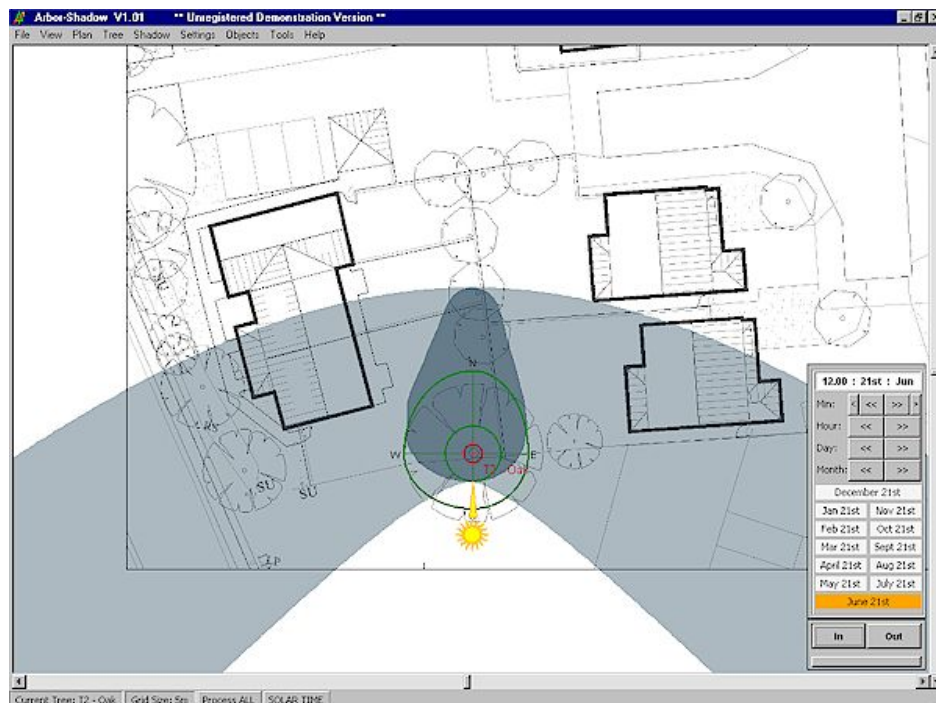


# Arbor-Shadow Manual

Revised for version 3:04



Written by Chris Skellern 2005/2006

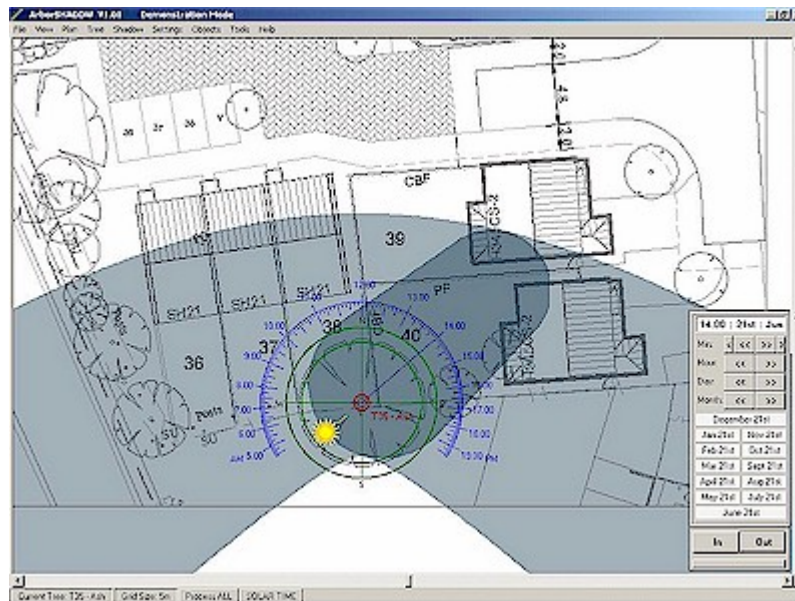
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# 1. Program Overview

## Arbor-Shadow

Arbor-Shadow is a tool which calculates and plots tree shadows onto a bitmap plan. It does not offer any kind of appraisal or conclusion to the issue of sunlight in the proposed site. It simply assists the arboriculturist in his/her assessment. It has many limitations and you may indeed consider it to have little value in your own work. You may also not agree with the calculation and plotting method employed. For these reasons, I recommend you read all of the information pages on the website and try out the demonstration program before considering purchase.



## Arboricultural Consultant

The relevance of tree shadows in relation to new development is important to ensure that proposed recreational areas such as gardens and windows (on building elevations) will not be excessively shaded by adjacent trees. If these areas do become excessively shaded, the tree may become a target for pruning or even removal. By understanding the position and motion of tree shadows at an early stage in the planning process, such problems can be avoided (by, for example, adjusting the proposed site layout). It is the job of the contracting arboriculturist to keep his/her client informed of these issues and to supply them with data from which they can modify their plans. The assessment of a tree's shading capability should be included within an Arboricultural Implication Assessment (AIA) which considers the relationship between existing trees and a proposed development.

## Tree Officer

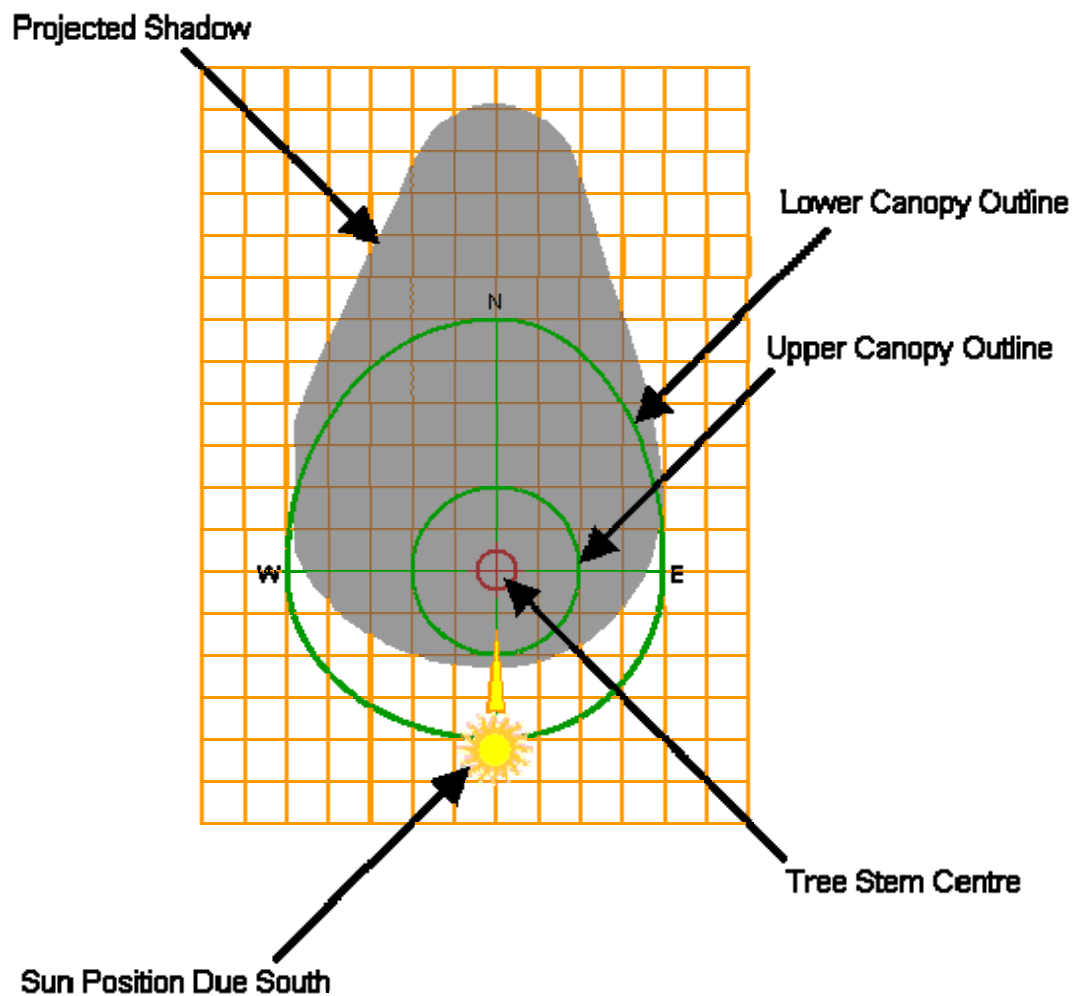
Tree officers working for Local Authorities are obliged to ensure that important trees are retained where possible in relation to new development. They must consider a number of factors, including the issue of sunlight. Councils receive a large number of requests to prune or remove protected trees due to sunlight interference. They can of course refuse the requests, but this may be overturned on appeal to the Secretary of State, who may, for example, judge that the light loss is unreasonable and the tree should be removed. To avoid such a set of circumstances arising, local authorities must ensure at an early planning stage that the issue of light interruption, both in the present and in the future has been considered. They should demand information from the developers demonstrating that a reasonable level of sunlight will be available to gardens, recreational areas, windows etc.

## 2. Shadow Display

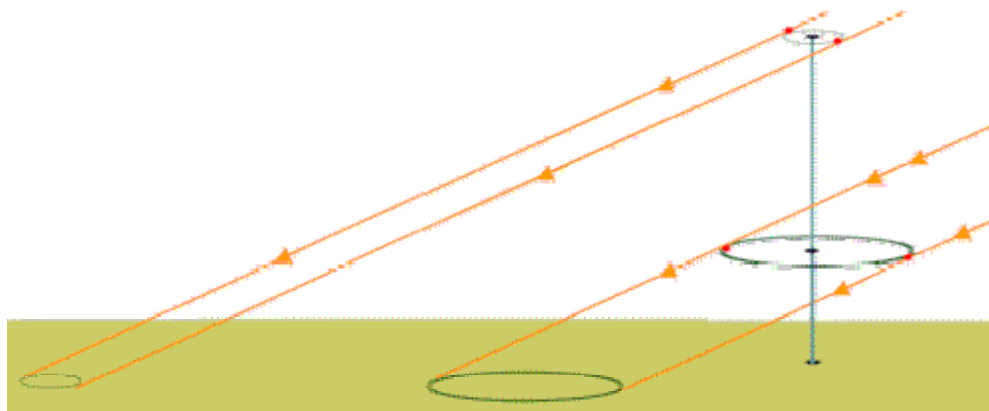
Arbor-Shadow can display a tree shadow for a single moment of time or can show its duration for a whole day as a 'day trace'. They are both shown graphically in 2D. You can imagine that are looking vertically down over the tree and viewing the projected shadow as a shaded area. The screen image will always be orientated with its top towards North.

### 2.1. The Tree Shadow

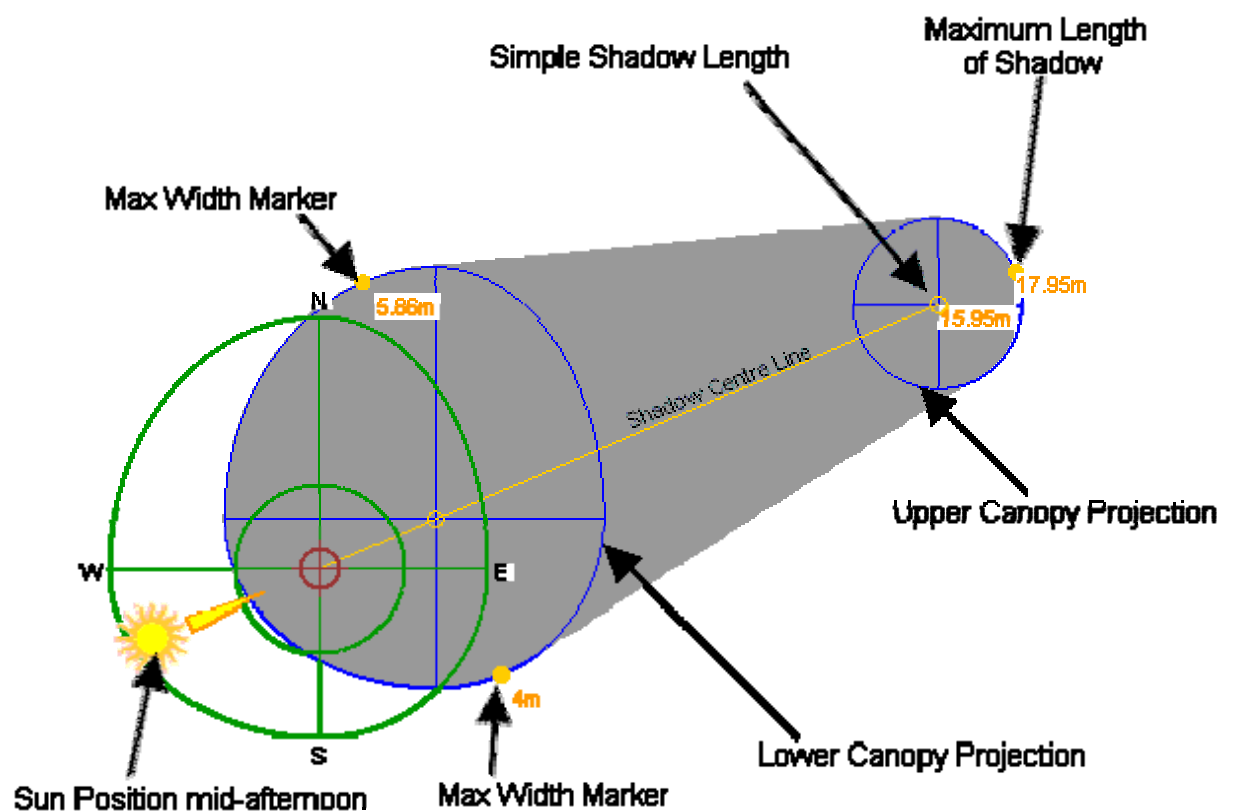
The following picture shows a tree with its projected shadow (grey shade) positioned over a 1 meter grid.



The shadows are created by projecting horizontal 'slices' of the tree canopy. The following image shows the upper and lower canopy outlines projected onto the ground.

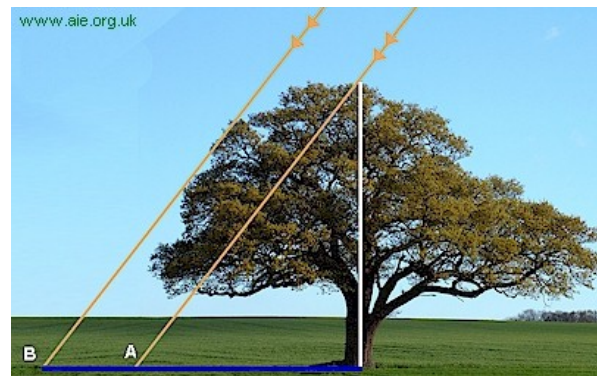


The upper and lower canopy projections can be seen within Arbor-Shadow by selecting the 'Show Shadow Detail' selector from a drop down menu. The following image shows these projections outlined in blue.



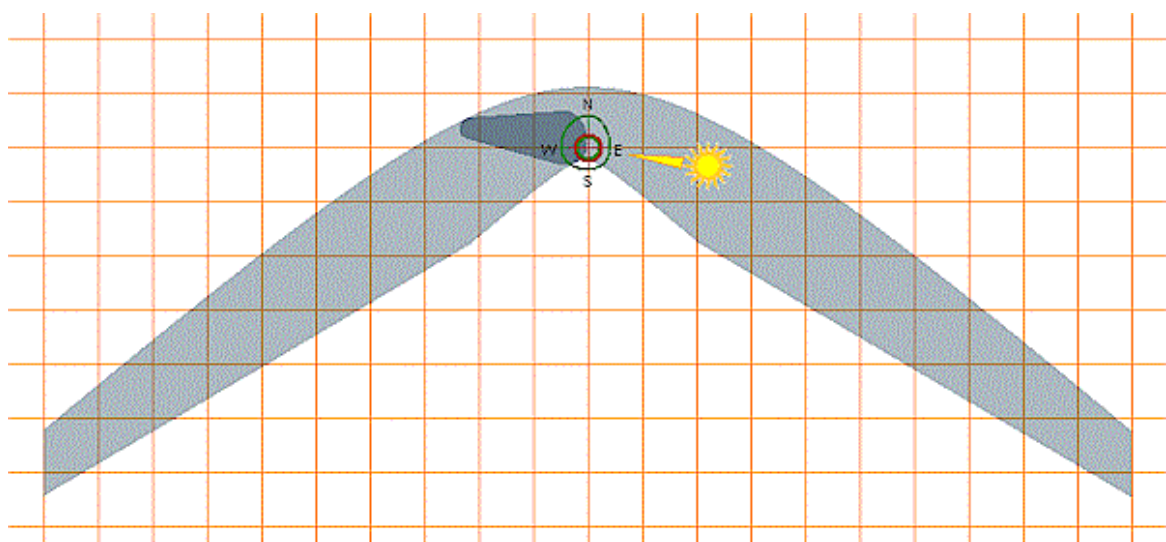
In this mode the detail also shows two shadow length dimensions. The 'Maximum length' is calculated using the presence of tree canopy spread (as these can increase distance) while the 'Simple Shadow Length' is calculated using just the tree height alone. The 'Width Markers' show the maximum width of the shadow when measured at right angles from the shadow centre line.

The following image shows the difference in the two shadow length calculations. Dimension A shows the 'Simple' calculation based upon tree height alone while B shows the true 'Maximum' shadow length. The influence of canopy spread can increase some broad tree canopy shadow lengths by a significant number of meters.



## 2.2. The Tree Shadow Trace

The tree Shadow Trace shows the area which the normal tree shadow would transit during a day. As the tree shadow moves from west to east its 'imprint' is recorded on the screen to leave a large shaded area. The smaller true shadow can be displayed on top if required (see below). Note the flat ends to the trace shadow on the eastern and western extents. This is a 100m cut off point (measured from the tree centre) which had to be included for memory conservation reasons. The grid below is spaced at 10m and the sun shows a position early in the day.

