select all the objects in four clicks of the mouse.



Quick Select dialogue box

Open the *Quick Select* dialogue (illustrated at left) by issuing the command *Tools* > *Quick Select* from the pull-down menus. Notice that the dialogue allows you to select objects by filtering out ones that have particular properrties in common. We will not be using that feature in this case. Simply click the *Select Objects* button (circled in the figure). The dialogue will disappear and you will notice that AutoCAD is prompting you to select objects.

Begin by typing **c** ↵ to tell AutoCAD that you wish to use a *Crossing Rectangle*. Then, pick the first two points indicated in Figure 4 (being careful to pick exactly inside the cavity). That will pick up most of the internal walls. You can then type **c** ↵ again to create a second *Crossing Rectangle* and pick the second pair of points to select the remaining parts of the internal walls. Press ↵ by itself to complete the selection process. The dialogue box will return. Simply click *OK* to dismiss the dialogue and you will be left with all the internal walls selected. Then pull down the layer list again and select *Timber* to move all the selected lines to the Timber layer. Press <**Esc**> twice to de-select the objects and the process is complete!

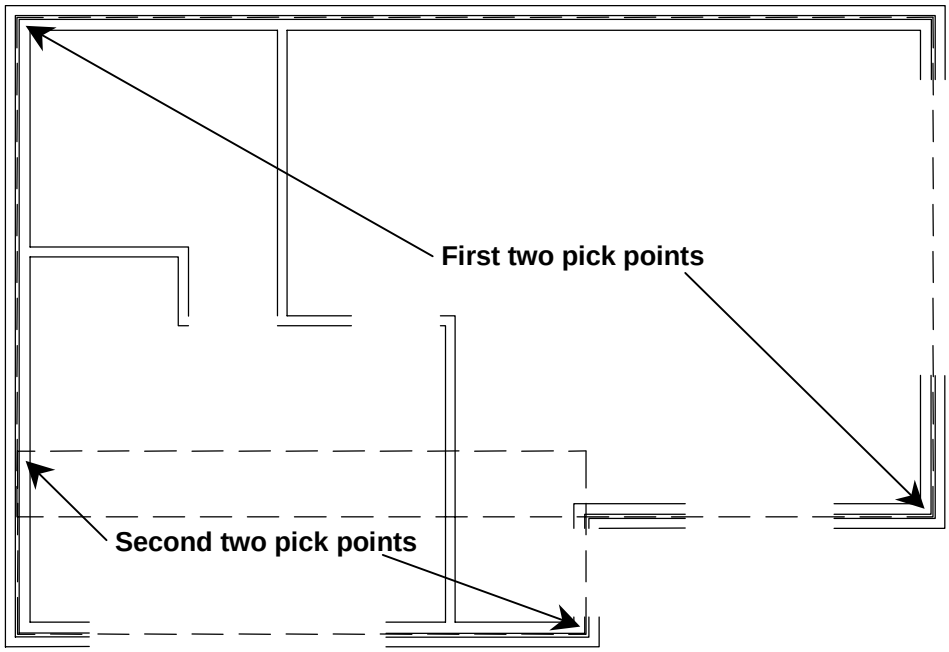


Figure 4 - Pick Points for Crossing Rectangles to Select Internal Walls

Setting the drawing background colour ...

If your AutoCAD happens to be configured with a white background in the drawing area, then you may not be able to see the yellow lines very clearly ... I suggest that you change the background colour for the graphics window (or, if you prefer, simply change the colour of the timber layer). To change the background colour, select *Tools* > *Options* and then choose the *Display* tab. Next, click the *Colour* button and, in the resulting dialogue box, set the *Model Tab Background* to any colour you like ... most people seem to prefer black, but you can try anything you like!

TECHNIQUES TO FINISH OFF THE WALLS

Introduction to the Trim command ...

We are now going to use the *Trim* command to create the last two openings in the external walls. Trim is one of the small number of basic entity editing tools that are typically available in CAD systems. It allows you to cut away (or trim off)

parts of existing entities against cutting edges made up from other entities. In this case, we will create a rectangle in the spot where the opening is to appear, then trim away the wall lines within the rectangle and then erase the rectangle. To make the opening to the bathroom ...


Rectangle tool.

The toolbar object snap modes did not work for me here ... use Shift-Right Mouse Button and pick them from the pop-up cursor menu instead ...


Trim command tool.

[Draw. Rectangle]	Select the *Rectangle* command ... we want to draw the rectangle at an offset distance from the NW inside corner of the bathroom, so ...
|FROM|	Invoke the *FROM* object snap.
|ENDPoint|	Invoke the *ENDPoint* object snap and pick the NW inside corner of the bathroom.
@500,-50 ↵	Position of lower left corner of rectangle (50 below the inside wall line so that it can be a little larger than the wall thickness).
@1000,350 ↵	Opening is 1000 long ... rectangle is 100 larger than the wall thickness of 250.
[Modify.Trim]	Select the *Trim* tool from the *Modify* toolbar ... AutoCAD prompts you to select all the objects to be used as cutting edges ... pick the rectangle that we just created.
↵	Press <**Enter**> to indicate that you don't want to select any more cutting edges (you can select as many cutting edges as you wish with this command) ... *AutoCAD now prompts you to select the objects to be trimmed ... simply pick each of the 4 wall lines where they cross the rectangle ...*
↵	Press <**Enter**>, when all four lines have been trimmed, to terminate the selection process and end the command.

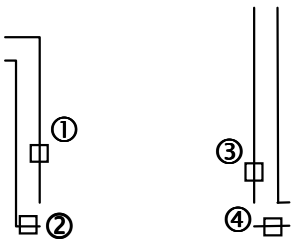
Now try it yourself on the last opening ...

Now repeat that process yourself in order to make the second opening for the kitchen window, which is 1500 long and positioned exactly 1800 away from the east end of the opening we just created. ***When you have finished, don't forget to erase the rectangles ...***

Introduction to the Fillet command ...

