

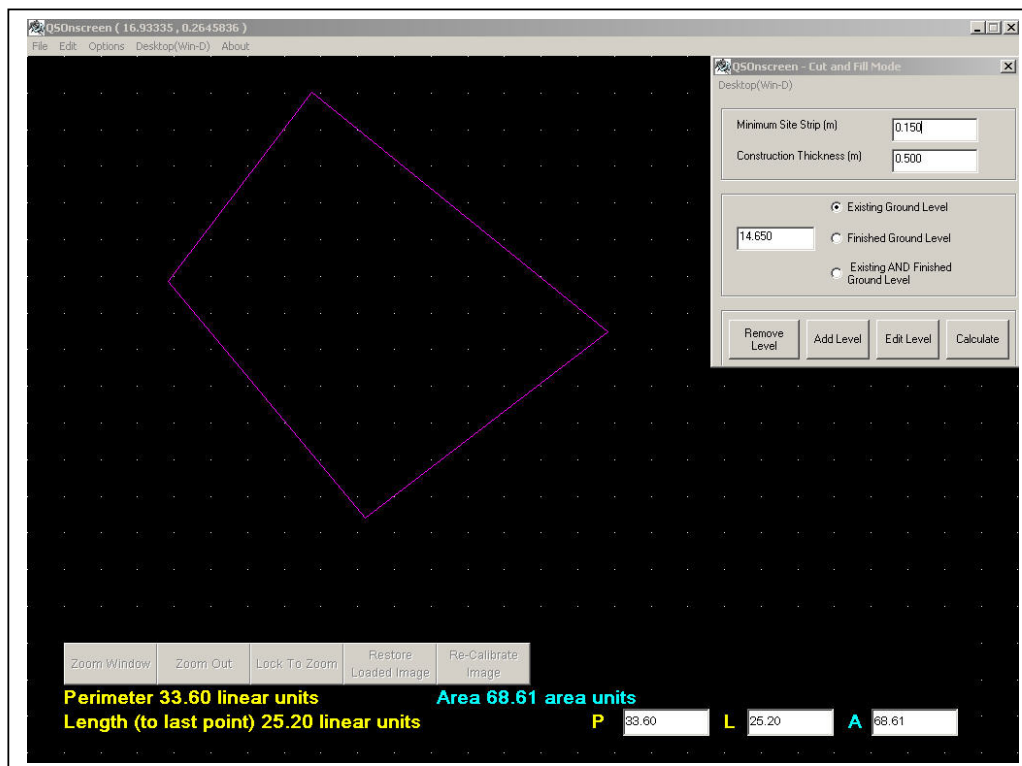
## QSOscreen Measurement Utility

(Note: Minimum screen resolution for use with this program is 1024 x 768. If you attempt to use the program at a lower resolution, the display will not fit on the screen. Higher resolutions will adjust automatically.)

Using QSOscreen, you can calculate simple or complex areas and lengths from screen images of your drawings by tracing around the outline with a mouse in the same way as you would use a digitiser or an old style planimeter with hard copy drawings.

General instructions on how to use the software to calculate areas and lengths are included in a separate document and it is assumed you have already familiarised yourself with the general operation of the program by following that document. This document describes specifically the cut and fill mode introduced into QSOscreen in version 3 of the software.

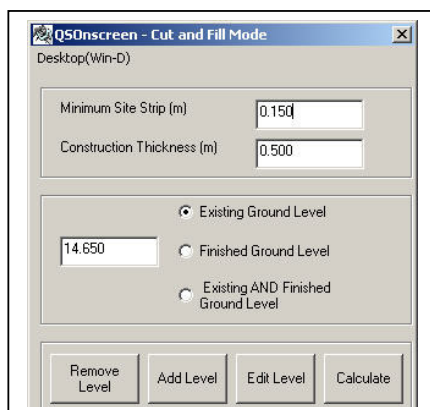
### Cut and Fill Mode



Cut and Fill Mode can be selected from the Options menu before or on completion of an outlined area.

After the calculated areas and lengths are given on screen a new window pops up for you to enter a level and to select whether it is an existing, a finished level or both.