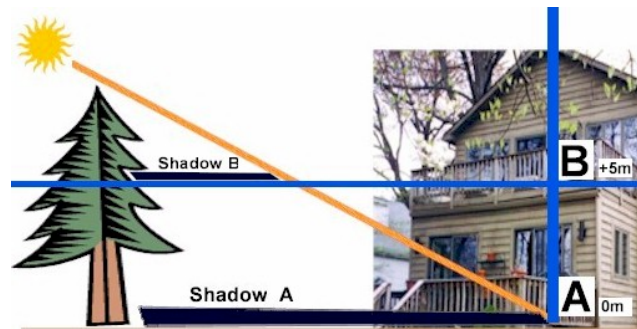


The above image shows the sun position at early morning (east) and the resulting true shadow located in the west (positioned over the day trace shadow).

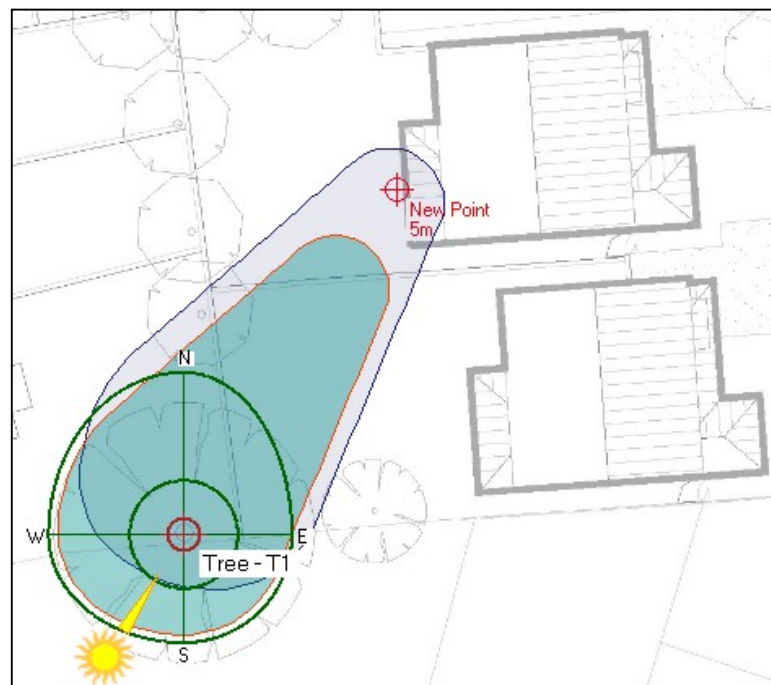
### 2.3. Tree Shadows and Target Height

The length of shadow changes in relation to the assessment target height.

The following image shows Point A & B sharing the same position on a plan but Point B is higher than point A. The shadow touches Point A but not Point B. In fact the shadow for the height of Point B is significantly shorter.



Arbor-Shadow has the option to display two shadows for such a situation where a target height adjustment is in force. The following image shows the shadow modified by the target height of 5m. And for reference purposes the larger shadow represents its position for a zero difference in target height (but this base shadow is not used for any assessment).



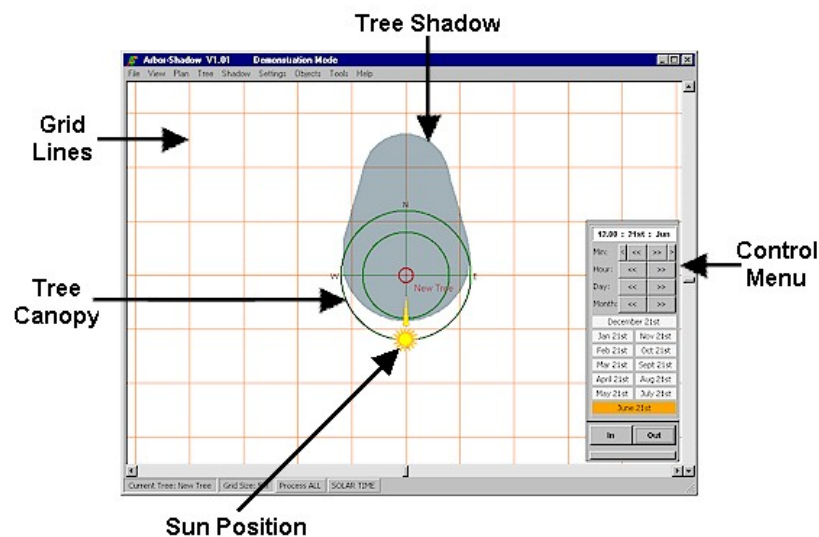
See the chapter on 'Target Height Adjustment' for further information.



### 3. Work Screen

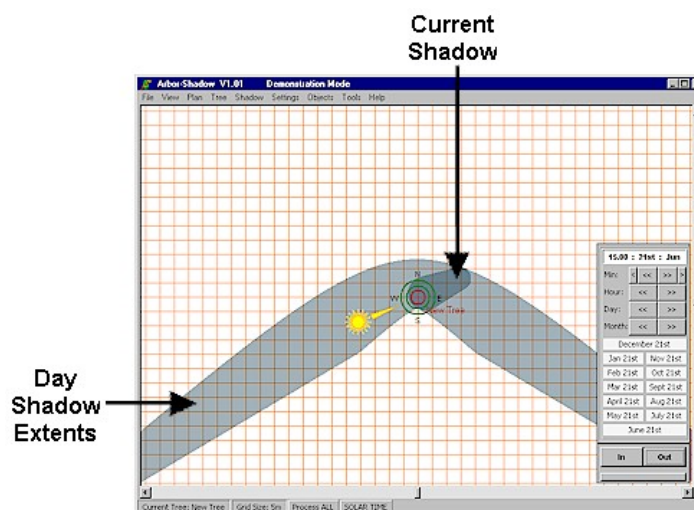
This is the area where the graphics are displayed. You can treat the screen display as a digital drawing plan where you are looking down vertically over the top of the tree. The scroll bars allow you to scroll around the plan and the zoom buttons enable areas to be zoomed in or out. The display is updated as soon as you make a change to any parameters.

The tree's location is represented by the red cross & circle. The two green circles represent the extents for the lower and upper canopies. The shadow is shown as the grey shaded area; in the following screen shot it is pointing due north and the sun is shown due south of the tree. A grid can be switched on or off and its spacing adjusted.



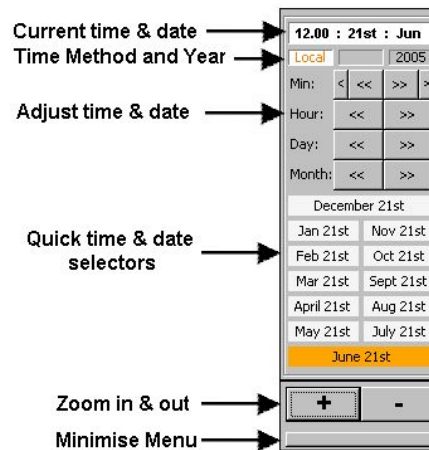
The above image shows the shadow for a single specified time. A further option allows the shadow extents for a whole day to be shown. The following image shows the extents of such a 'day shadow' displayed with the darker time shadow overlaid. Imagine the day extents as the area which the actual shadow would touch from sunrise to sunset.

In the following image I have set the time to 3pm so the sun has moved westwards past 'due south' and the resulting shadow moved eastwards. I have also zoomed out slightly and the grid squares have scaled accordingly.





The Menu controller allows quick adjustment of time, date and zoom. Minutes can be adjusted singly or by a step of 10. The Quick selectors will set the time to noon for the indicated day and month. The following image shows the current selector for June 21st is active.

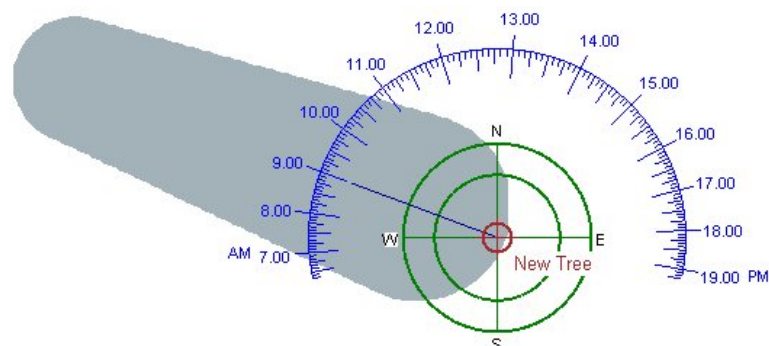


### 3.1. Moving Trees & Objects

To move a tree, a point or an area, simply position the mouse over its centre circle and press the left mouse button. With the button pressed move the mouse pointer to the new position and release. You can use the Lock function found in the Tools menu to lock all trees and reference areas. This prevents accidentally moving an object.

### 3.2. Clock Overlay

This is an indicator which can be switched on from the View menu. It is a means of identifying the centre of a shadow (the part which is in line with the stem). The following image illustrates the point. The blue indicating line shows the sun position as being at 9.00am, this also marks the shadows centre line.

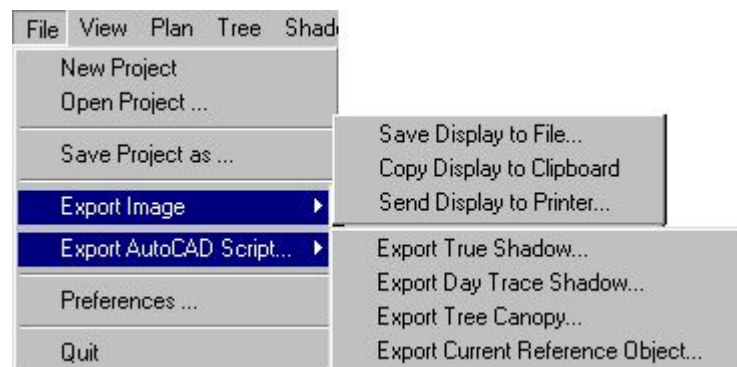


This image also shows that I am using Local Time as the tree canopy north-south axis line points to around 12.46pm. If I were using Solar time then this axis would always point to 12.00 Noon.

## 4. Screen Menus

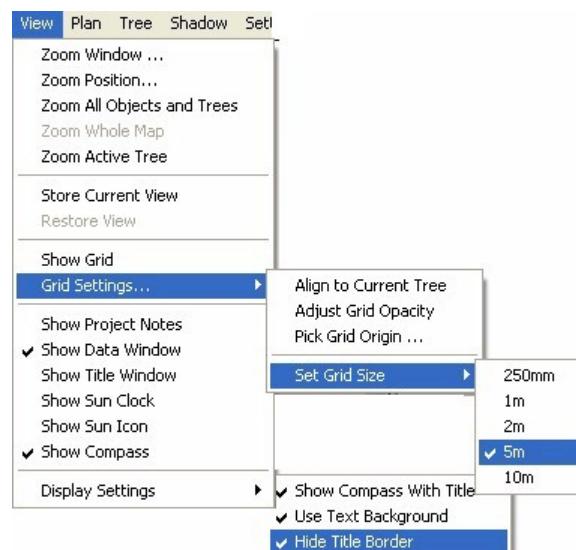
### 4.1. File Menu

Projects can be loaded, saved and the Preference settings adjusted from here. The Export Image selection allows the image of the work screen display window to be saved, printed or sent to the clipboard. The Export AutoCAD Script selectors provide output for users of AutoCAD. It saves the shadow outlines as a Script file which can then be loaded into AutoCAD. It will also save the canopy extents and the reference area as a script file if required.



### 4.2. View Menu

The Zoom functions modify the viewing area. The Grid functions enable the grid size to be determined and allows you to set the origin to a tree centre or any point you choose.



You can store and later go back to a viewing position with the Store and Restore selector.

The Show settings control a number of display options which you may want to show for inclusion within a printout (such as the Title Block). See also Data Window. The **Show Compass With Title** simply locks the North, South, East, West compass image to the Title Block. Leave this selector unchecked if you want to manually position it.

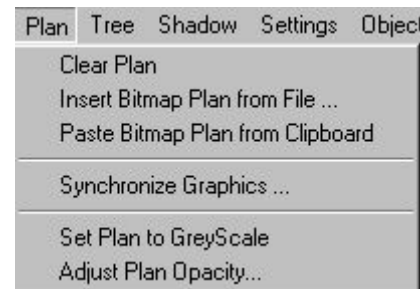
The Use Text Background puts a white background behind screen text labels (tree & object). The **Hide Title Border** simply hides the black border of the Title Block.

Each project file can have text notes saved with it. These enable you to add notes relating to the layout, assessment etc. Select **Show Project Notes** to view and edit these.

### 4.3. Plan Menu

These selectors allow a bitmap image to be inserted as a background to the shadow plot. Once loaded you must select Synchronize Graphics to scale the shadow output to the plan.

The plan is likely to be in colour and may also be dark. You can use the Set Plan To Greyscale to remove the colour and then Adjust Plan Opacity to adjust the plans intensity. These options enable the shadow output to be seen clearly on the background.



### 4.4. Tree Menu

These selectors enable you to add new trees and adjust settings which relate to the currently selected tree. See Edit Tree.



### 4.5. Shadow Menu

Calculating the data for graphic display requires a great deal of processing power and if you are displaying a number of trees together then the screen drawing may slow down. You can overcome this by using the **Process Current Tree Only** function which will only process shadows for the currently selected tree.

Two types of shadow can be displayed. These are the current shadow for a selected time (**Show Tree Shadow**) or the extents of shadow activity for a whole day (**Show Tree Shadow Trace**). The shade levels can be adjusted with the Opacity controls. The fill shade and outline can be selected as required.

**Show Shadow Detail** enables the upper and lower Crown Projections to be seen along with the shadow axis line.

The **Show Base Shadow** is an option which works in conjunction with the target reference point. If you have assigned a height to the reference point then the resulting shadow will be bigger or smaller than one calculated for zero height. Subsequently, you can show two shadows, the one which relates to the target height and one which relates to zero height (base shadow).



#### 4.6. Settings Menu

With these selectors you can choose the time system you wish to use (Solar or Local time); most users will use Local Time.

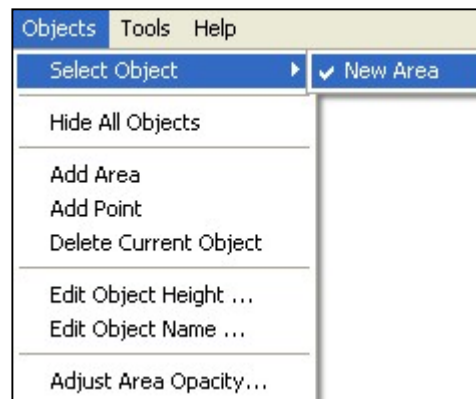
Trees and objects can be locked so that they cannot be accidentally moved. The set Latitude/Longitude allows you to define a location and time zone (see Site Position/Time Zone).



## 4.7. Objects Menu

Reference objects such as the area definition and point can be controlled from here. The Opacity control relates to the area shade level.

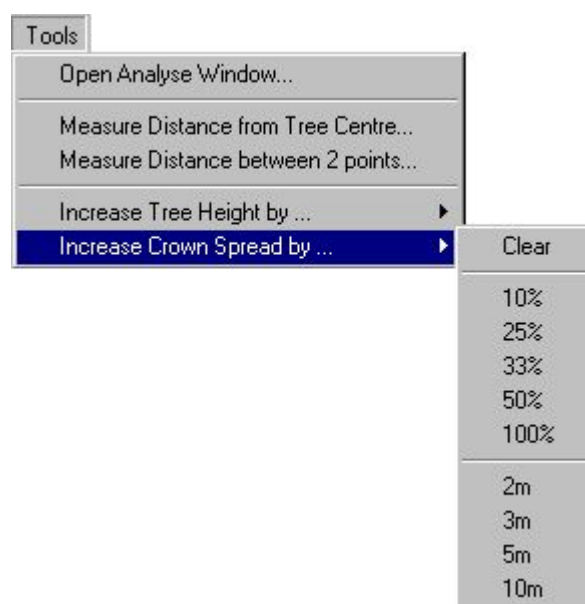
By default objects are assigned a height of zero, you can change this to any height you wish (negative values accepted) using the **Edit Object Height** setting. Any Analysis will then be carried out using this height difference (trees are all set to zero ground height).



## 4.8. Tools Menu

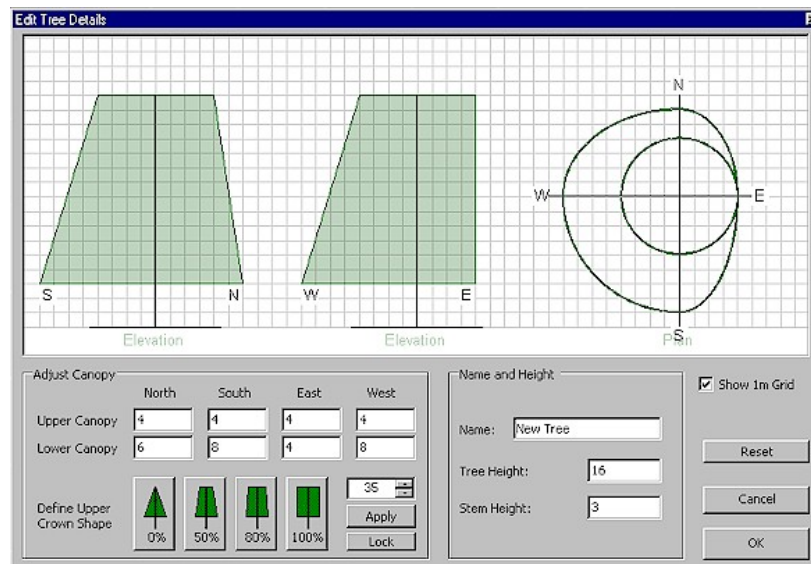
Miscellaneous tools such as the Analyse function can be selected here. Also two measuring functions allow you to measure distances on the plan.

If you wish to modify the current tree height or spread dimension by either a percentage or a fixed amount, then these can be assessed here too. This allows you to assess a trees shadow in relation to future growth without permanently changing the trees dimensions.