The next job to do with the wall lines is to patch up the internal walls around the bathroom door. To do that we use another basic editing tool known as *filleting*. The *Fillet* command is used to take any two objects (lines, arcs, etc.) that intersect or, if one or both were to be extended, would potentially intersect, and then extend or trim each one so that they meet, and finally insert an arc (of pre-defined radius) into the join of the two objects. *In its most common usage, the arc radius is set to zero so that the two objects join at a single point*. The illustration in the margin supports the following instructions to use the *Fillet* command to clean up the internal wall gaps ... *you should zoom in on this part of your drawing before proceeding (use the Zoom Window tool again).*


Fillet command tool.



Pick points for the fillet operation.

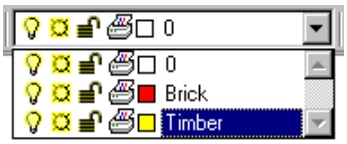
[Modify.Fillet]	Invoke the *Fillet* command ...
r ↵	Select the *Radius* option … AutoCAD seems to assume a radius of 10 as the default … we need to change that to 0 so that the lines join at a sharp point.
0 ↵	Radius of 0 … AutoCAD now prompts you to pick two objects ... *pick the two objects at the points labelled ① & ② in the illustration* ... AutoCAD should join the lines at a point.
↵	Press <**Enter**> to recall the *Fillet* command ... *repeat the process, this time picking the objects at the positions labelled ③ & ④ in the illustration* ...

..Zoom Previous tool.

Having zoomed in to do this editing, now use the *Zoom Previous* command to return to the last view that you had of your drawing

Cleaning up around the main entry door ...

The last step in cleaning up the walls involves closing off the ends of the two external wall skins around the main entry door ... this is so that we can later insert a door jamb across the cavity. *We don't have to worry about the other openings because they will be hidden by the window & door jambs in each case!*



Layer Control tool.

[Standard. Zoom Window]	Use *Zoom Window* to enlarge the area around the main entry door (as illustrated in Figure 5).
[Object Props. Layer Control]	Pull down the layer list (click the down arrow!) in the *Layer Control* tool (as illustrated) and pick the *Timber* layer ... this makes that layer "current", meaning that every new entity that we draw will be placed on that layer.
[Draw.Line]	Invoke the *Line* command ... use |ENDpoint| to pick on the two points labelled ① in Figure 5.
↵ ↵	Press <**Enter**> twice to terminate and then re-invoke the *Line* command ... *remember, you can always recall the last command* ... pick the points labelled ②to close the timber skin on the south side of the opening.
↵	Terminate the *Line* command.

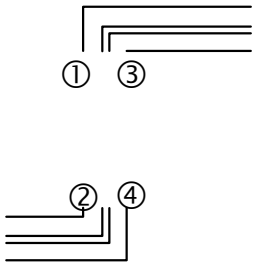


Figure 5 - Cleaning up the Main Entry Door

You should now make the *Brick* layer current, and then repeat the process to clean up the outer skin (points labelled ③ and ④ respectively). *Finally, use Zoom Previous to view the whole drawing again.*

CREATING THE WINDOW AND DOOR BLOCKS

Create a new layer ...

Before drawing the windows and doors, you need to create a new layer (which you should call "windoors") and then make that the *current* layer (by selecting it and clicking the *Current* button before closing the dialogue box). Do that yourself using the *Layer Control* dialogue, and making it any colour that you wish!

For the purposes of this exercise, we are going to draw the window and door symbols in a blank area of the drawing and then store them as *blocks*. Once created, *instances* of these blocks can be inserted anywhere on the drawing, at any rotation and scale. We will do the doors first (because they are all the same, and therefore slightly easier).

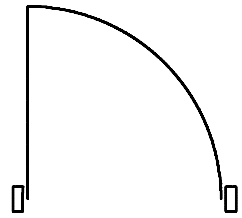


Figure 6 - The Finished Door Block.

Create and Insert the Door Blocks

Figure 6 shows what the finished door symbol will look like. We will begin by drawing a rectangular door frame (arbitrarily 100 x 40 mm), copy that to form the second frame and then draw the door swing as a *polyline*. Proceed as follows:

[Draw. Rectangle]	Issue the *Rectangle* command - pick a starting position in the living / dining area, roughly above the entry doorway.
@40,100 ↵	Top right corner of the rectangle - at this point, you may wish to zoom in on the door drawing to make your task easier.

[Modify.Copy]	Issue the *Copy* command in order to duplicate the frame at the other end of the door - in response to "Select objects:" prompt, pick the rectangular frame just created.
↵	To complete the selection process - then pick a "Base point" anywhere on the drawing to define the first end of the copy vector.
@860<0 ↵	To define the "End point" of the copy vector - door will be 900 mm wide with an opening width of 820 mm.

This polyline is to begin at a position offset from the lower-right corner of the left door frame by 20 mm in the X direction and 50 mm in the Y direction. First zoom in on the area around and above the two door frames and then proceed as follows:

Draw Polyline tool.

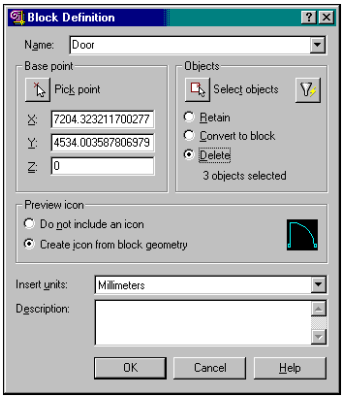
***NOTE**: you could use a combination of Polar Tracking and Object Tracking to make this drawing process a lot easier than described … feel free to try that for yourself!!*

[Draw.Polyline]	Issue the *Polyline* command - use |FROM| and |ENDpoint| (as described several times now!) and snap to the *lower-right corner of the left door frame*.
@20,50 ↵	Defines the "Start point" of the polyline as an offset distance away from the "Base Point" located at the lower right corner of the left door frame.
@780<90 ↵	Length of the door swing - 40 mm less than the door opening size!
a ↵	Selects the *Arc* option to initiate an arc segment in the polyline.
d ↵	Selects the *Direction* option to force AutoCAD to begin the arc in a specified direction.
@100,0 ↵	To specify the desired direction as "easterly".
@780,-780 ↵	To nominate the end point position of the arc.
↵	To complete the polyline command.

Make Block tool.

The next step is to convert this drawing into a "block" so that instances of it can be placed at different locations in the drawing.