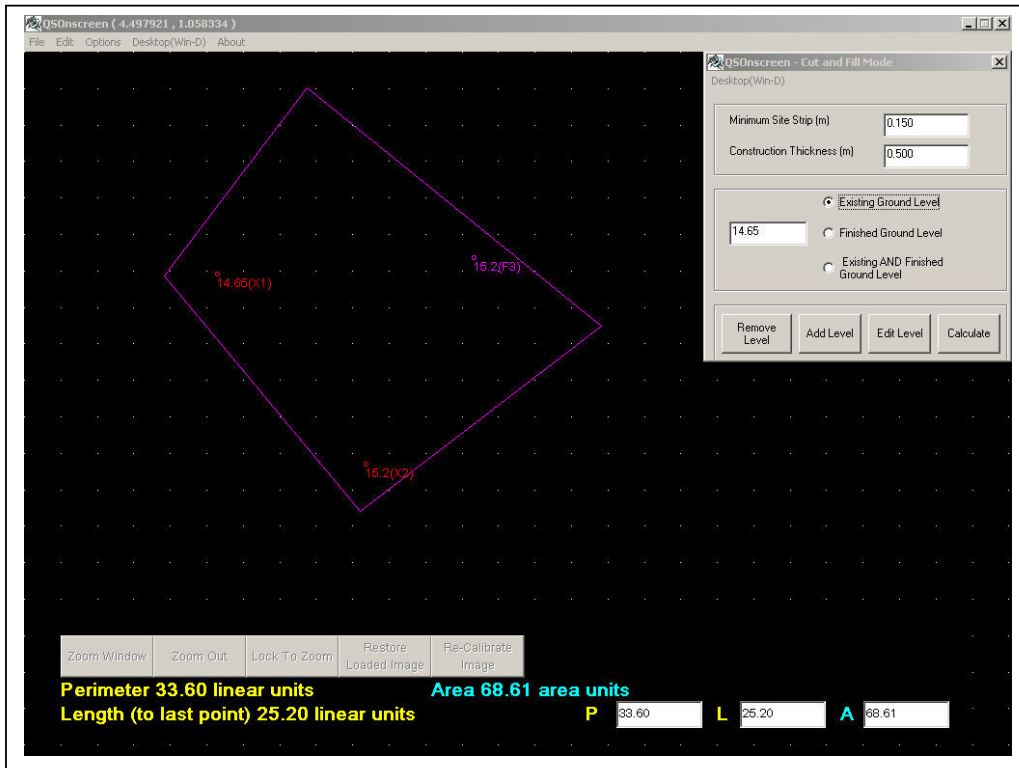
In this example, we want to enter an existing level of 14.650 onto the outlined area so first of all type that number into the box at the bottom of the cut and fill mode popup.



Next select “Existing Ground Level” from the options next to the level number and finally click on the “Add Level” button. The popup will now disappear and the cursor will change to a crosshair for you to place the entered level into an appropriate place on (or near) the selected shape.

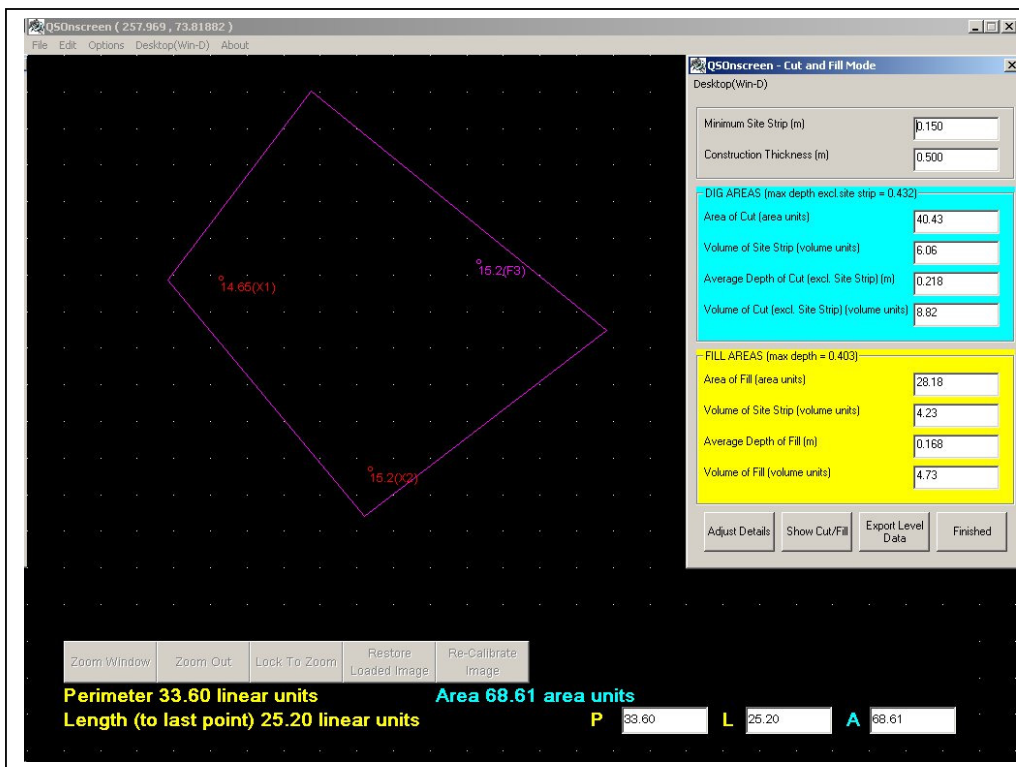
You must enter valid numeric values for the “Minimum Site Strip” and “Construction Thickness” (say) 0.150 and 0.500 for now. These can be changed at any time prior to calculation of the cut and fill quantities and can be adjusted after a calculation if required. More about that later. For the time being we’ll continue with the basics of operation.