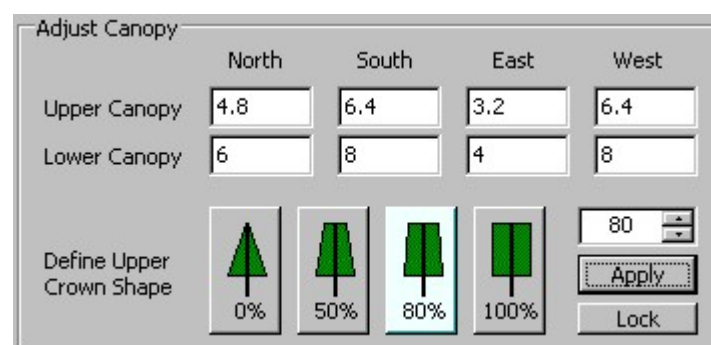


## 5. Edit Tree Window





This window allows the tree dimensions to be entered. As the dimensions are entered so the graphical representation will change. Each field is error checked as you enter data and will display a message should you attempt to enter an impossible value. The plan view shows a vertical view of the tree with the two canopy outlines shown as the green ovals. The following example shows the tree as having an eastern spread on both its canopy extents of 4m so they meet on the eastern extent (i.e. the tree is flat sided).



The upper crown canopy can be set to calculate automatically from the lower crown canopy using a percentage. To do this, first select a percentage value, either from clicking over one of the crown shapes or adjusting the percentage box (located above the Apply button).



Once you are happy with the value select Apply and the upper crown will change its values. As an example the following picture shows an 80% selection, I have clicked the Apply button and the upper crown is set to 80% of the lower crown.

Adjust Canopy		North	South	East	West
Upper Canopy		<input type="text" value="2.1"/>	<input type="text" value="2.8"/>	<input type="text" value="1.4"/>	<input type="text" value="2.8"/>
Lower Canopy		<input type="text" value="6"/>	<input type="text" value="8"/>	<input type="text" value="4"/>	<input type="text" value="8"/>
Define Upper Crown Shape					
		0%	50%	80%	100%
					<input type="text" value="35"/> <input type="button" value="Apply"/> <input type="button" value="Lock"/>

However, this does mean you need to keep pressing Apply. If you would rather see the graphic display change as you change the percentages settings, then select the **Lock** button.

Now, the upper crown boxes become greyed out to indicate that they are locked to the lower values by the percentage. As you change the percentage, so they will change and the graphical display will change instantly.



## 6. Using Plans

### 6.1. General

A bitmap can be inserted and used as a background image. You can use any image you like, it can be an aerial photograph, site plan scan, an AutoCAD screen shot or a picture of Mickey Mouse! Arbor-Shadow doesn't care what it looks like as it is simply used as a background with the trees and shadow graphics displayed on top.

A loaded plan will always align its centre to the centre of the work screen. All tree & object positions are located relative to the work screen centre. When you save a project the loaded bitmap file is also saved with your tree data file.

The graphic speed processing limitations of the program only allows a small number of trees to be analysed at once. So it makes sense to only load in the relevant section of a site plan that is required. This site section can then be analysed and saved with a reference name relating to the trees & site. By keeping the site bitmap size small you will use less memory and less processor time. It is also important to plan ahead and think about where the shadows will be within the image.

There is little point in having your tree sitting in the middle of a plan as there wont be any shadows to the south of the tree. Its a good idea to set the image view so that the trees for assessment are located close to the bottom and you have the highest zoom possible. The higher the zoom the better, as you will then have more detail to work with, once within Arbor-Shadow.

### 6.2. Loading a Bitmap Plan

You have two methods of inserting a plan bitmap (both of these are selected from the Plan menu). You can load a file from disk or paste directly from the windows clipboard. I prefer to use the latter in conjunction with the Print Screen keyboard button and the AutoCAD program. Simply display the section of plan required on the AutoCAD screen, press the Print Screen keyboard button and then select Paste from Clipboard from the Plan menu.

The loadable file types are JPG, BMP and GIF. A minimum size restriction exists of around 120 x 120 pixels. Also, you may find an error generated if you try inserting a bitmap with colour indexing. To avoid this problem, simply load the image into a paint program and save again.

### 6.3. Scaling the Graphics

Although in a few cases the scale of a loaded bitmap may be known (for example if you have scanned a drawing of a known scale at a known scanning resolution), I have found it is much simpler in the long run to scale the graphics manually on screen. Older versions of the program permitted a scale to be entered directly, but this has been removed in favour of a single method.

To display the tree shadow graphics to a scale represented by the loaded plan requires you to tell the program how many pixels of the bitmap represents a meter. To do this, you simply draw a line along a known measurement on the screen and enter the corresponding distance in meters. So, if for example you know the length of a building elevation is 9.54 meters, you can pick a point on the screen bitmap at each end of the elevation and enter the 9.54m distance. The program will now automatically draw all tree dimensions, shadows etc to the correct scale so they are accurately displayed over the plan (see chapter example for scaling).

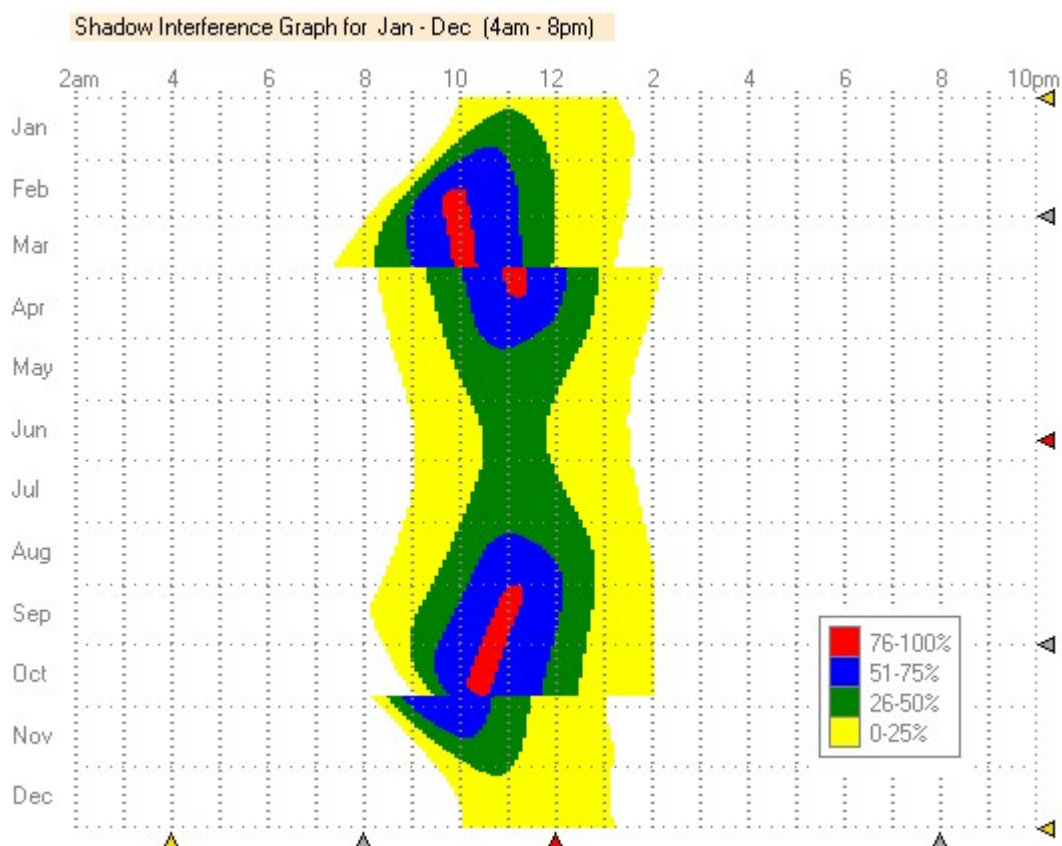
## 7. Analyser Window

### 7.1. Display Window

The Analyser window enables a defined reference Area or Point to be scanned for overshadowing by the currently selected tree (or all trees together) for most times of a day and all days of a year. The scanning process produces an interference graph which shows the times of day that shadowing of the target occurred. And in the case of an Area reference object, it will show an approximate percentage of interference (i.e. the percentage of the area overlapped by the shadow for that moment in time). Reference points are assumed to have no area so any interference will always be 100%.

Percentages can be shown on the graph as four ranges of colours (0-25%, 26-50%, 51-75%, 76-100%) or as gradual greyscale (0-100%). This enables the results to be interpreted quickly and a recording made of the image (for use in reports etc).

The following image shows such a scan. The coloured area shows the times (and percentages) when shadowing of the target occurred. *I will leave you to work out why the graph shifts one hour to the right for the period 'end of March to end of October'!*



The following image shows the analyser window with the results of a scan displayed. It has assessed 'Area 1' against the tree shadow produced by a single tree.

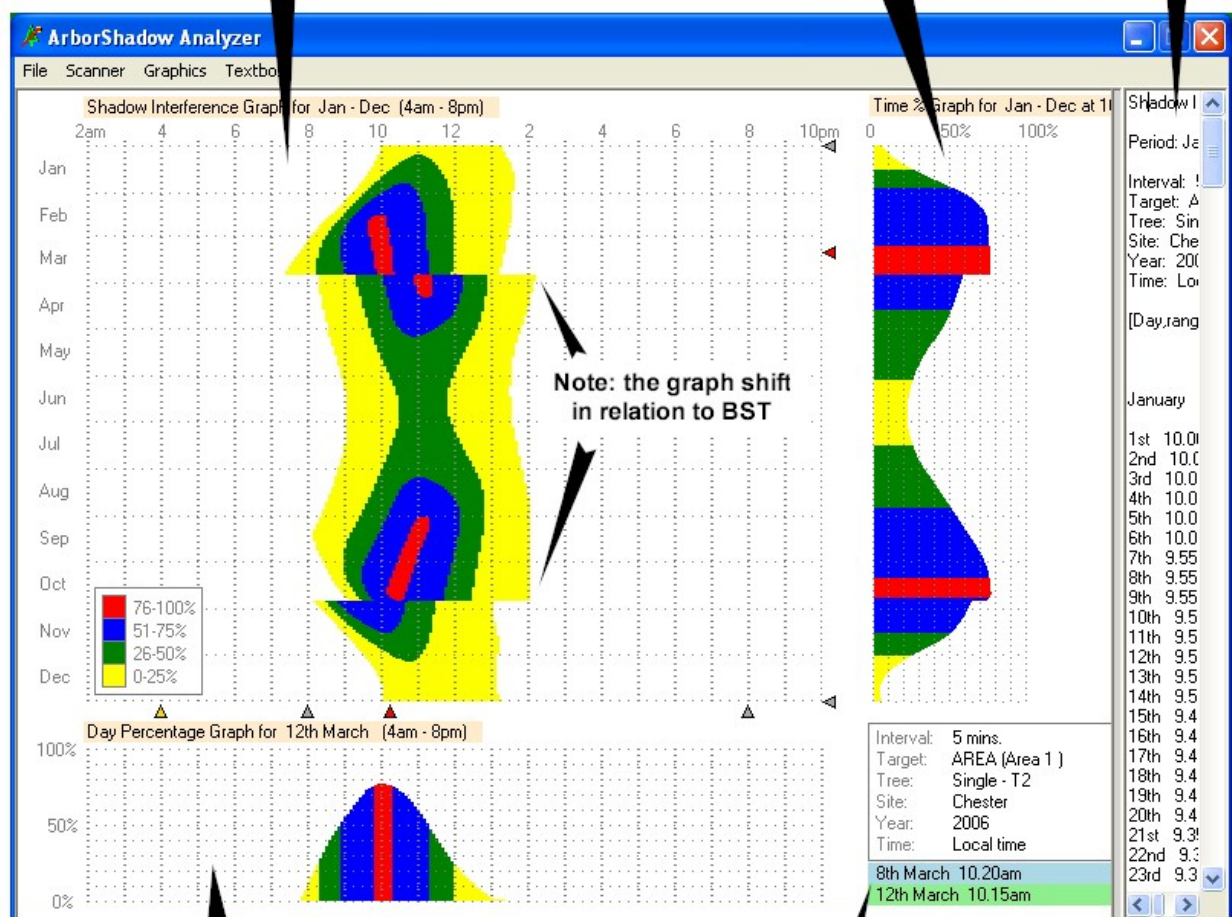
The Analyser has three graphs on its display. The largest shows the times throughout the year when interference was detected within the target.

The right hand graph displays the percentage values of the interference for each day but for a single time of each day. And the lower graph shows the percentage values for all times of a day but only for a single selected date. The selected times and day of the smaller graphs are indicated by the small red arrows and will change as you click the mouse on the largest graph. They basically allow you to see a cross section through the graph (if you imagine the percentage values as the third dimension of the graph).

**Main graph showing times when shadowing within the target occurred (the colours show the percentage or severity of shade)**

**Percentage graph showing 'a vertical slice' through the main graph for a single time but for each day.**

**Expandable text display box**



**Percentage graph showing 'a horizontal slice' through the main graph for a single day but for all hours.**

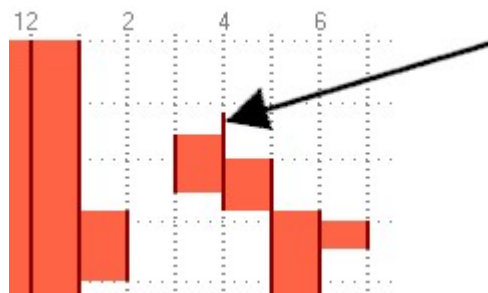
**Blue bar shows date for mouse pointer. Green Bar shows selected date (as used by % graphs, and indicated with red arrows).**

The start and stop times of the scan can be adjusted to speed up the process. If, for example, you have no interest in winter months or the times of day before say 9am then the Grey coloured adjuster arrows can be set to ignore these time periods. The Yellow adjuster values simply indicate the times selected for the displayed scan (as you can load previously saved scanned files which may have different settings to those which are current).

It is important to understand a little about the actual scanning process so you can interpret the results correctly. During the scan, the program simply steps through the time and days and calculates the shadows for each moment. It works out any interference with the target, stores the results for display etc. The important point to realize is that the time period between each step interval is not analysed. **Only the time of each step is analysed.** So if you are using a time interval of 60 minutes, then analysis will be carried out on each hour only. The period between say, 2pm and 3pm wont be analysed, only the moment of 2pm and then of 3pm will be.

In the following image of a point object scan carried out at a 60 minute interval, the actual scan times are indicated by the bold colour lines. If two adjacent intervals have made interference with the target then the period in between the bold lines is filled with a lighter colour shade (to make the graph more visually pleasing). But this is an **'assumed interference only'**, it wasn't actually scanned. However, it is very likely to have interference if it were to be! Otherwise you have a situation where a shadow is within a target at say 2pm, and it must then leave the target area within a short while, only to re-enter the target area to be detected at 3pm.... its very unlikely to happen, and could only happen with more than 1 tree (due to the shape of the polygon area).

The large black arrow shows a time when interference occurred at 4pm but not at 3pm or at 5pm (for those specific days), subsequently the 'fill' shade colour has not been used.



Unfortunately the scanning process is very time consuming, as it requires a huge amount of processing time. With the use of multiple trees and/or higher tolerance settings, the scanning process can be very, very slow indeed.

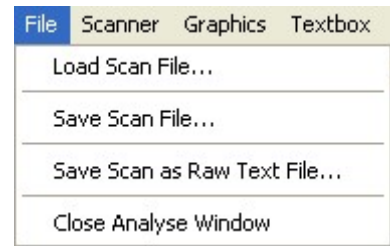
The high accuracy (5 min) scan should be reserved for those times when you wish to produce graphics for inclusion within reports. I suggest you attend to other activities such as making that important cup-of-tea during such a scan!

It is important to remember that any scan will apply to the **currently selected reference object**. The scan output displays the object name, so it is a good idea to always individually name trees and objects to avoid confusion. Additionally, in an effort to identify different objects, the scan output of a point is always red.

## 7.2. Analyser Drop Down Menus

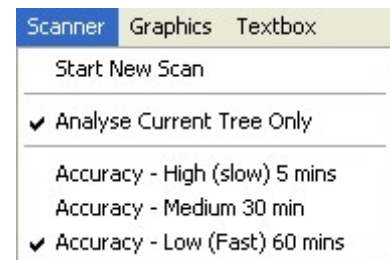
The **File menu** enables existing scans to be loaded and saved.

The actual scan data can also be saved (**Save as Raw text file**) for importing into Excel (see the website for data format). If you feel brave you could attempt a 3D graph for the whole year!



The **Scanner menu** enables a scan to be initiated and its level of accuracy to be adjusted. A 60 min tolerance will analyse quickest but will give results with +/- 1 hour. I tend to use this first to get a quick idea of a scan and then rescan to 5 mins if I wish to save the results as a file.

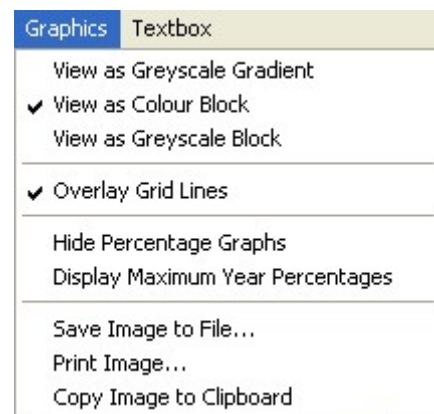
If you only wish to scan the currently selected tree then check this selector otherwise the scanner will include all trees but with a time penalty!



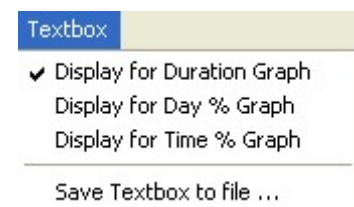
The **Graphics Menu** controls various display settings. You can decide how you wish to display the graphs (colour or greyscale). You can hide the percentage graphs and remove grid line overlay.