- Issue the *Make Block* command from the *Draw* toolbar (illustrated);
- Enter the *Block Name* "**door**" in the space provided;
- Click the *Pick Point* button and use |ENDpoint| to locate the *base point* at the lower left corner of the door symbol;
- Click the *Select Objects* button and construct a selection box (window) around the entire door symbol to identify the entities to be included in the block;
- Make sure that the *Delete* option is checked since we don't wish to keep the entities used to create the block.

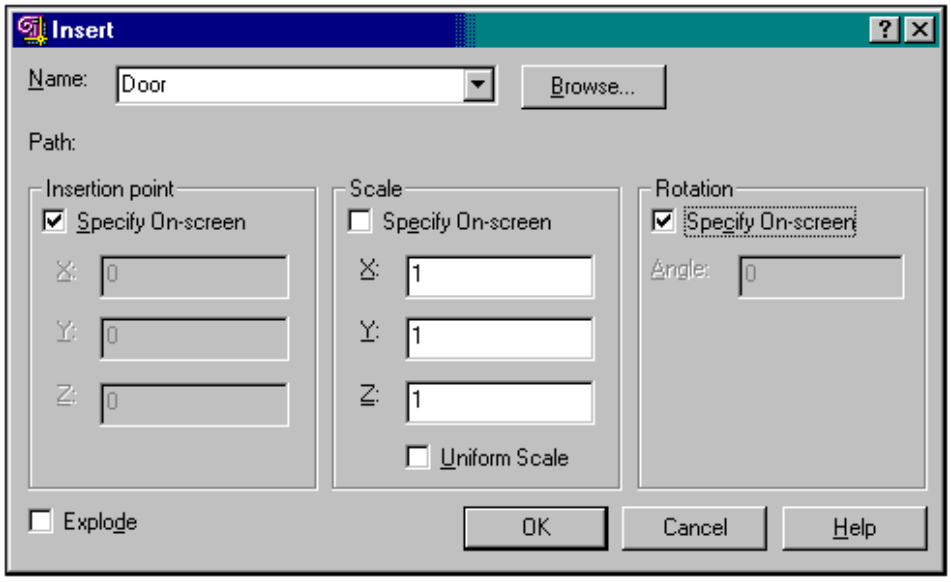


***Block Definition dialogue** …*

The procedure to insert the door symbol is controlled by a dialogue box. This may be opened by either typing **insert ↵** or clicking the *Insert Block* tool on the Draw toolbar. The dialogue box is illustrated over the page.

Insert Block tool.

Select the *Door* block by pulling down the list in the name box. We wish to position the block on the screen, so leave that option checked. We don't wish to change the scale of this block, so leave that option unchecked. However, we may wish to rotate the block as we insert it, so that option should also be checked as shown in the figure. Click *OK* when ready.



Zoom Window tool

[Standard. Zoom Window]	Issue a *Zoom Window* command (this is a transparent command, meaning that it can be executed while another command is active) ... zoom in on the entry door area of the plan - AutoCAD will perform the zoom and then automatically resume the insert operation.
|NEArest|	Invoke the NEArest object snap mode (this snaps to the nearest point on the entity selected) ... *pick a point just east of the cavity at the south end of the door opening for the main entry door* ... AutoCAD should snap to the line that closes the end of the brick skin - this sets the position of the insertion point.
90 ↵	Specify a rotation value of 90 … you could use Polar Tracking to specify this rotation rather than type it!

The Nearest Object Snap tool.

***NOTE**: using this specific object snap mode effectively overrides Running Object Snap which should still be in effect at this point …*

The first door should now be in position, neatly closing the 40 mm cavity. Use *Zoom Previous* to display the whole drawing. Use the same procedure to enter the other two doors, this time using |ENDpoint| snap to accurately position them and *Polar Tracking* to get the rotation correct.

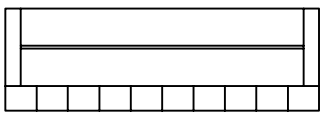
That completes the doors. We now have to make the windows, cross-hatch the walls and insert the furniture. We will then be ready to set up the final layout of the plotted sheet.

***Save Drawing** tool ...*

Don't forget to save your drawing before going on!

CREATE AND INSERT THE WINDOW BLOCKS

Brief outline of the plan for this stage ...



The Completed Window Block

The process this time is generally the same as for doors, except that there are three window sizes in this plan. We will therefore create three different blocks, one for each window size. The first window block will be created from scratch and then inserted. The second one will be created by modifying the first block, and then inserting that in two of the openings. The third window block will be created and inserted by you, on your own, so make sure that you understand the process the first two times! *Before proceeding, check that the current layer is set to **WINDOORS**, then create the first window block (as illustrated in the margin) as follows*:

Rectangle tool.

[Draw. Rectangle]	Issue the *Rectangle* command to draw the end frame member - select a starting point anywhere towards the lower left corner of the living area ...
@50, 250 ↵	Opposite corner of the rectangle.

Have a go yourself ...

Now, adapt the steps described when creating the door symbol, to copy this frame 950 mm to the right (this will create an overall window width of 1000 mm). You will probably want to zoom in on your window before proceeding ...

Draw Line tool.

ENDPoint Object Snap mode.

Offset tool.

[Draw.Line]	Issue the *Line* command to draw one side of the window (between the frames).
|ENDPoint|	Select the *ENDPoint* snap mode and then pick the top right corner of the left-hand rectangular frame.
|ENDPoint|	Specify the end of the line using *ENDPoint* snapping on the top-left corner of the second frame.
↵	Complete the *Line* command.
[Modify.Offset]	Issue the *Offset* command to draw the remaining lines along the length of the window.
120 ↵	Distance of offset - pick the line just created and then pick a second point below it.
↵ ↵	Complete the command and then recall the command a second time (to draw a second offset with a different distance).
10 ↵	Distance of offset - pick the line just created (by the last offset) and then pick a second point below it.

Now it's your turn again ...

Without further instruction, offset the line just created through a distance of 120 mm to complete the window .