The '**Display Maximum Year Percentages**' selector changes the output of the two percentage graphs so they show maximums reached for the whole year and time extents instead of those defined by the mouse selection.

The image can be saved to disk or the clipboard for inclusion within reports etc.



The **Textbox Menu** controls the content of the textbox. You can choose which type of data you wish to view and save the contents to file, if required.



## 8. Reference Objects

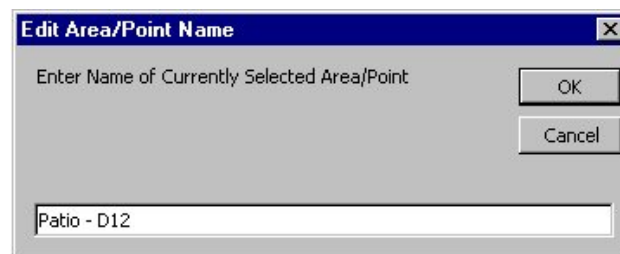
These are defined within the Objects Menu and can be either a Point or an Area. They are both used in conjunction with the Analyser. They can be given a name of your choice and assigned a height value (this refers to its height above or below tree base height and not the actual height of the object).

### 8.1. Points

The point is an object with a single plan position consisting of a circle, cross hair, name and height value.



It can be moved as required and can be renamed by selecting Edit Object from the drop down menu. The following picture shows the edit name box.



Select OK and the point is assigned the new name. Editing the height value works in the same manner.



A point can be used for example, to mark the position of a view on an elevation. You may wish to find out the times when this position is affected by a tree shadow. For example the following picture shows a point marking the position of patio doors on a proposed dwelling.

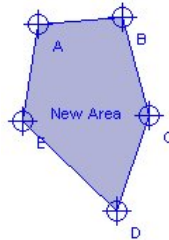




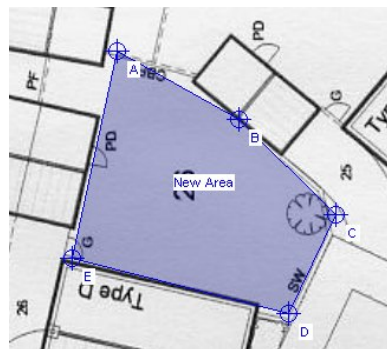
Had the doors been located higher on an elevation perhaps as part of a flats balcony you may wish to assign a height value (the difference in height can make significant differences to the results).

## 8.2. Areas

Areas work in much the same way as a Point except that they consist of 5 corner points strung together to form an adjustable Polygon. Each corner point A-E can be moved as required. The Area will automatically scale itself as you change the zoom view. The name and height can also be edited in the same way as the Point.

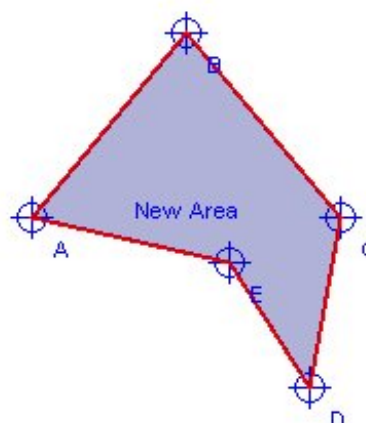


Areas are useful for designating the boundaries of a garden and determining the extent of shadowing from adjacent trees. The 5 adjustable sides enable a fit into odd shapes (the addition of further sides may be included in future versions).



One restriction of the Polygon is that all internal angles must equal 360 degrees and each individual angle must be less than 180 degrees. If, while you are adjusting the shape, you produce an illegal angle a warning box will appear and the polygon will turn red. The following picture shows that the internal angle of point E is higher than 180 degrees.

Error: Area shape wrongly formatted

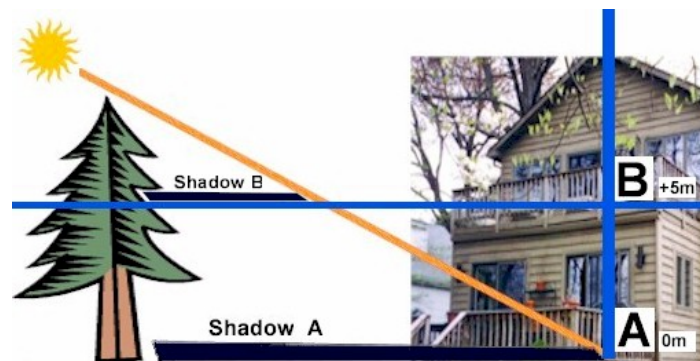




## 9. Target Height Adjustment

The target area or reference point can be assigned a height value of between -100 to +100 meters. This is the height at which shadow modification takes place and is the difference between the base of the tree stem and the target.

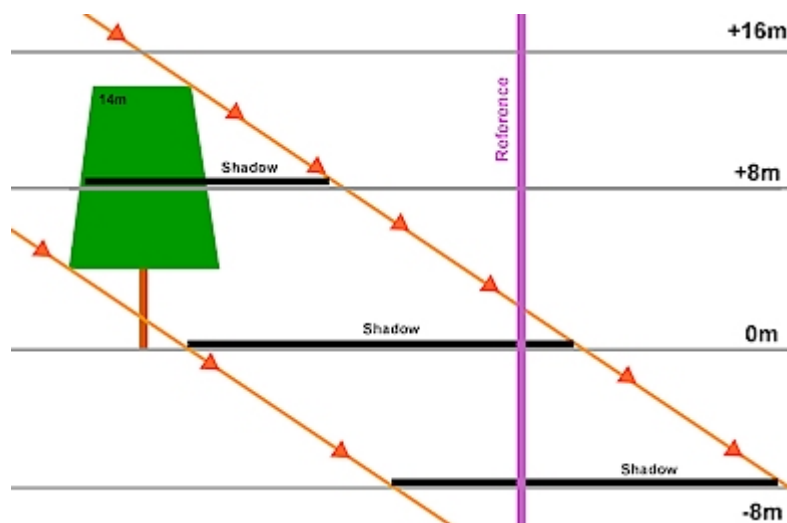
For example, the following picture shows points 'A' and 'B' as reference places which share the same X/Y position on a plan. Point A has a target height of zero while point B is +5m higher (it is located 5m higher than the tree base). The displayed shadows are then recalculated so that their size and length reflect this higher level (see the shadow B).



This option also works with negative values where a target might have a lower level than the tree (i.e. be positioned at the base of a slope etc). In these situations you must remember to consider the shadow produced by the hill itself (the hill on which the tree stands) as it is beyond the scope of the program to create this.

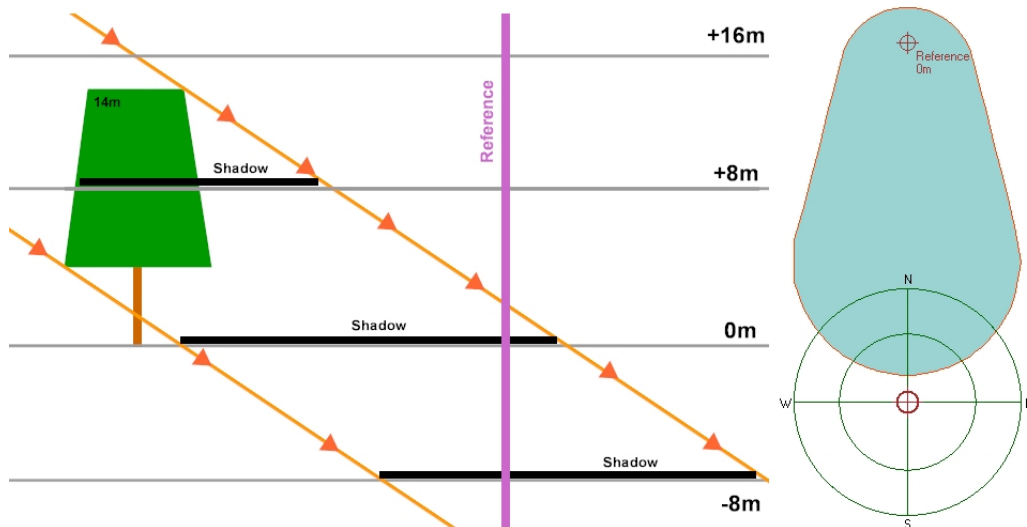
In the case of an area, the height value applies to all corners of the area.

Also, you need to be aware that shadows 'will dissapear completely' if your target height is greater than one of your trees (see image below). The target height level of 16m is higher than the 14m tree so no shadow can be cast on that level. If you are using multiple trees you may find some trees have no shadows in these situations.

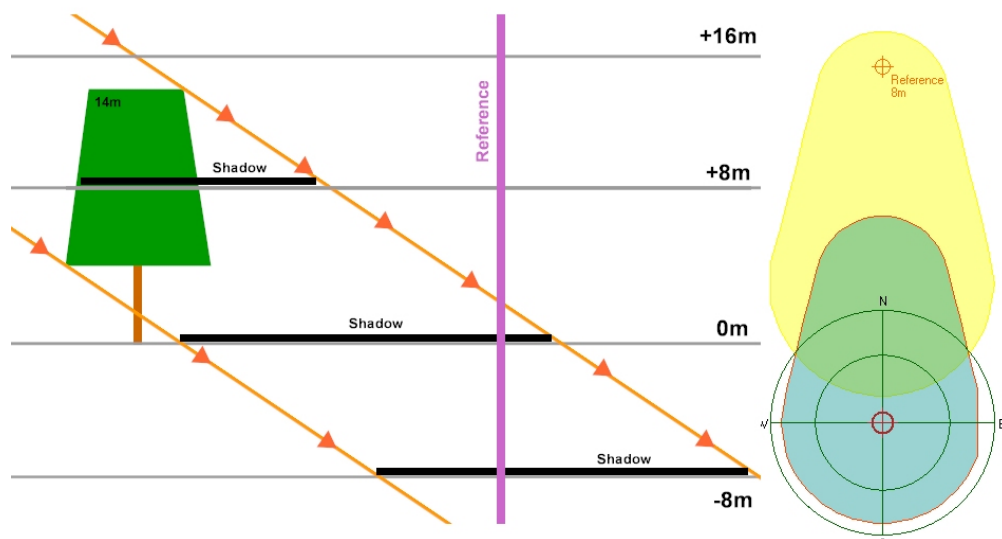


Arbor-Shadow displays the shadows in relation to the '**currently selected target height**'. So if you have multiple targets defined on your plan, with different heights, the shadows will automatically change length as you click on and select different targets with your mouse. An option is also included so that you can view, at the same time, the extents of the shadow for zero height difference. This is shown as a lighter (yellow) shade and has no purpose within assessment analysis. It is simply included as a visual aid. Analysis will always include a target height adjustment (if it exists).

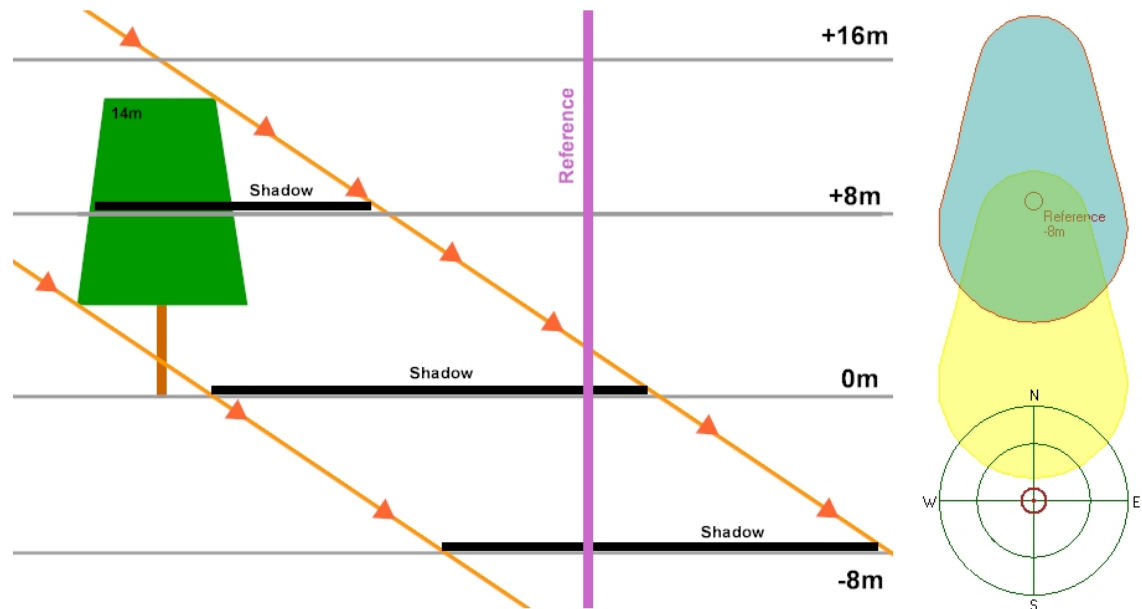
The following image shows on the right hand side an Arbor-Shadow representation of the (crude) drawing on the left. This is for a zero target height. The reference point is within the tip of the shadow. The base of the shadow is just in front of the tree stem base.



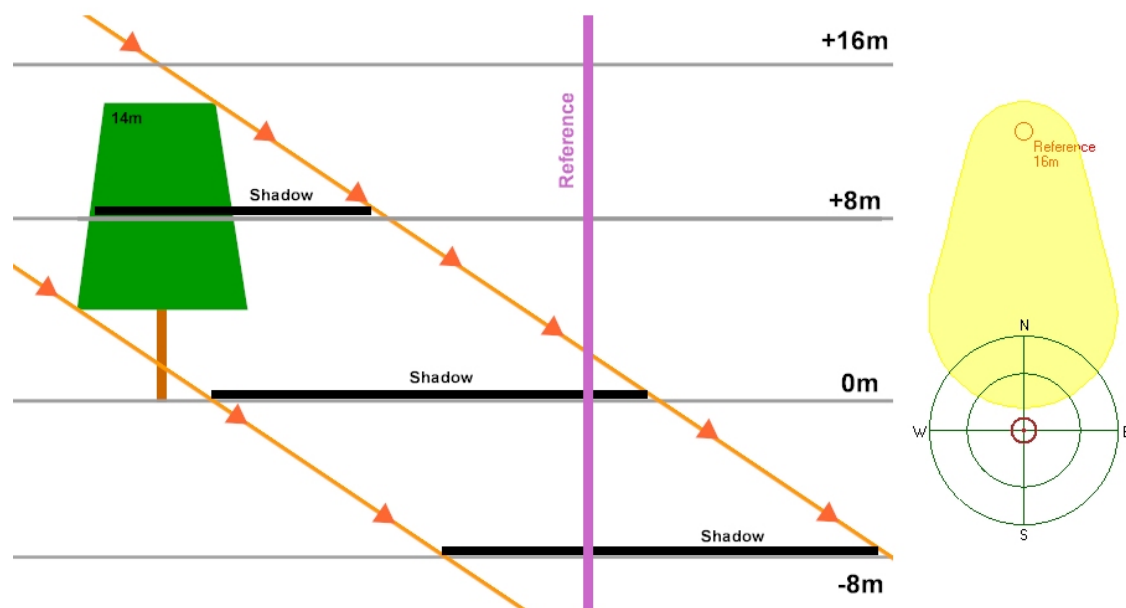
Now take a look at the shadow produced for an elevated target of +8m (follow the +8m level on the image). The yellow shadow is the base shadow for zero height difference (so is the same as the image above). The true shadow now sits partially within the tree crown (in reality there wouldn't be shadow here as you would be actually within the canopy).



This image shows the shadow for a target assessment of  $-8\text{m}$  (so the target is lower than the tree stem base). The shadow has now moved further from the tree centre.

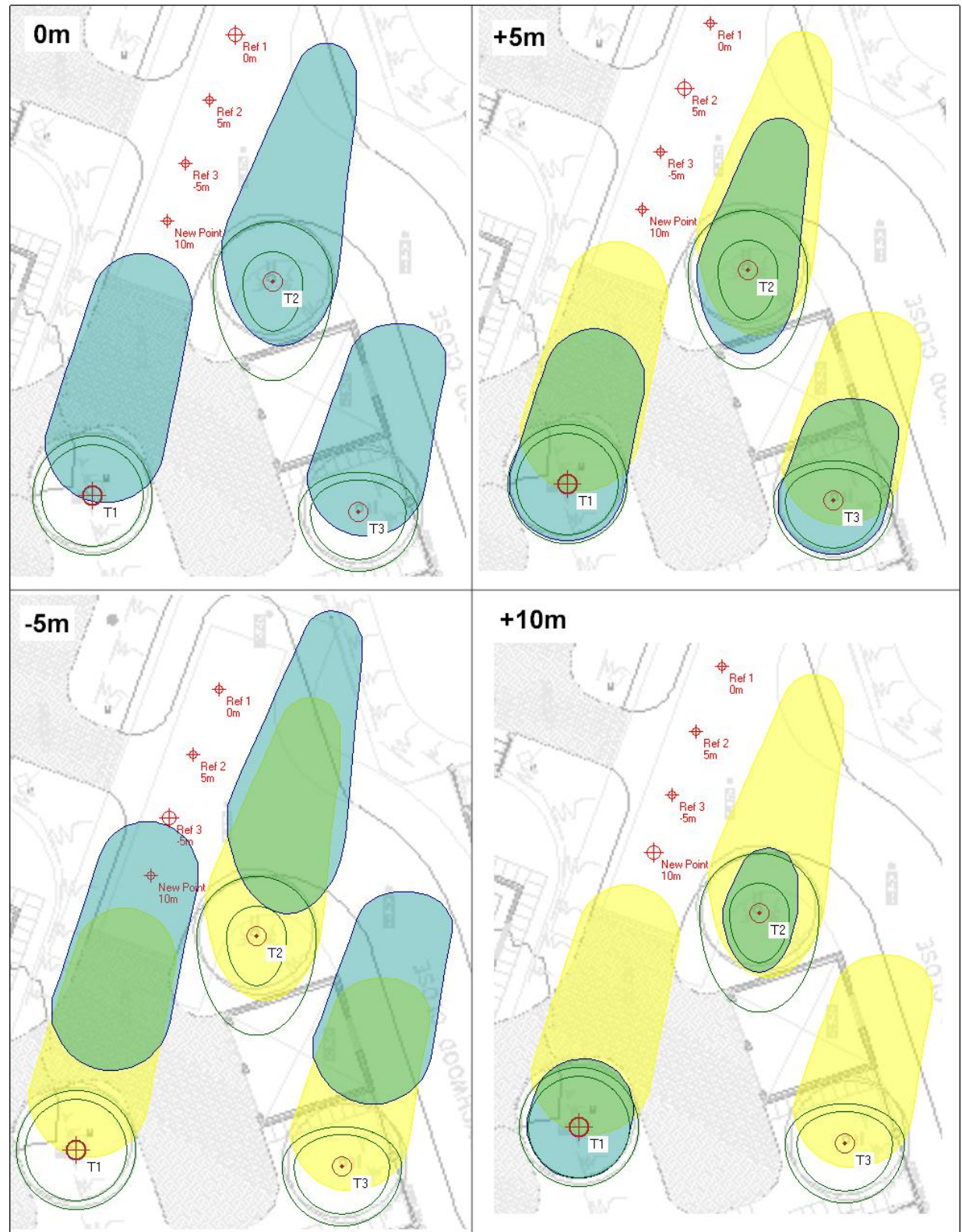


Finally, the next image shows the shadow display for the  $+16\text{m}$  target height. And of course there is no shadow! Only the base shadow is shown for zero reference target height.