We will now add an 80 mm brick-on-edge sill to our window using the *Line* and *Array* commands. You should draw the outline *Object Tracking* …

*Using **Object Tracking** to draw the outline of the window sill ...*

[Draw.Line]	Issue the *Line* command (not Polyline!!) … beginning with an |ENDPoint| snap on the SW corner of the window …
@0,-80 ↵	To draw the first segment 80 mm down the sheet ... Then use *Object Tracking* to pick the next point, lining up orthogonally with the other end of the window (with POLAR, OSNAP & OTRACK all selected, move the mouse over the SE corner of the window and then back to the approximately correct position so that you have two intersecting tracking lines, then click that point) …
|ENDpoint|	Snap to the SE corner of the rightmost window frame to complete the outline of the sill.
↵	To complete the *Line* command.

To draw the brick joint lines along the sill we use another useful drawing tool. This is called the *Array* command and works as follows over the page:


Array tool.

[Modify. Array]	Issue the *Array* command - this command is used to produce multiple copies of entities arranged in a rectangular grid (numbers of rows and columns) or a circular pattern - we will use the rectangular grid option have one row and several columns - *in response to the prompt, pick the left-most edge of the brick sill just drawn*.
↵	Complete the selection process.
↵	Accept the default *Rectangular* option.
↵	Accept the default *number of rows* (1).
10 ↵	Specify 10 *columns*.
100 ↵	Space between columns (*not precisely correct for bricks-on-edge, but will do for our drawing!*)

Forming the Window block ...


Zoom Previous tool.

Follow the same process as with the doors to create the window block and then use *Zoom Previous* to restore the earlier view and insert an instance of this block into the window opening in the bathroom (*hint: make the insertion point the SE corner of the window opening and rotate it through 180^{o}*).

Creating the second window block ...

To create the second window block, we will insert the first block in a blank area of the drawing, stretch it to the new length we require, and then save it under a different block name:

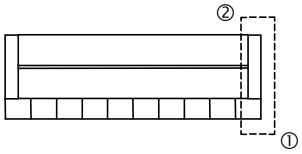
insert ↵	Issue the *Insert* command (by typing it, or using a toolbar if desired) - *without further instruction, place the instance in the living area of the plan, unscaled and unrotated* ... then proceed as follows ...
[Standard. Zoom Window]	Issue the *Zoom Window* command and zoom in on the window (*being careful to leave room to extend the window to the right*).


Zoom Window tool.


Explode tool.

[Modify. Explode]	Issue the *Explode* command and, as instructed by AutoCAD in the *Command Window*, *pick the window just inserted* - this will cause AutoCAD to convert this instance of a block back into normal graphics so that it can be modified.
[Modify.Stretch]	Issue the *Stretch* command - create a selection box beginning at the lower-right corner as illustrated in the margin (*being careful not to include any of the sill brick lines in your selection*).
↵	To complete the selection process - AutoCAD now prompts you to specify two points to define the distance and direction in which to "stretch" the portion of the entity that we have selected - *pick a point anywhere to serve as the base point of the stretch vector and then proceed as follows ...*
@500,0 ↵	Define the second point of the stretch vector - *the window should stretch to 1500 mm long.*


Stretch tool.



The Selection Box that should be used for the Stretch command in this example

Use the Array command yourself ...

Now use the *Array* command, as before, to duplicate the right-most brick sill line to fill the gap just created. *This time, specify 6 columns with 100 mm spacing.*

You can now finish off the windows all by yourself ...

When the window drawing is complete, create another new block out of it, this time called "w1500", making the insertion point again in the NW corner. Zoom out again and insert two instances of this new block, one in the kitchen window opening and the other in the window adjacent to the entry porch.

When that is complete, repeat this whole process again to create a third window block called "w3000", this time 3000 mm long. That is, insert the "w1500" block in a temporary location, explode it, stretch it by 1500 mm, use the *Array* command to duplicate the last sill line across 16 columns with 100 mm spacing, create the new block, and then insert instances of it into the dining / living room (east wall) and into the bedroom window openings.

We have now finished the base plan. The next step is to hatch the brickwork, then draw in the furniture and finally, set up the drawing sheet layout.

HATCHING

Make Object's Layer Current tool

(located on the extreme left end of the Objects Property toolbar above the drawing area)

Now that the windows are in position, it is possible to cross-hatch the outer skin of brickwork. To do that, we first need to make *Brick* the current layer, giving us an excuse to introduce another shortcut: the *Make Object's Layer Current* button (as illustrated). First click this button once and then pick any line on the *Brick* layer (red) … AutoCAD will then set the current layer to be the same layer occupied by that entity (ie. the brick layer).

Next, call up the *Boundary Hatch* command ...

Boundary Hatch tool …

[Draw.Hatch]	Select the *Boundary Hatch* command - this will bring up the *Boundary Hatch* dialogue box (Figure 2 below).

Using that dialogue, work through the following steps:

- ensure that the *Type* is set to "Predefined" ... this means that you are using one of AutoCAD's built-in patterns ... the other options are *User-defined* (to create a pattern "on-the-fly") or *Custom* (to use a pattern that you have pre-defined yourself);
- Click on the pattern selection button (marked in the figure) and choose the "ansi32" pattern from the choices offered in the *Hatch Pattern Palette* box ... that pattern will then be displayed at the top of the *Boundary Hatch* dialogue box as illustrated;

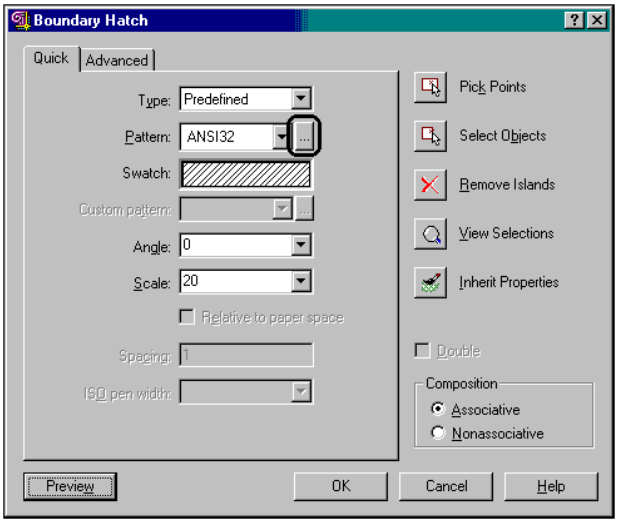


Figure 2 - The Boundary Hatch Dialogue Box

***NOTE**: from my experience, there seems to belittle consistency in AutoCAD about pattern scales when using their predefined patterns … the best strategy is always to create a small test rectangle and experiment in that small area with the predefined pattern you plan to use … I did exactly that to establish that a scale factor of 20 was "about right" for this drawing …*