To further illustrate these differences I have plotted 3 trees and 4 reference points on the following site plan. The reference points have different heights and are in the middle of a road (this is purely for demonstration purposes)! As I click on each reference point in turn (and thus make it active), so its height influences and changes the shadow size. Remember that the yellow shading represents the base shadow (always for zero height). The blue ones are those which would be used by the analyser.

*Note how one shadow disappears on the +10m image because its tree height is less than 10m.*



## 10. Opening & Saving Project Files

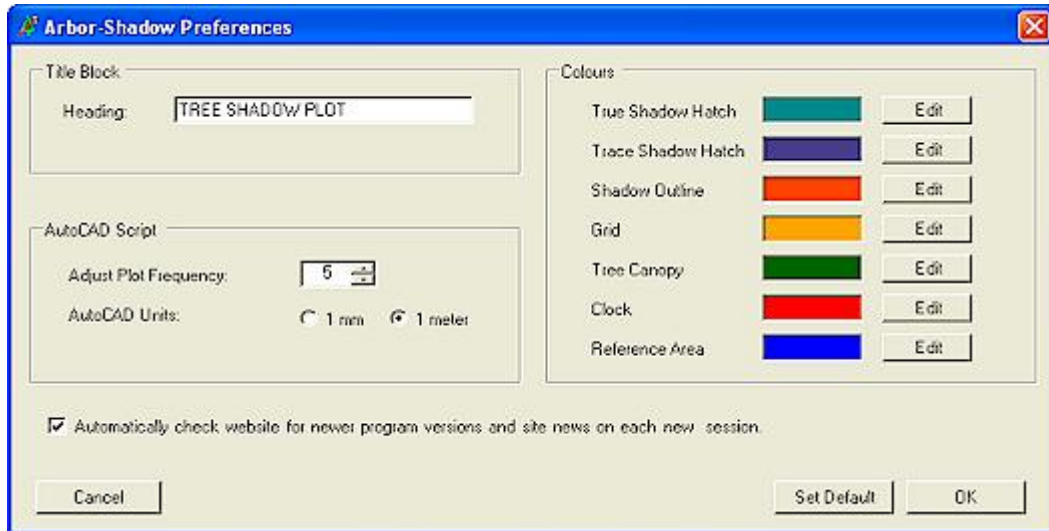
The Arbor-Shadow project can be saved to disk and later reloaded. The project settings are saved as a separate file from the bitmap plan (if used). The files have a special format and are terminated with the .ATF index. If a plan is being used within the project then this will be saved with the .ASR index but use the same file name as its ATF file.



A demonstration file is included with Arbor-Shadow and this can be loaded from the demo folder located with the main Arbor-Shadow application folder.

## 11. Preference Window

This window allows you to change the text heading of the Title Block and adjust the AutoCAD related variables which are required during the script creation routines. You can also define colours for certain items such as shadow hatch.



If you wish to export to AutoCAD then before creating scripts using the Export function you must first determine which unit of measurement is being used within AutoCAD. Site plans may be created using 1 AutoCAD unit to represent either 1mm or 1 meter. If you get this setting wrong then the shadow plot will either be very large or very tiny when compared to the rest of the drawing.

The plot frequency controls the number of co-ordinates used to create the shadow plot line. A setting of 1 creates the highest quality shadow with up to 1600 separate lines used for each shadow trace. A setting of 5 will divide this amount by 5 resulting in a slightly less accurate plot (as parts of curve become straightened) but with less objects.

Use the check box to automatically visit the Arbor-Shadow website and look for a newer program version or for newer content to the website. It will do this at the beginning of program start-up. You can also carry out the process manually by using the Help drop down menu.



## 12. Latitude, Longitude & Time Basis

This window allows the setting of the site latitude & longitude. Although these values are not critical in the UK (due to our fairly small land mass) they will nevertheless have an influence. The latitude value will influence the sun's altitude and azimuth values and the longitude will influence local time calculation.

The Time Zone selector is for use by counties outside of the UK, it is the difference from GMT (or UT).

The Daylight Saving settings enable you to set British Summer Time (if you are working in the UK) or Daylight Saving Time for the USA and other countries which use the same dates.

The location list contains most major towns & cities for the specified regions. Select the nearest location to your site or enter a new location in the boxes below the list. You can also Add this new location to the list for future use. If you later wish to remove a location, select the Delete button.

**Set Latitude, Longitude & Time Basis**

Time Zone  
Hours from GMT: 0 *Time Diff, +/- from GMT - Leave to 0 if using BST*

Select Year  
2005 *Use Current Year*

Daylight Saving  
☐ None  
☒ British Summer Time (UK: 27th March - 30th October)  
☐ Daylight Saving Time (USA: 3rd April - 30th October)

Select Location  
☒ United Kingdom  
☐ North America  
☐ Europe  
Lancaster  
Leamington  
Leeds  
Leicester  
Lichfield  
Lincoln  
Liverpool  
Llandudno  
Llanelli  
Lockerbie

Define Location  
City: Lincoln *Add to List Delete from List*  
Latitude: 53.23333 dec 53 14 deg/min *North Only*  
Longitude: -0.5333334 dec 0 32 deg/min ☐ East ☒ West

Cancel Reset OK

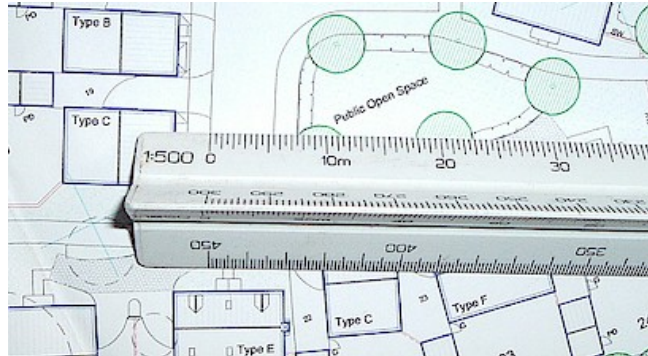
Latitude and Longitude positional data is shown as degrees & minutes or as decimal degrees. Ensure you enter the correct data format if entering data manually.

Note: Currently, the program only caters for northern latitudes (I am hoping to rectify this restriction soon)

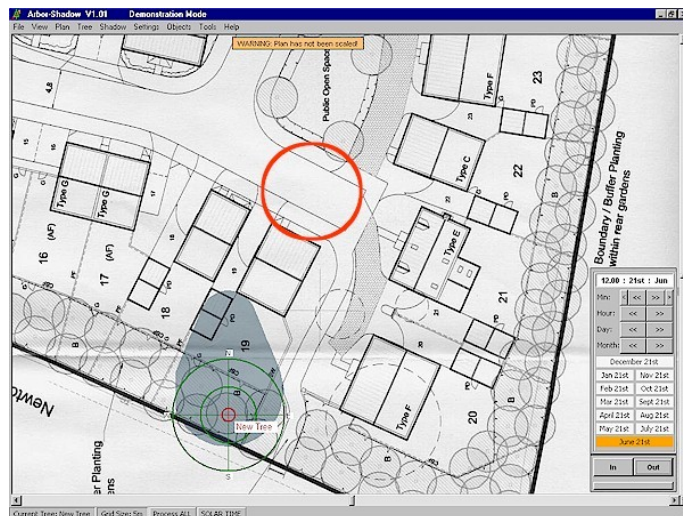


### 13. Plan Scaling: Example 1

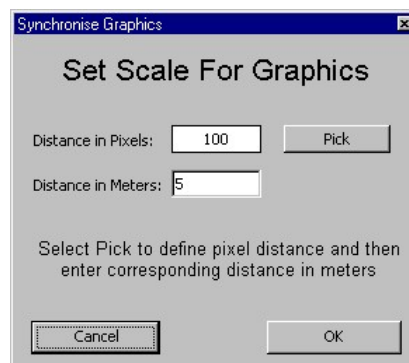
For this example let's assume that I have been supplied by my client with a paper copy of a plan. I have scanned the section which I need into my PC and produced a bitmap file. I need to select an item to measure from the plan so am choosing the width of a road (I could use anything I like). My paper plan has a scale of 1:500 so when measuring across the road I gain a reading of 5.5m from the scale ruler (see picture below). If I were instead using a bitmap generated directly by a CAD program (such as AutoCAD), I would do this measuring procedure on the CAD screen using the Enquire Distance function.



I have loaded my plan bitmap into Arbor-Shadow. I have drawn a red circle to show the area which I measured with the scale ruler (the above picture is approximately 90 degrees rotated).

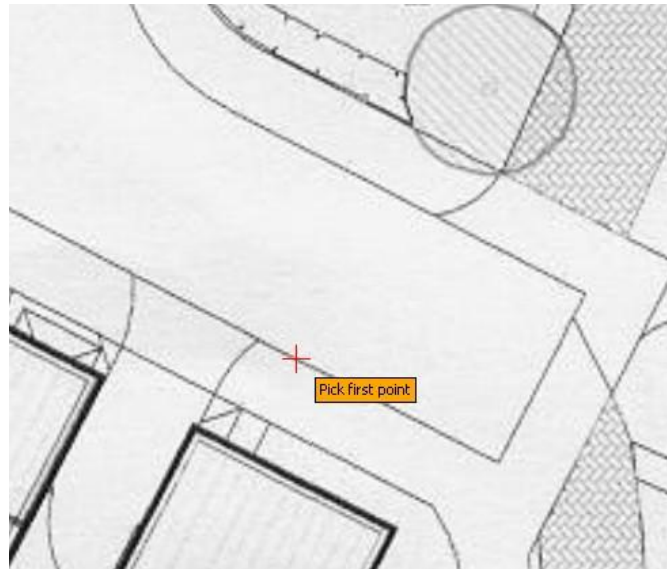


I must now select the Synchronise Graphics selector from the Plan menu so the following window is displayed.

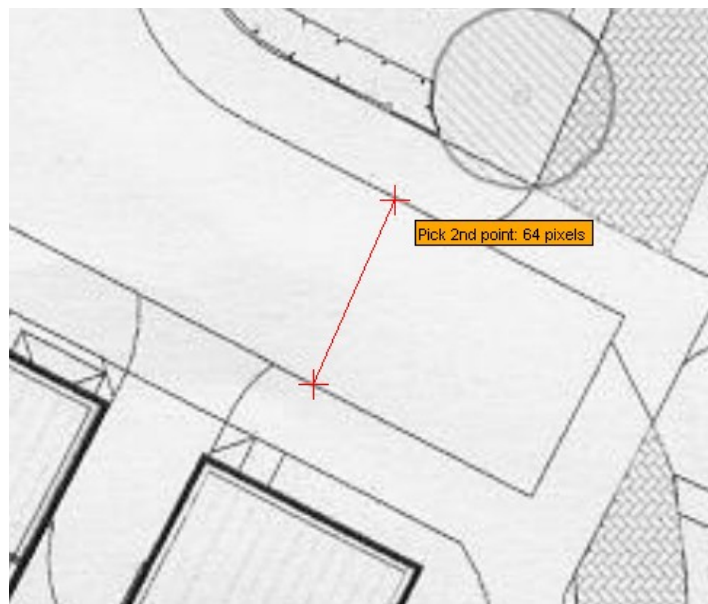


By default the window defines 100 pixels of the bitmap to equal 5 meters in distance (a pixel is one unit of the bitmap picture or 1 coloured dot).

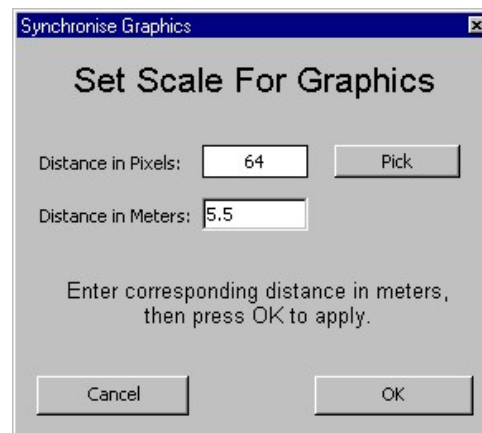
I now select the Pick button and the window disappears and a red crosshair appears on the plan with a little message prompting me to 'pick the first point' of measure. I position the cross at the same point on the plan which I measured with the scale ruler and click the mouse....



I now see another prompt asking me for a second position, which in this case, is the other side of the road. Once positioned, I click the mouse again.



Once clicked the Synchronizing window reappears with the 'picked' distance of 64 pixels defined (this is the distance in pixels across the road). All that remains to do is to enter the real distance (which I measured with my scale ruler); this is 5.5 (see below). Press OK to finish.



And that's it, the shadow graphics are now adjusted accordingly. Compare the tree graphics (especially the length of shadow) in the following picture (after scaling) with the same one at the start of the chapter. They have resized correctly to the scale of the bitmap.



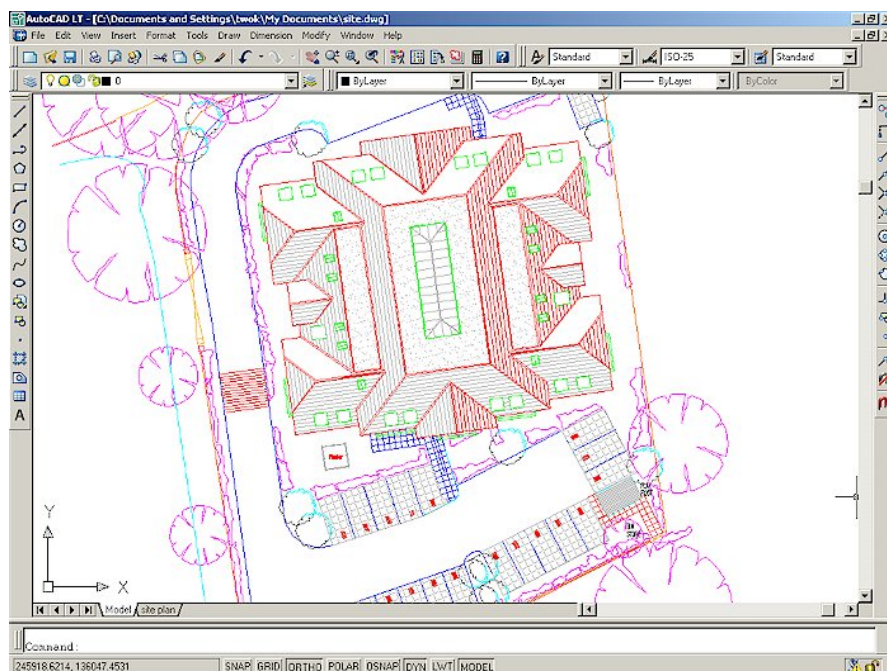


## 14. Plan Scaling: Example 2

For this example I shall transfer an image from AutoCAD by using the windows clipboard.

I start the process from within AutoCAD 2006 LT. I have positioned the view of the tree that I wish to assess at the bottom right hand side of the screen (the magenta canopy outline to the right of the car park). It is important to plan ahead and think about where the shadows will be. They wont be to the south of the tree and in this situation I'm not interested in any shadowing to the right of the site. Also I want to get as close into the bitmap as possible as I can only save the visual screen display as a bitmap.

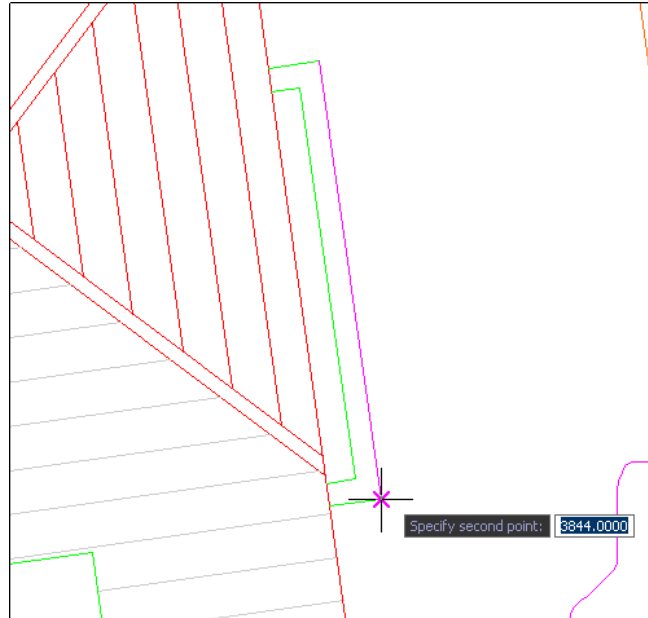
There are two ways to save the screen display as a bitmap, the quick way is to simply press the Print Screen button located on my keyboard or I can actually save the image using AutoCAD routines. The advantage of using the latter method is that I wont have the AutoCAD application window saved with the image.



To save the image properly from within AutoCAD, first set the view as above and then type BMPOUT or JPGOUT into the command line (JPGOUT seems to be available around version 2004 onwards so earlier programs will need to use BMPOUT). The program will now present you with a file selector box so you can name the file etc. Once you have selected OK from the file box you will be requested on the Command Line to select the objects for inclusion within the bitmap. Press Enter, to select all. The image is then saved to file. One important note is quality. I recommend you use BMPOUT as the jpeg quality is poorer and because the size of file isn't an issue here (BMP files can be quite large but they are good quality while JPG is compressed).

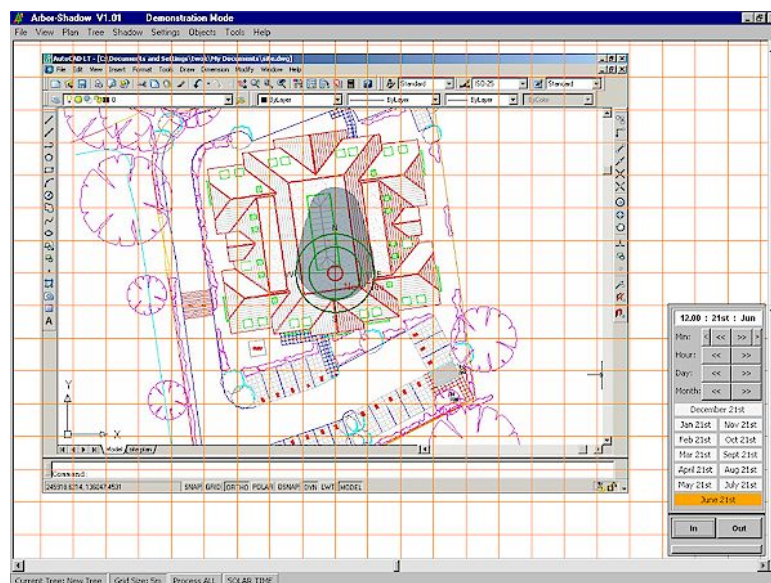
Once you have saved your file or loaded the clipboard by pressing Print Screen you must now, before you quit AutoCAD, take a measurement for scaling purposes (required within Arbor-Shadow).

For this example I have chosen to measure a patio door step located on the lower eastern elevation (see below). To do this I first zoom in slightly, select Enquire - Distance and click the mouse on the top corner of the step. I then drag the mouse to the lower corner and lock it to that corner. AutoCAD 2006 LT gives me a running readout which in this case is 3844mm or 3.844 meters.

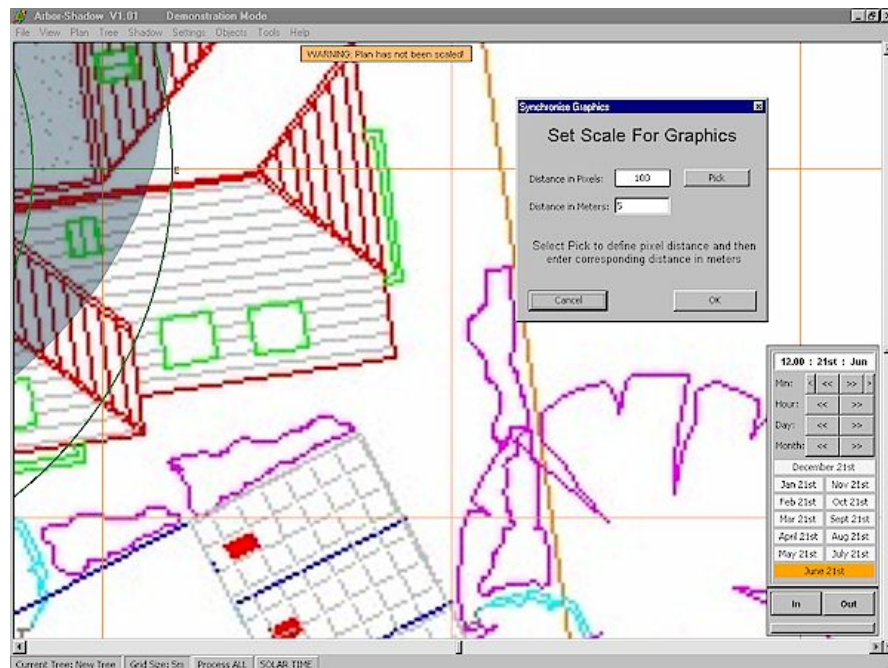


Now I can close AutoCAD and open Arbor-Shadow.

The next step is to insert the saved bitmap file by either loading it from disk or inserting from the clipboard. For this example I shall use the paste from clipboard method to illustrate the problem of the application window edging being included within the screenshot. The following image shows the image pasted (complete with AutoCAD window)! The grid is also switched on which confuses the image a little. Note the default tree located within the centre of the map, I shall only position this after scaling.



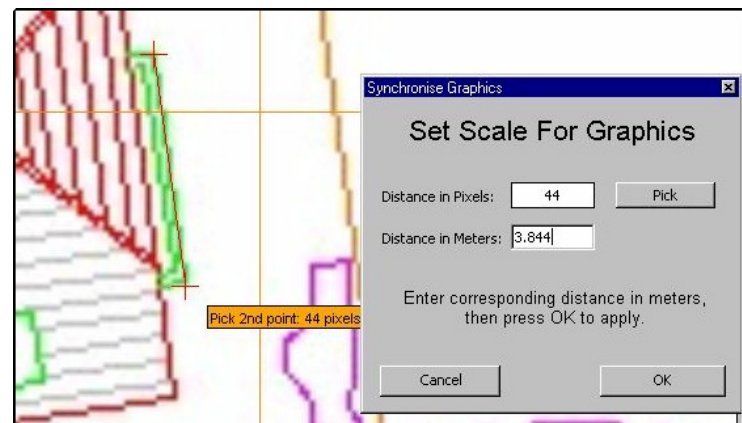
Scaling the plan is the next job using the measurement I took from within AutoCAD. I must now tell Arbor-Shadow that the same door step equals the distance of 3.844m. I start by zooming in to the same area and selecting the Synchronise Graphics window. I select Pick from the window.....



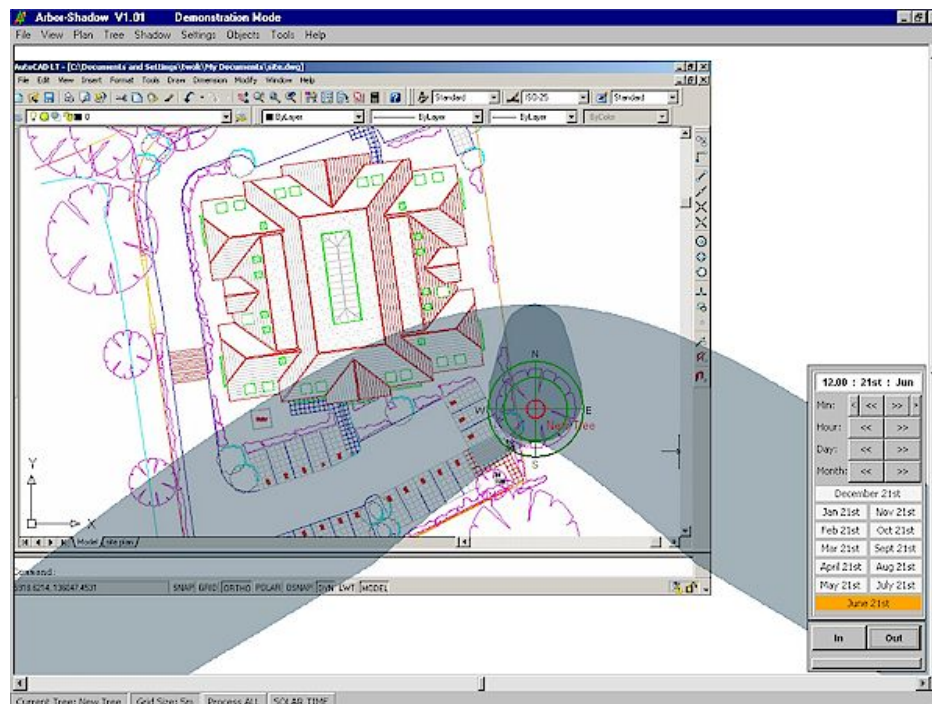
and measure off the distance which I wish to define with the mouse.



And must finish by entering the distance of 3.844 meters into the distance text box.



Once the OK button is clicked the graphics are scaled. All that remains is to position the tree correctly and begin my assessment.



The AutoCAD window is annoying but is not a real problem as I shall zoom in close when ready to export images for inclusion within a report, so it won't be seen. However, it's probably better in the long run to save as a BMP file from within AutoCAD. I will also now convert the image into greyscale and then adjust its opacity using the functions found within the Plan menu. This improves clarity.

Another point worth mentioning about the above example is that I should have zoomed in harder from within AutoCAD before storing the screen image. I didn't actually need to see the northern side of the building so I should have concentrated on the southern side. I could then have enjoyed more quality when zooming in to the plan while inside Arbor-Shadow (you can see the effect of this in the above door step images, the graphics are becoming blocky and losing definition).



## 15. Data Display Window

This window appears at the left hand side of the main display window when its selector is checked within the View drop down menu. It simply gives a readout of various variables which you may occasionally need to look at.

They are organised in subject areas, as a 'tree structure' so only the subject area required needs to be selected. Most of the data variables are self-explanatory so I shall only describe a few in detail.

### Height and Spread

Height Mod simply reminds you whether the modification setting is active. If it is it will show ON and the modification value will be displayed. The Height value will then be modified accordingly. The same applies to the Spread Mod & value indicators.

LCS = Lower Crown Spread      UCS=Upper crown Spread

Shadow Max Length is the length of longest part (measured from the tree centre) of the currently displayed shadow. ST Length is the length of shadow based upon tree height only (without the influence of crown spread). Tot Area is the area of the tree shadow in square meters.

### Reference Objects

The reference objects relates to the currently selected object (area or point). The A-E values relate to the distances from the currently selected tree of each point on the Area. If the object is a point then only A will have a value. The Area relates to the area of the Area object ! The Ovr Area value is the area of overlap between current tree shadow and current area. This is also displayed as a percentage (Ovr Per) of the Object area.

### Date & Time

Active Time indicates the current time system employed.

Selected Tree

Name: Tree - T1

Height Mod: OFF

Mod Value: -

Height: 19m

Stem: 3m

>

Spread Mod: OFF

Mod Value: n/a

LCS North: 6m

LCS South: 4m

LCS East: 4m

LCS West: 5m

UCS North: 2m

UCS South: 2m

UCS East: 2m

UCS West: 2m

>

Shadow

Max Length: 12.25m

Max Width: 9.01m

ST Length: 10.25m

Tot Area: 94.23m <sup>2</sup>

>

Sun Position

Altitude: 61° 39" (61.7)

Declination: 23° 26" (23.4)

Azimuth: 176° 40" (176.7)

>

Site Position

Place: Oxford

Latitude: 51° 45" (51.75)

Longitude: 1° 15" W (-1.25)

>

Ref Objects

Total Objects: 1

Current: Garden 1

Area: 45.46m <sup>2</sup>

Ctree Overlap: 6.62m <sup>2</sup>

Ctree Overlap: 14.6%

Ttree Overlap: 6.62m <sup>2</sup>

Ttree Overlap: 14.6%

A: 16.03m

B: 14.8m

C: 14.93m

D: 10.39m

E: 11.56m

>

Date & Time

Day: 21st

Month: June

Year: 2005

Active Time: LOCAL

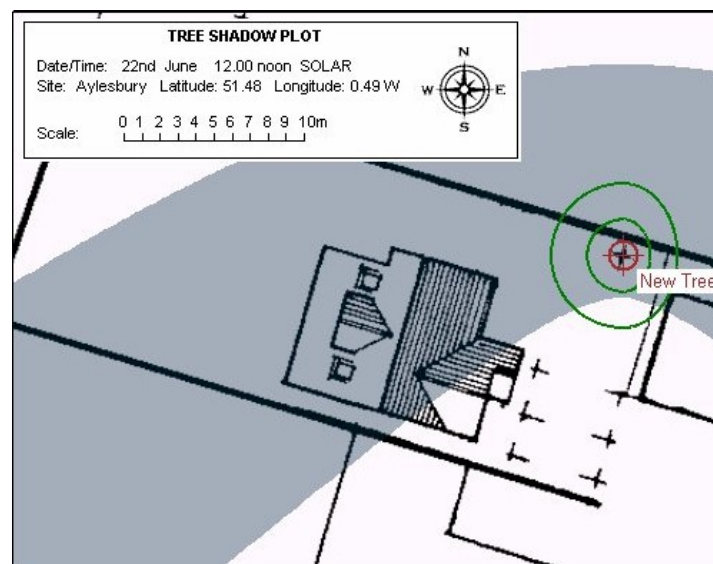
Time: 13.00

>

## 16. Title Block

The Title Block can be switched on from the View menu. It is intended for use with exported graphics where a scale and site details can be included with the image which is then included within a report.

The block consists of a rectangular white box with a definable title text. it also displays data relating to the shadow date and time and site details. The following image shows it in use. The scale changes with the current zoom setting so will always be accurate for the screen display and thus, the exported image. The compass can be switched on 7 off independently from the View menu. It can also be isolated from the Title Block and repositioned independently on the image (see Menus for further information).



The border of the title box can be switched off if preferred from the View menu settings.

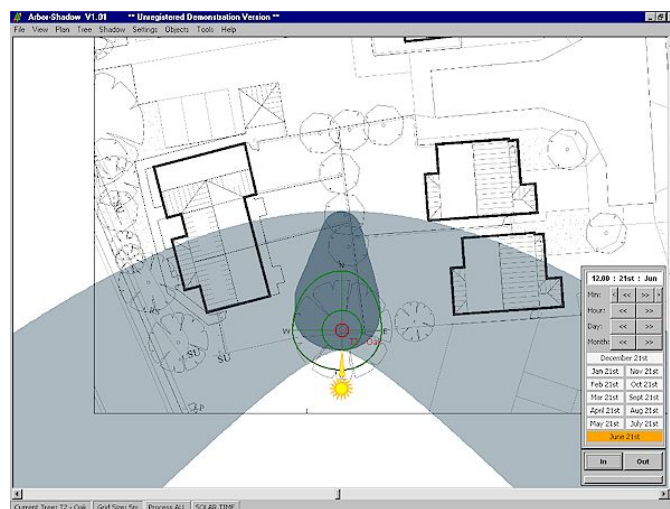
The Title text can be changed by using the Preferences window which is selectable from the File menu.

## 17. Plotting to AutoCAD

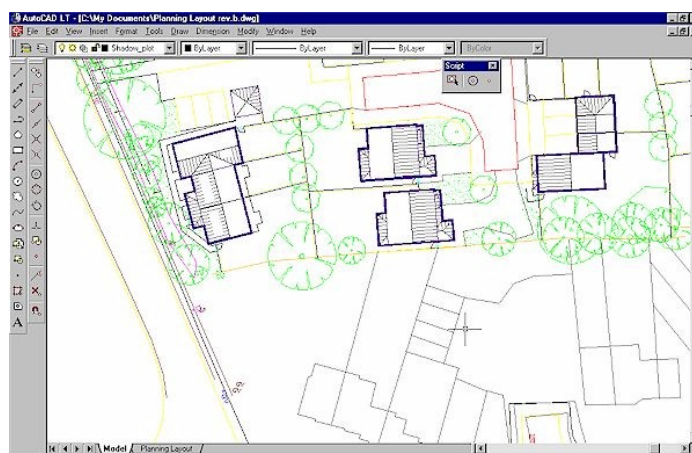
Arbor-Shadow can be used to create AutoCAD script files which can then be loaded into any version of AutoCAD for plotting. The scripts can be either the individual shadow, the day extent trace or the larger canopy outline of the tree. When you select the Export Script function you will be asked to define a filename.

The script file consists of a number of drawing entities which use the relative method for co-ordinate placement. All co-ordinates are calculated from the tree centre position so when plotting within AutoCAD we must ensure that the script also starts drawing relative to the same tree centre.

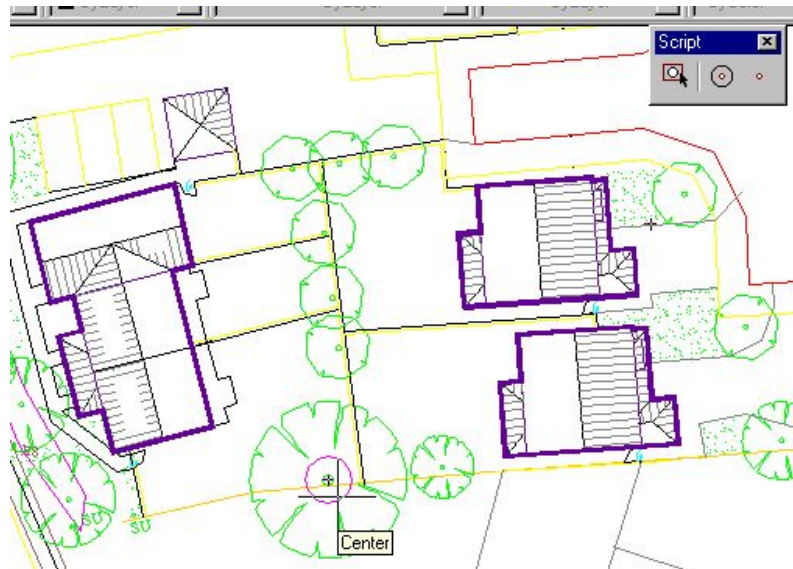
As an example I will plot the two shadow outlines on the following image. I have exported both shadow types and created them to files on disk.