- set the *Scale* value at 20, but leave the *Angle* setting at 0;
- next, click the *Pick Points* button ... the dialogue box will temporarily disappear allowing you to pick points on the drawing within each of the areas to be cross-hatched ... while observing the prompt in the *Command Window*, pick the points marked in Figure 3 below noting that as you pick each one, AutoCAD marks the corresponding boundary ... you can cancel any one pick by typing **u** ↵ if you make a mistake ...when all boundaries have been identified, press ↵ to return to the dialogue box;

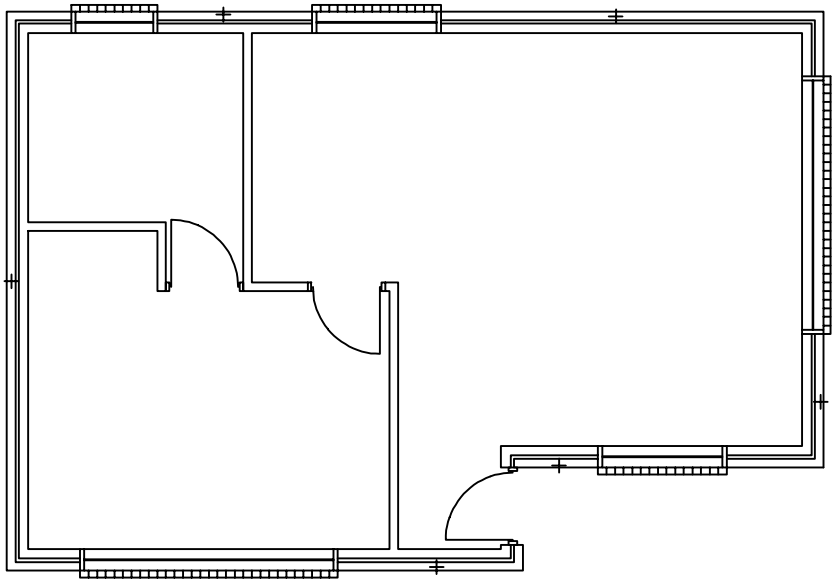


Figure 3 - Pick Points to Set Up the Boundaries for Hatching

- if you wish to check the hatching before committing yourself, click the *Preview* button ... *you can interrupt the previewing process by pressing <**Esc**> if you find the hatching is incorrect or too dense*;
- when satisfied, click the *Apply* button to dismiss the *Boundary Hatch* dialogue box and draw the cross-hatching.

Save tool.

This would be a good time to save your drawing by clicking the Save tool on the Standard toolbar:

DRAWING THE FURNITURE ITEMS

Before we begin drawing the furniture, you must create a new layer called "furniture" (any colour that you wish!), making that the current layer. Since we don't want the furniture to be too prominent, set the Lineweight to 0.18 for that layer. This process has been described twice now: try to do it yourself from memory.

Overview of where we're heading!

Once that is done, we will begin by drawing the built-in wardrobe in the bedroom and then the kitchen benches. After that, we will use blocks to draw the rest of the furniture items shown on the plan.

Built-in Wardrobe ...

To draw the line which delineates the built-in wardrobe, issue the LINE command and begin at the SE corner of the wardrobe with an |ENDPoint| snap mode and then use a |PERpend| snap mode for the second point, picking the inside face of the west external wall.

Kitchen benches ...

... use the |FROM| *object snap mode*

Polyline tool.

We will draw the kitchen benches as a polyline beginning 1400 mm up from the SW corner of the kitchen (adjacent to the bedroom door). *We have already outlined how to use the* |FROM| *object snap mode to specify the start point of such a line*. Endeavour to construct the polyline yourself, referring back to the earlier example where necessary: begin at the point indicated, draw 700 to the right, 900 up, 1500 right, 1400 down, 600 right, and then finish the polyline perpendicular (|PERpend| object snap mode) to the inside face of the north wall of the kitchen. Check that your benches are the same as the sample plan.

The next step is to add the other furniture symbols to the drawing. Normally, over a period of time, you would build up a "library" of commonly-used furniture symbols to use in this kind of drawing. This is done by drawing each symbol, making a block out of it, and then writing that block onto a separate drawing file all by itself. You are then able to insert that block, from its separate drawing file, into any drawing that you produce in the future. Note that AutoCAD provides no such standard library, although there are several third-party vendors who will. (In the next tutorial, you will use one such standard library, but in this tutorial we are deliberately only using the basic facilities provided by AutoCAD.)

A unique approach to drawing furniture ... you could argue that it would be easier to draw simple rectangles for each item, but it would not be half so instructive!!

For this tutorial, we will use another technique to draw all the furniture items. Notice that all the remaining furniture in this plan can be made up from one or more simple rectangular boxes. We will create a new block, called "box", which will be a simple rectangle 1000 mm square. We will then insert that block into the drawing, using different X and Y scale factors each time, to build the symbols to represent the furniture that we wish to show. This is probably not the normal way of doing it, but it serves to illustrate an important way in which you can use blocks.

Create the basic furniture block ...

Begin by drawing a *Rectangle* 1000 mm square anywhere on your drawing. Use the *Block* command to save this square symbol as a block called "box", with the insertion point at its SW corner.

Zoom in on the bathroom / kitchen area of your plan as shown in Figure 4 and, using that figure as a guide, insert the furniture as instructed.

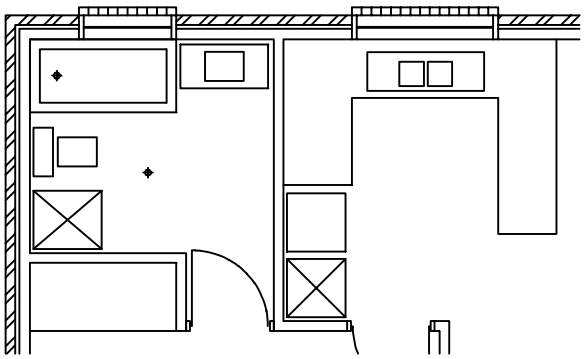


Figure 4 - Plan of the Bathroom / Kitchen Area showing the Furniture

We will begin with the *Fridge* in the SW corner of the kitchen ...