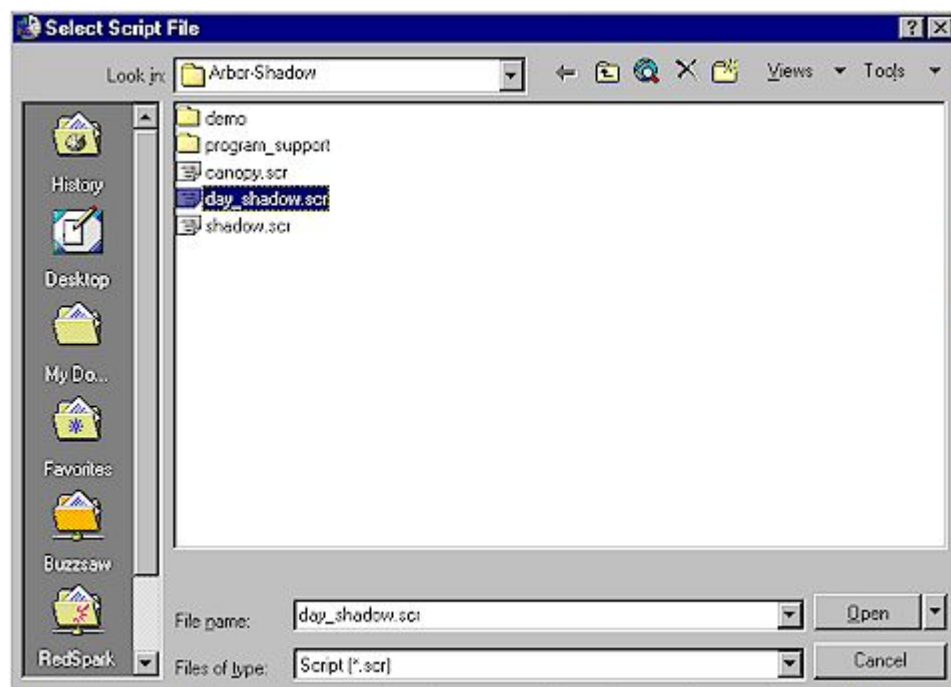
I have the original AutoCAD drawing loaded and positioned correctly (see next image). I have checked which units are being used and set the preferences accordingly. I also have my script toolbar active. This is a good time to create a new layer so you can keep the shadow data separate and switchable. I have created one called Shadow\_Plot and ensured it is Current. A typical plot produces hundreds of entities which can be a pain to remove or transfer to a layer at a later time.



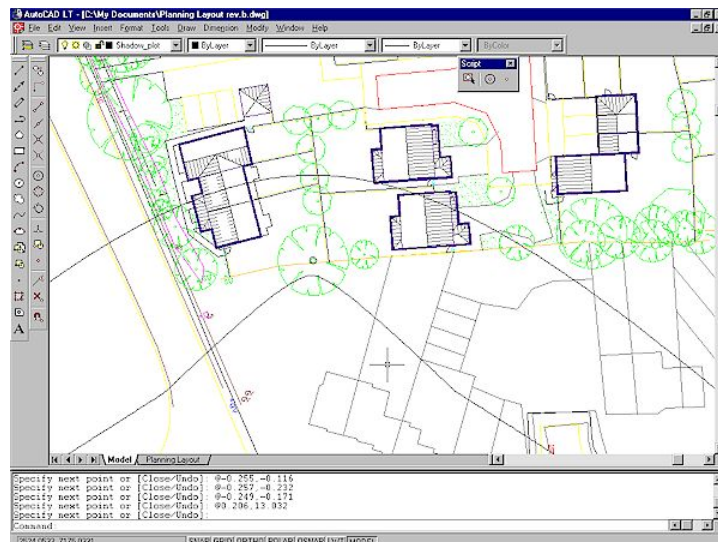
To plot the shadow scripts I must ensure the current plot position is first centred to the centre of the small circle which designates the tree position. This is carried out using the ID command which is built into the custom tool button. So, after selecting the Script plot button on the custom menu I am asked to pick an ID point with the mouse. So I need to use Snap to Circle Centre which is also on my toolbar and then position the mouse cross hair near to the target tree centre (see below).



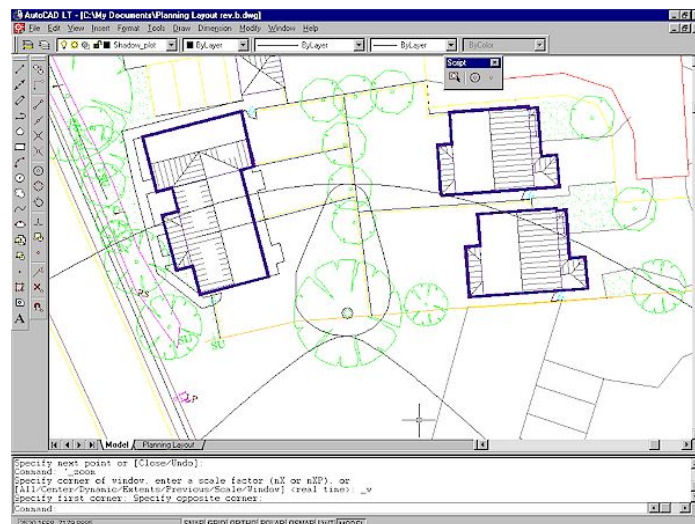
Click the mouse and the Script load window appears. It's now a simple case of loading the script file which I have previously saved from Arbor-Shadow.



Once selected the shadow outline is plotted.



I shall now repeat the operation for the true shadow outline.



The image resembles the Arbor-Shadow screen shot at the start of this page. Obviously some accuracy is lost in the process due to the scaling of a bitmap within Arbor-Shadow. This is one good reason why it is best to use a high resolution bitmap and choose to synchronise over a long distance so that accuracy increases.

As you can see the plot only creates an outline. If you wish to fill (hatch) the shadow then you have two options.

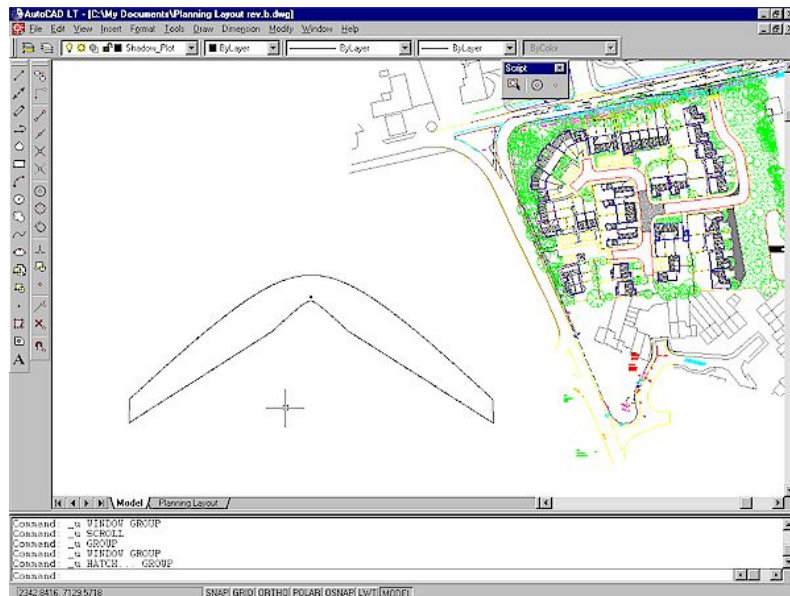
One option is to first plot a single shadow. Then turn off all other layers. Create the Hatch (on a new layer if required). And switch all layers back on.

Or, alternatively, and probably easier is to first plot the shadow away from the site on an empty background. Create the hatch as above and then move the whole shadow plot to the target tree position.

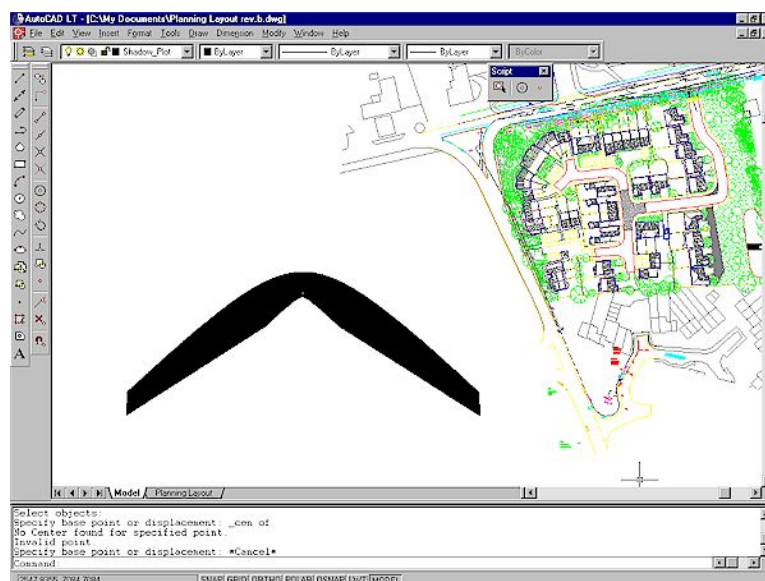


## 18. Plotting to AutoCAD: Hatch

In this example I have plotted the shadow script on an area away from the site plan. Note the small circle inside the shadow outline. The centre of this circle represents the centre of the tree position. It is included to act as a reference point when moving and centring the shadow.

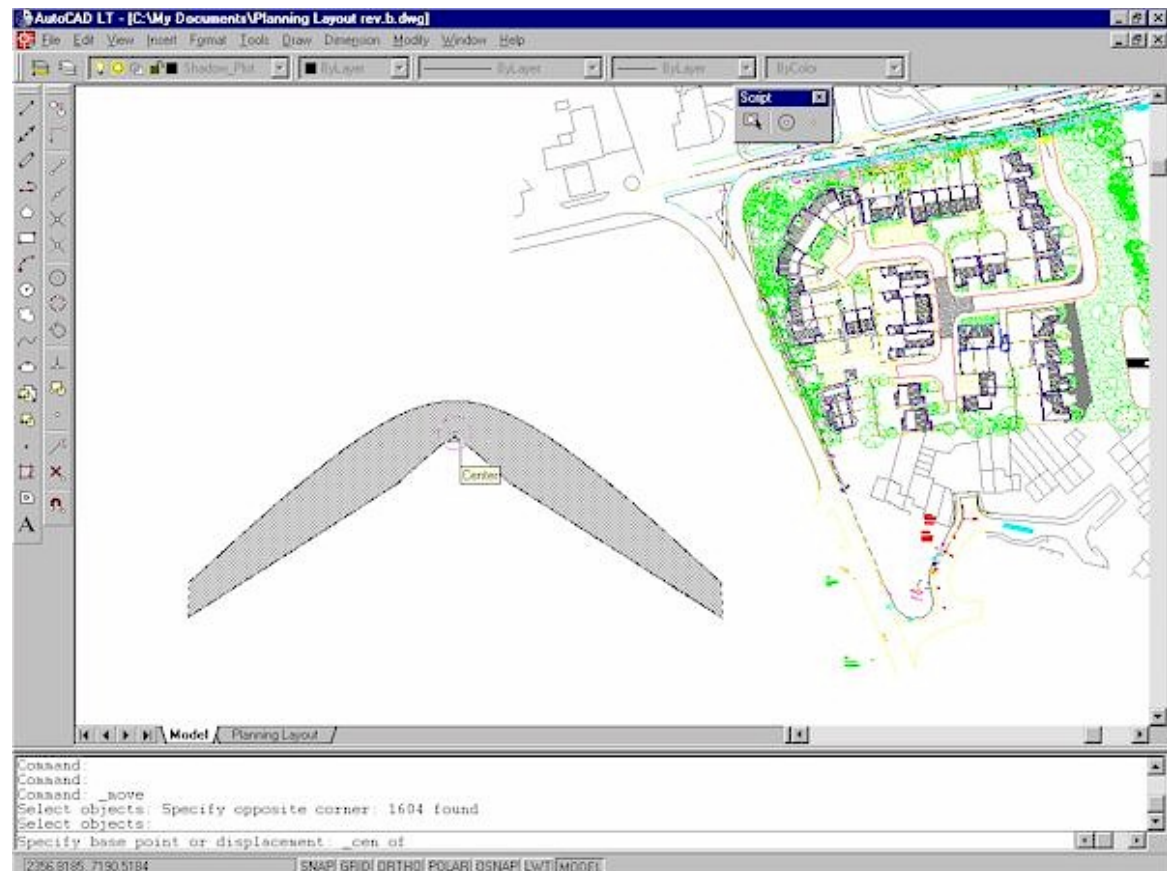


Next step is to hatch the shadow by selecting the Hatch command. You may wish to specify a new layer at this stage; I shall use the existing shadow\_plot layer. See your AutoCAD manual for Hatch instructions but generally you need to first select pick objects, draw a rectangle around the whole shadow, press enter, choose your hatch style, and its scale etc. I have chosen a solid hatch style (below).

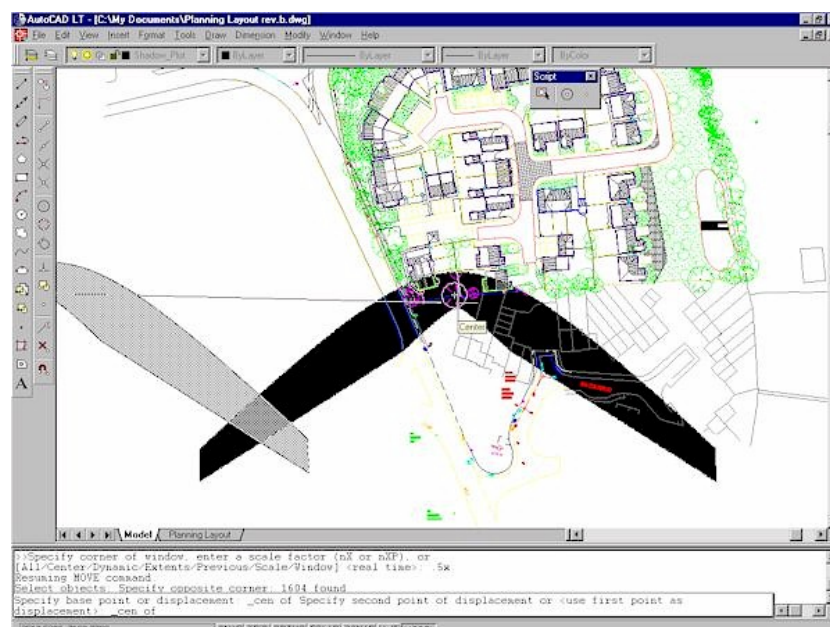




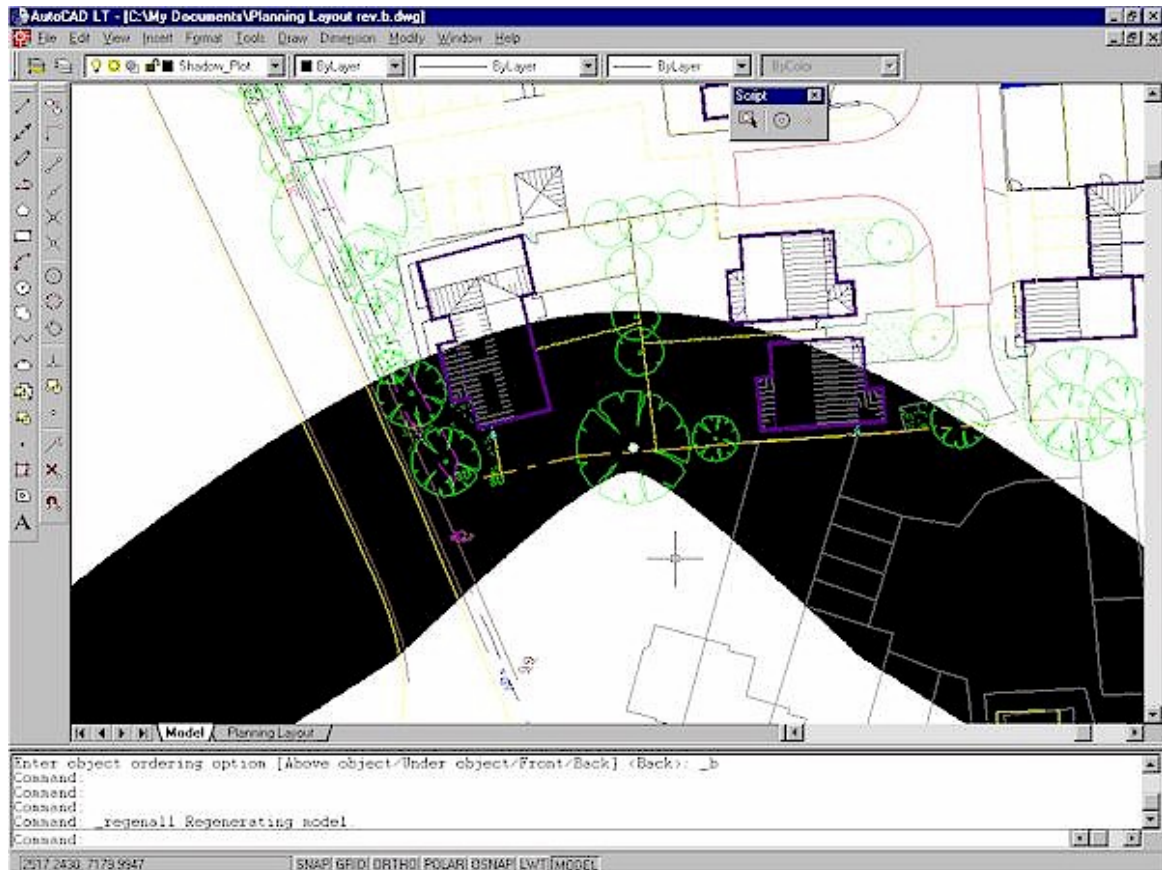
Now I must move the whole shadow group to the correct position on the plan. This is carried out using the Move command. When prompted for the source base point you need to use **Snap to Circle Centre** to centre on to the reference circle (see below).



Then when prompted for the Move objects you select the whole shadow group. And finally, when prompted for the destination base point you again use the snap to circle centre at the target tree position (see below).



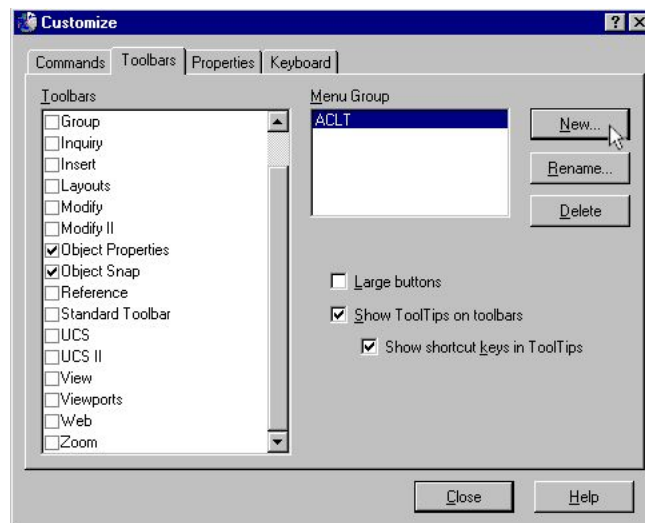
And that's it. One last point is when using a solid hatch it will obscure all other entities drawn below it, so you will probably need to change the display order for the hatch. To do this, first select the hatch entity, and then use the display order selector on the drop down menus to send the hatch to the back of the drawing so it lays below all others (as below).



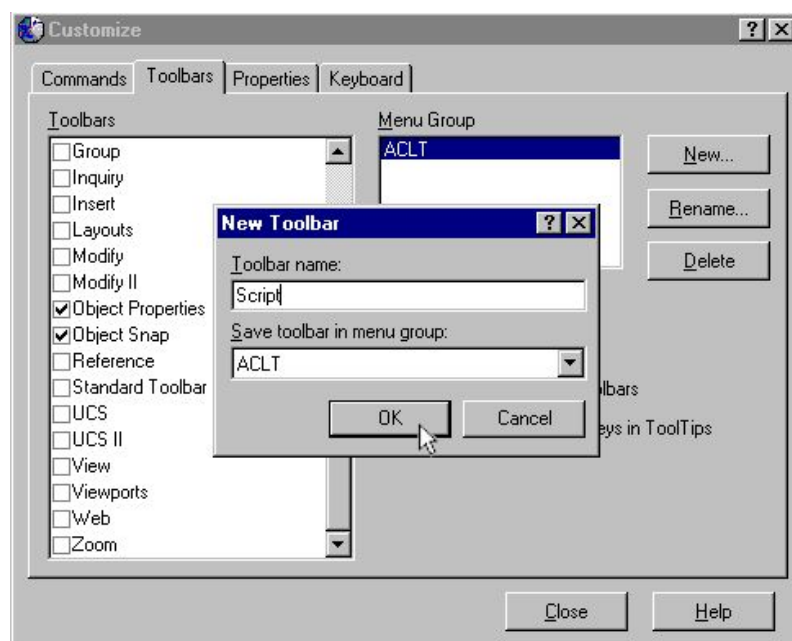
## 19. Installing a Custom AutoCAD Script Control Toolbar

If you intend to plot shadow data on to AutoCAD drawings then you will need to load and run scripts from within AutoCAD. It is not essential to install a Toolbar to load and plot the scripts, as the same commands which it uses, are already available on the existing AutoCAD drop down menus. However, it does save a lot of time and makes the process much simpler. It is also only necessary to create the toolbar once as it automatically loads when you open AutoCAD. The following process applies to Pre-2006 AutoCAD versions.

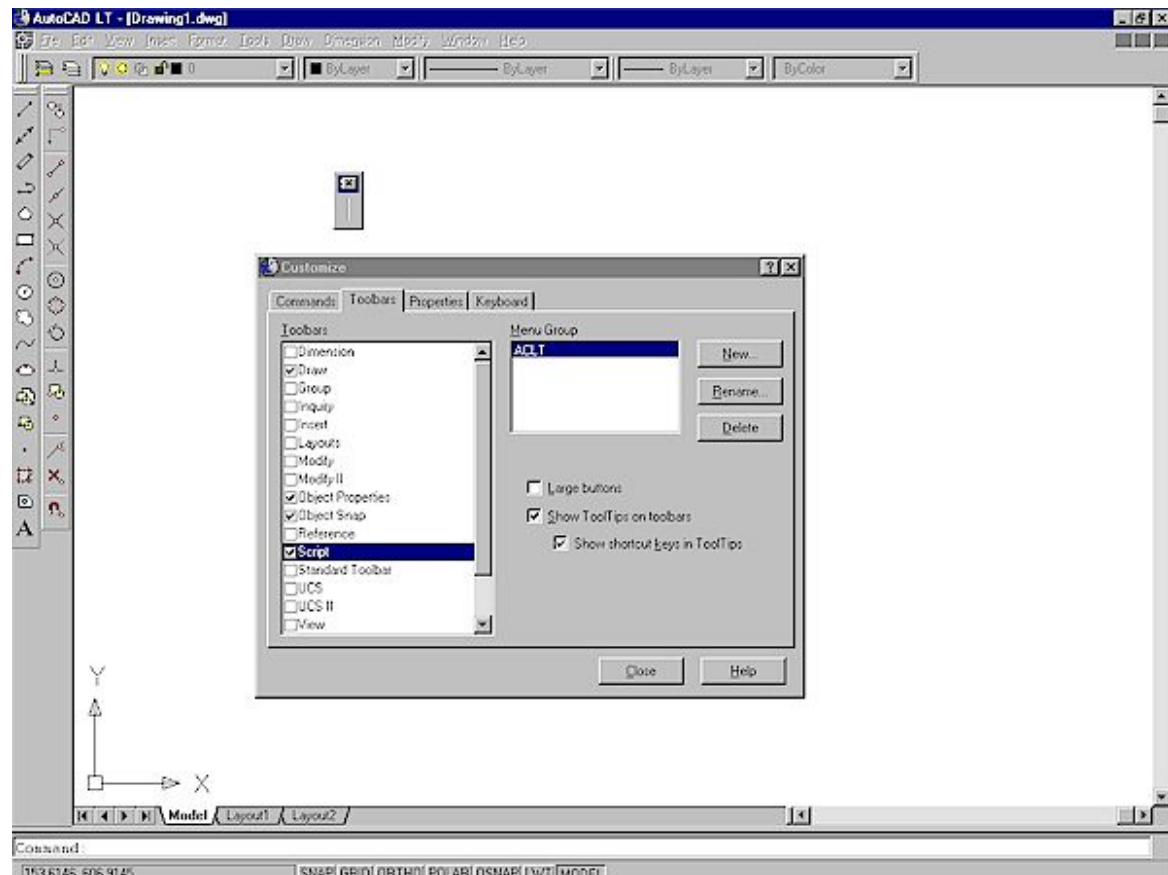
You have AutoCAD open and can now start by selecting the Customise Toolbar/Menu dialogue window from the Tools drop down menu. Now select the Toolbars tab and click on the NEW button (see below).



Now give the new toolbar a name, I am calling this one Script! Click OK.

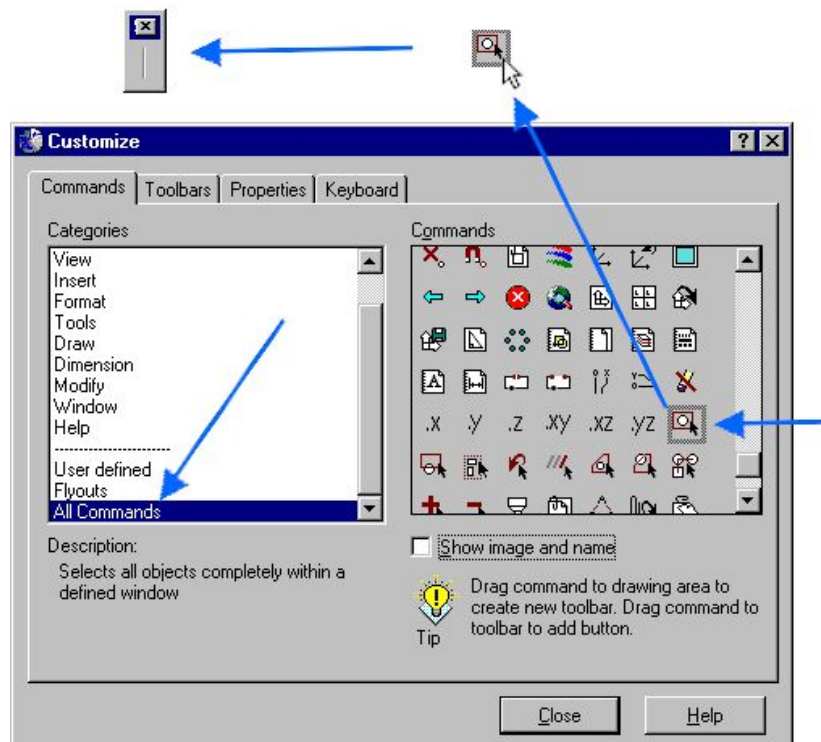


A new toolbar appears on the screen (see below). At this stage it doesn't have any buttons, so that's the next step.

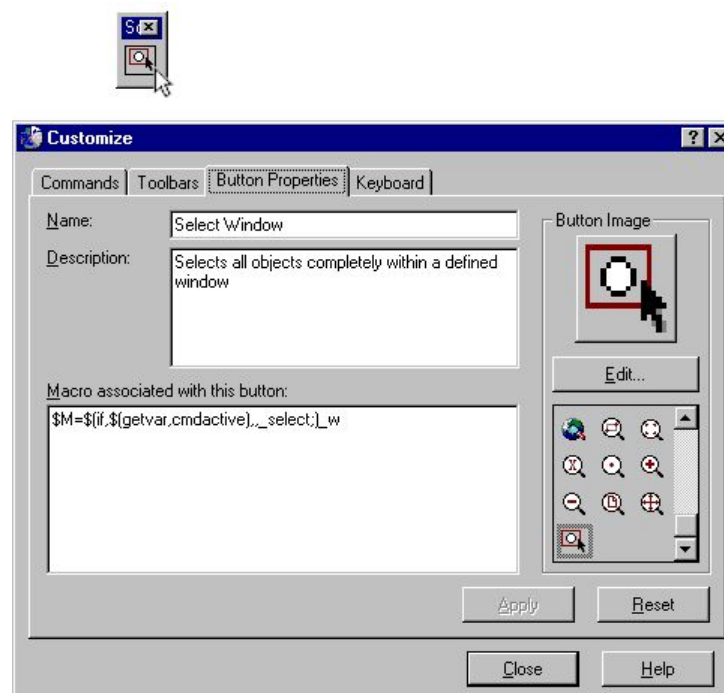


First click the Commands tab on the window and then scroll down the category list and select All Commands. A list of all available buttons will appear in the commands window (uncheck the Show Image and Name selector to see then as below). You must now choose any button you like which you wish to use to represent the Script Plot process (we will change its commands and name later). If you want to draw your own style then you can still choose a stock icon from the list and redraw it later.

In the following example I have chosen the filled circle in a rectangle. To use it, I must first grab it with the mouse and move it to my new toolbar. Do this by clicking and holding down the mouse over the button and moving it to the toolbar.



And I have my first button. Now click the mouse on the new button within your new toolbar. Its properties will appear. These properties relate to the stock button and are no good for our purpose. So we must now enter our command macros and also change its name and description. You can also edit the image if you wish.

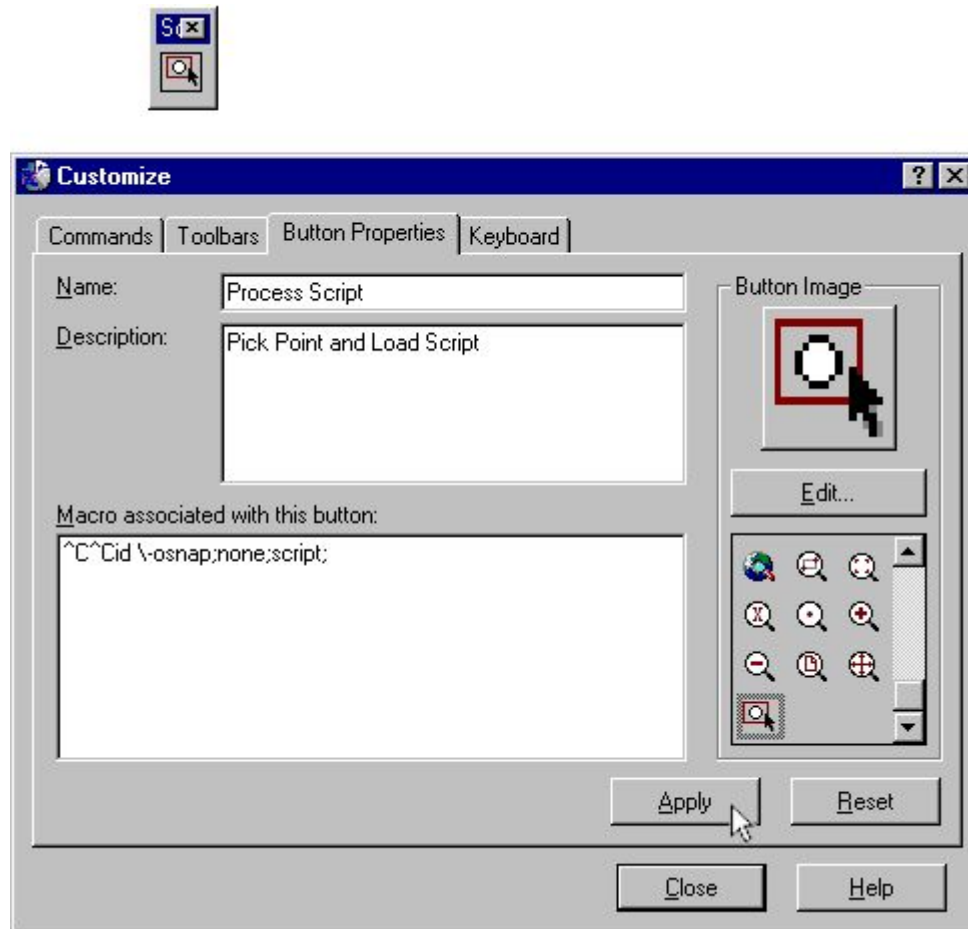




The essential text to enter is the Macro. The name and description text can be anything you like. You must get the Macro correct (it is critical you use these exact letters without modification).

`^C^Cid \-osnap;none;script;`

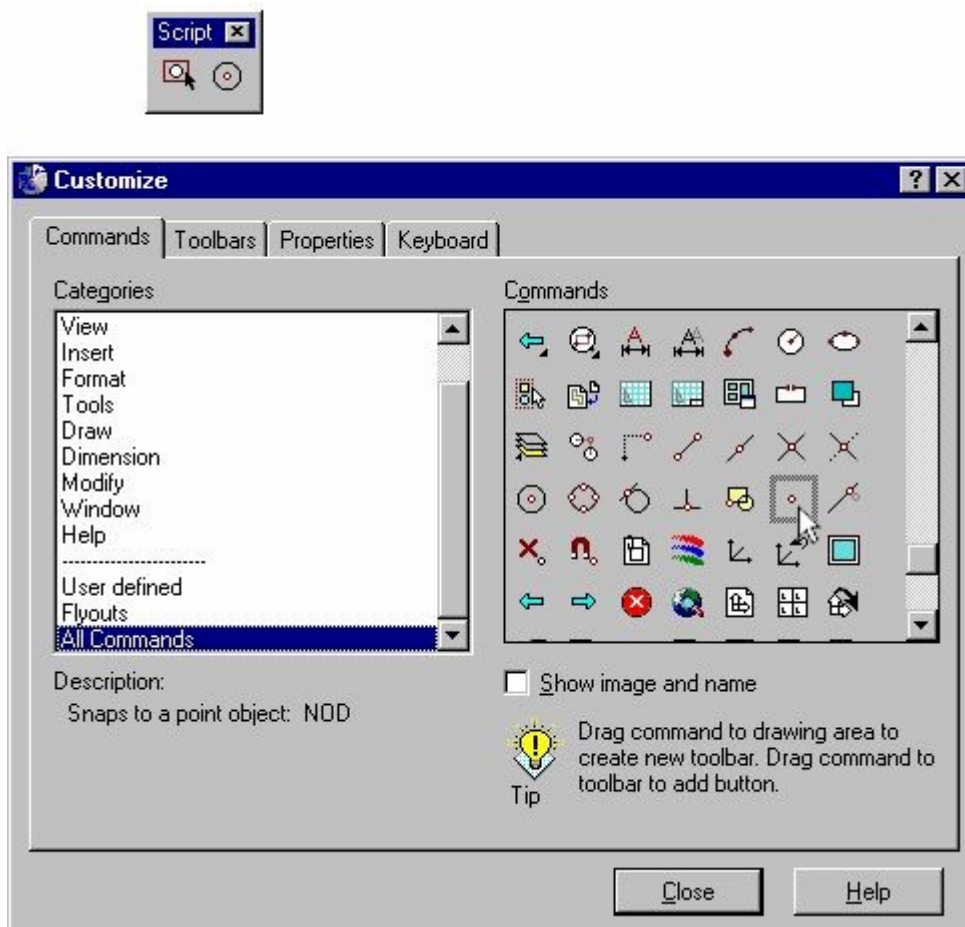
The above macro first cancels any current unfinished AutoCAD commands. Then it requests you to pick an ID point. It then cancels any object snap settings. And finally opens the script selection window. In the following image I have inserted the important macro text. Now I click Apply and Close.



I could stop now and keep the toolbar as it is. But it looks a little pathetic on its own so will add 2 more buttons which I use a lot for plotting tree related data. These are the snap to circle centre and snap to node. You could add more and build a toolbar with you favourite command.



Adding more buttons is simple. Simply open the customise window again, select the button list as before. And transfer the buttons you wish to use. In the following image I have already moved the Snap to Centre button to the toolbar and are now clicking on the Snap to Node button.



Once finished I have a 3 button toolbar called Script which I can hide, move and select like any conventional toolbar.