Drawing the Fridge ...

Insert Block tool

insert ↵	Issue the *Insert Block* command .. use the *Insert Block* tool in the *Draw* toolbar if you prefer … in the dialogue box, set the position and scale to be set on the screen with rotation set to 0.
box ↵	An outline of the box symbol should appear attached to the cross-hair cursor - AutoCAD will prompt you for an insertion point - pick a point close to, but not on, the SW corner of the kitchen (refer to figure!) … **Hint**: you will need to temporarily disable *Running Object Snap* by clicking the OSNAP button on the *Status Line* (illustrated at left) to do this operation without snapping to the corner of the Kitchen.
0.6 ↵	Set the X-scale factor to 0.6 times the current size of the object - this will result in a box 600 mm wide.
↵	Set the Y-scale factor to the same as the X factor.

OSNAP Status Line button …

... complete the Fridge ...

... then draw the Wall Oven ...

Use the *Line* command with |ENDpoint| object snapping to draw a cross through this rectangle (as illustrated) to distinguish it from other fixed items of furniture. Then use the same insertion technique to draw the *Wall Oven* next to the *Fridge*.

I will lead you through the process of drawing the Double-Bowl Kitchen Sink and the bath tub, and then leave you to draw the other furniture items yourself.

Double-Bowl Kitchen Sink ...

insert ↵	Re-issue the *Insert* command.
↵	Accept the default block to insert ... it should be the "box" since that was the last thing inserted - pick an insertion point, judged by eye, where you want to draw the kitchen sink.
1.2 ↵	Set the X-scale factor to 1.2 times the current size of the object - this will result in a box 1200 mm long.
0.4 ↵	Set the Y-scale factor - 400 mm wide.
↵	Recall the *Insert* command
↵	Accept the default block to insert.
@330,50 ↵	Specify the insertion point *relative* to the last point entered: that is, the insertion point of the last box!
0.25 ↵	250 mm long.
↵	Same width.
[Draw. Copy Object]	Issue the *Copy* command from the *Draw* toolbar - *select the sink tub just created.*
↵	Complete the selection - pick a *Base Point* anywhere you wish.
@290<0 ↵	Place the copy 290 mm to the right … *you may need to pick the whole sink unit and use the Move command to adjust its position a little*.
insert ↵	Re-issue the *Insert* command.
↵	Accept the default block to insert ... it should still be the "box" since that was the last thing inserted.

Bath Tub ...

|ENDPoint|	Select the *ENDPoint* snap mode and then pick the NW corner of the bathroom to lock the position of the Bath right into the corner.
1.5 ↵	Box 1500 mm wide.
-0.75 ↵	Set the Y-scale factor to a negative number in order to draw the box in a negative direction relative to the insertion point.
↵	Recall the *Insert* command.
↵	Accept the default block to insert.
@100,-100 ↵	Specify the insertion point relative to the last point entered, that is, the insertion point of the last box.
1.3 ↵	Set the X-scale factor to 1300 mm wide.
-0.55 ↵	550 mm wide in negative Y direction.

Do the rest yourself, using the same techniques ...

You can now proceed on your own to insert the following furniture items:

- *Vanity Unit* in NE corner of bathroom - 900 x 450 mm with centred bowl 400 x 300 mm.
- *Washing Machine* in SW corner of bathroom - 700 x 600 mm, crossed, since it is not built-in.
- *WC* next to the bath - cistern 200 x 500 and pan 400 x 300 mm.

Bits and Pieces ...

Have a go at drawing the *floor waste* in the bathroom by yourself: use a 30 mm radius circle, with two 100 mm cross lines. When you are satisfied with it, *copy* it into the *Bath* as well to serve as the *plug hole*.

Finally, draw the threshold at the main entry door, and then draw in the edge of the entry porch using the *Object Tracking* tool as we did when we constructed the window sill earlier in this tutorial.

***Adding Lineweights** ...*

The final change that I made to this drawing was to incresae the line weight on the external faces of all the walls. I set mine to 0.70 the first time, but would suggest that you could use 0.50 instead. Use *Quick Select* (as you did earlier) to select all the lines, then pull down the list of line weights and choose the one you think is most appropriate. If you wish to preview the lineweights on the screen, click the LWT toggle on the *Status Line*. If the line weights are shown too exaggerated (likely on the high resolution monitors in the labs!), then select *Format > Lineweight* and adjust the slider back to the first notch and click OK.

That now completes the plan of our granny flat!!! Your drawing should now look like the one in Figure 1. The final step is to layout a drawing sheet with a couple of views of the plan and a bit of text (as in the completed drawing at the end).

LAYING OUT THE DRAWING SHEET

***Brief Introduction to Paper Space** ...*

AutoCAD supports two modes of operation: up to this point, everything we have drawn has been in *Model Space* where objects are drawn at their real-world size; we are now going to switch to *Paper Space* so that we can lay out an A4 sheet of paper (*drawn at its actual size*) and place two scaled drawings of our granny flat on it. This final layout is shown at the end of these notes. Proceed as follows:

Look below the drawing area and note the row of tabs, the first labelled *Model* and the others labelled *Layout1*, *Layout2*, etc. The layout tabs allow you to set

up layout drawings in paper space. Click on the first of these. AutoCAD will open the *Page Setup* dialogue box. Notice that the dialogue has two tabs. Select the *Plot Device* tab. On that tab, pull down the list of plotter names and select the one labelled "BlackWhite" (this "device" suits any of the A3/A4 printers available in the Faculty). Below that, pull down the list of *Plot Style Tables* and select "monochrome.ctb". This plot style will ensure that your plot is printed in solid black (the laser printers tend to print coloured lines in shades of grey which creates an unsatisfactory effect for CAD drawings!). Next, switch to the *Layout Settings* tab and ensure that A4 paper is selected and the orientation is set to *Landscape*. Click *OK*.

AutoCAD will then display your sheet as shown in Figure 5 below. The sheet is displayed on a grey background with a dotted line representing the plotter margins (outside of which the device cannot print). Within that margin is created a single rectangular viewport containing a view of your drawing from Model Space.

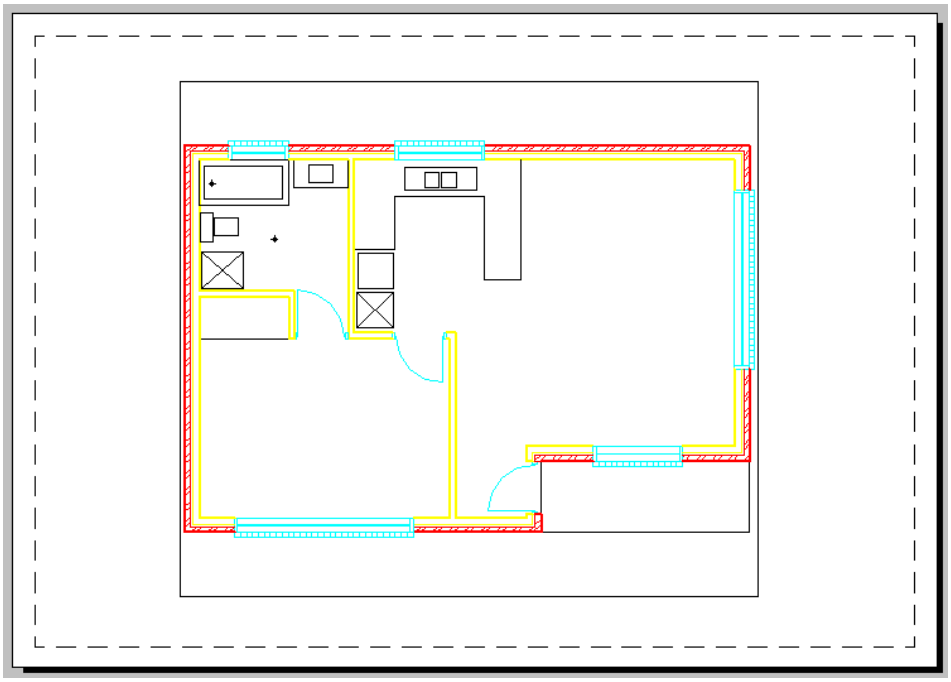


Figure 5 - The A4 Sheet Showing the Initial Viewport

To set up the drawing sheet, work through the following steps:

- the first thing to do is to set the current layer back to "0";
- draw a rectangle 277 wide by 190 high (20mm smaller than an A4 sheet) – use the *Move* command to position that rectangle within the plotter margins (dashed rectangle) and centred on the page - this rectangle will serve as the sheet border.

The next step is to set the scale of the plan within the viewport and then adjust the size of the viewport to suit … I always suggest that it is best to make the viewport only a little bigger than the view it encloses. Proceed as follows:

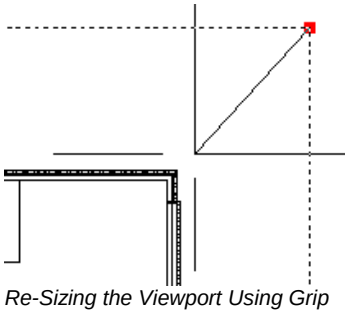
PAPER	Click the PAPER toggle on the *Status Line* - this allows you to work in model space within one of the displayed viewports - *since you only have one viewport, there is no ambiguity about the one with which you wish to work: where there is more than one viewport, you can switch between them merely by clicking on the one you want.*

... note that the toggle button on the Status Line changes to MODEL *to indicate that you are now in Model Space and the crosshair cursor appears within the viewport.*

Zoom Scale tool (in the Zoom flyout on the Standard Toolbar) …

*Realtime **Pan** & **Zoom** tools … these are great for quick zoom & pan operations …*

[Standard. Zoom Scale]	Select *Zoom Scale* command - this allows you to set a scale factor to be applied to the view …
1/100xp ↵	This is the scale factor to be applied to the zoomed view - it means a factor of "one-hundredth" of the paper space scale (the significance of "xp") - since paper space is at a scale of 1:1, this sets the viewport to a scale of 1:100.
[Standard. Realtime Pan]	Use the *Realtime Pan* tool to position the plan in the bottom left corner of the viewport … simply click the tool button (as illustrated), move to any position in the viewport and hold down the left mouse button while dragging the view around until you are happy with the position (as close to the lower left corner as you can make it!) … press <**Esc**> to turn off *Realtime Pan*.
MODEL	Click the MODEL toggle button on the *Status Line* - this switches back to paper space - *notice that the cross hair cursor now spans the whole drawing area again*.



Re-Sizing the Viewport Using Grip Editing techniques ...

Once back in *Paper Space*, you are able to re-size the viewport so that the plan at 1:100 scale fits snugly within it. The simplest way to do that is to use *grip editing* as illustrated. Simply click on the viewport and observe that it is highlighted with blue boxes (*editing grips*) at each corner (difficult to see on the white background!). Click on the top-right corner grip until it is highlighted, then move the cursor (without holding down the mouse button) until the viewport neatly encloses the plan (as shown at left), and finally click on that position. The viewport should now be just bigger than the plan view. Now use the *Move* command to re-position the viewport to anywhere you wish within the A4 border.

Create the second viewport ...

We now need to create a second viewport. Just for fun, we will make this non-rectangular. Proceed as follows:

Circle tool

You could also call this command from the pull-down menus ...

View > Viewports > 1 Viewport

circle ↵	Construct a circle to use as a viewport … you can actually use any closed polygonal shape that you can create with AutoCAD, but we will simply use a circle ….
mview ↵	Issue the *Mview* command - this command allows you to create a new viewport in paper space …
o ↵	Select the *Object* option … AutoCAD will prompt you to select any closed shape … pick the circle that you just created.

Now use exactly the same procedure to create a 1:50 scale plan drawing of the bathroom within that viewport ... the end result is illustrated in final drawing at the end of this tutorial. Note that when you use the *Zoom Scale* command to set the viewport scale, you need to specify the scale factor as "**1/50xp**". Once you have re-sized the new viewport, you should use *Move* to adjust the position of both viewports until you are satisfied with the layout.

Making the viewport borders invisible ...

When you have done that, we need to make the viewport borders invisible since they are not an essential part of our drawing. That is done by creating a new layer (perhaps called "vp"), changing the two viewports to that layer, and then making it a "non-plotting" layer (that being one of the properties of layers). *You should be able to do all that by yourself!*

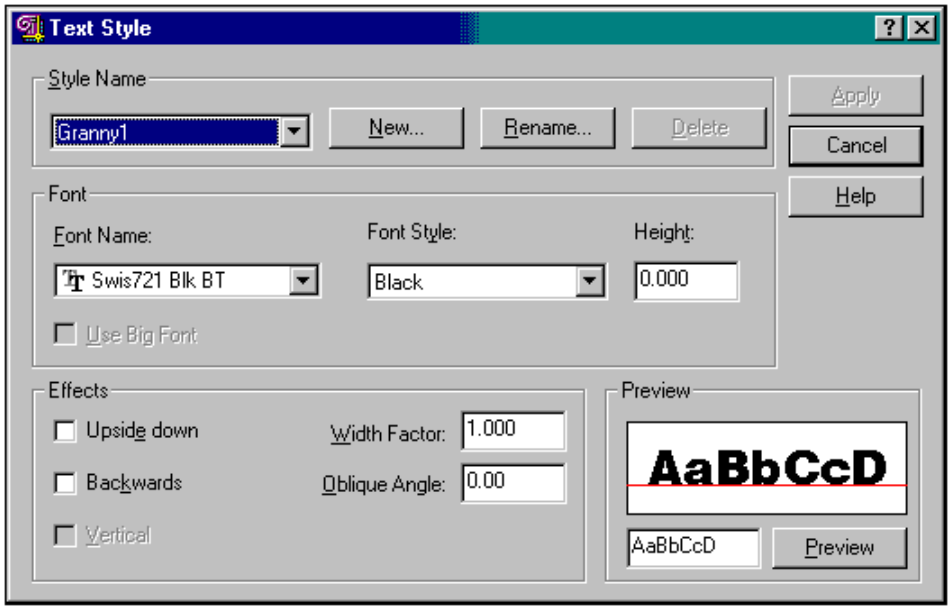
Labelling the Plan ...

The last thing to be done now is to label the drawing. There are two steps to that process: first you need to create a new text style to use; then you use the Text command to create items of text in that style. This is all best done in *paper*

space using text at its plotted size (since paper space is always plotted at 1:1 scale).

Creating a new text style ..

Begin by issuing the *Format > Text Style* command from the pull-down menus. You will get the following dialogue box …



Previewing the Available Fonts

A useful hint: if you select any font name in the pull-down list, you can then use the DownArrow key to scroll down through the list of fonts watching the Preview box to find a font that suits your needs … that's a convenient way of finding a font!

Click the New button to create a style giving it any name you wish (I called mine "Granny1"). Pull down the list of fonts and choose any that takes your fancy. The fonts are previewed in the lower right corner of the dialogue. It is prudent to leave the height of the font as 0.0 (as in the illustration) since that tells AutoCAD that for this style, you will specify the height on the fly for each piece of text. When ready, click OK to continue … *the text style you just created becomes the current style and will be used for any text you create until you create/select another style*.

***Hint**: use Single Line Text for labels as we do here, but use Multiline Text for blocks of text …*

*… **the text button on the Draw toolbar executes the Multiline Text command which is why we don't use it here …***

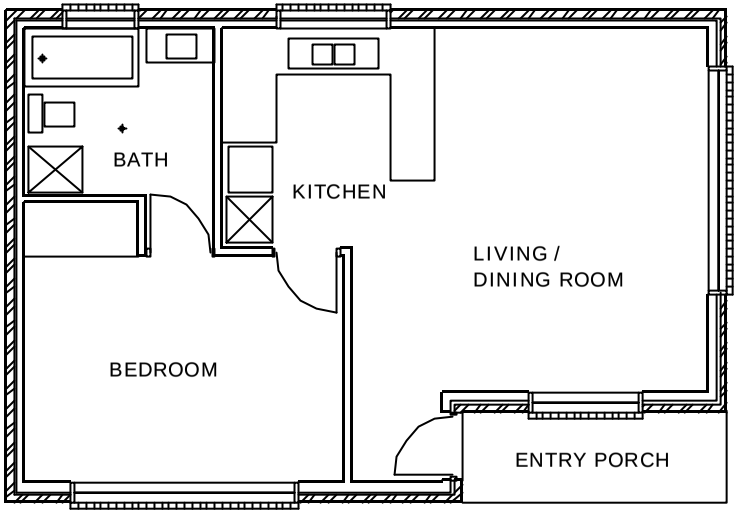
To create an item of text proceed as follows …

Draw >Text > Single Line Text	Issue the *Single Line Text* command - we are going to enter the main title of the drawing: "Proposed Granny Flat" - pick the appropriate spot on the drawing.
7 ↵	Set height of text at 7 mm.
↵	Accept the default rotation of 0°.

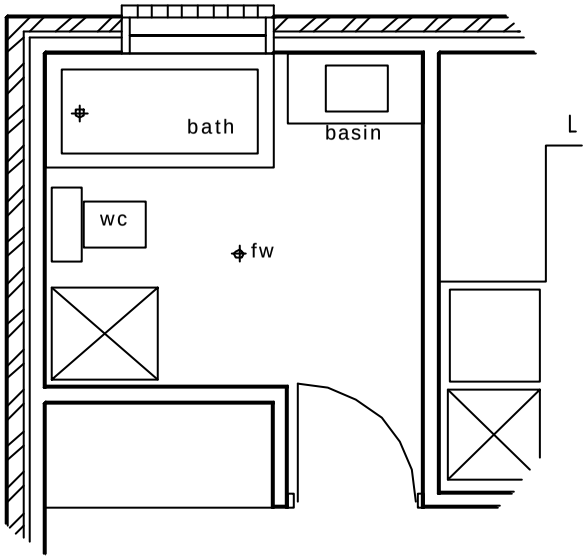
*Then type in the text "**Proposed Granny Flat**" followed by ↵. Then press ↵ again to terminate the command.*

Following the same process, now enter any other text you wish to add to your drawing. All the text is inserted in paper space, even that which appears on top of the model views in the viewports. The drawing titles and the "Drawn by" line were all entered in 5 mm text. The rest is 2 mm high text.

All done.



Floor Plan 1:100



Bathroom Plan 1:50

Proposed Granny Flat

Drawn by: Jim Plume

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