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Once you place a level onto the outlined shape, the popup reappears for you to enter another level. The minimum requirement is one existing level and one finished level. In this example we will enter a second existing level (15.200) and a finished level (also 15.200). Note that existing levels show a suffix (X1, X2...) after the level and finished levels show the suffix (F1, F2...) They are also in different colours, the same as the polygon lines. These colours are user selectable from the options menu.

Alternatively, you can choose the option to enter both an existing AND finished ground level (suffix B1, B2...) at the same point. This will be useful in locations around the perimeter where new paving or landscaping works might need to meet up with the levels of adjacent existing work.

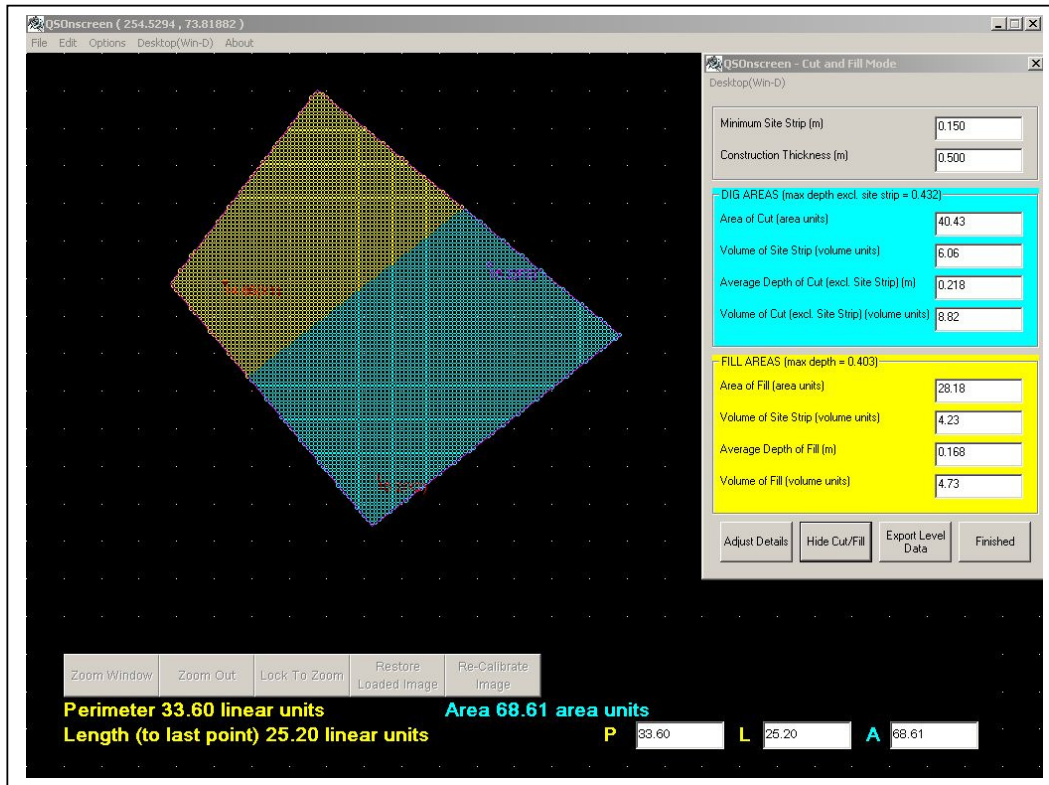


When you have entered all the levels, click on the "Calculate" button on the popup to do the number crunching.

The areas and volumes can be copied and pasted into your spreadsheet or QS software using standard windows copy and paste functions.

In this basic example, we have indicated that the finished site is flat at a level 15.200 and the existing ground slopes up from top left to bottom right in the direction of the two points indicated.

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Click on the “Show Cut/Fill” button to see the division of cut and fill areas in user definable colours (see options menu). This button toggles between “Show” and “Hide” the cut/fill shading.

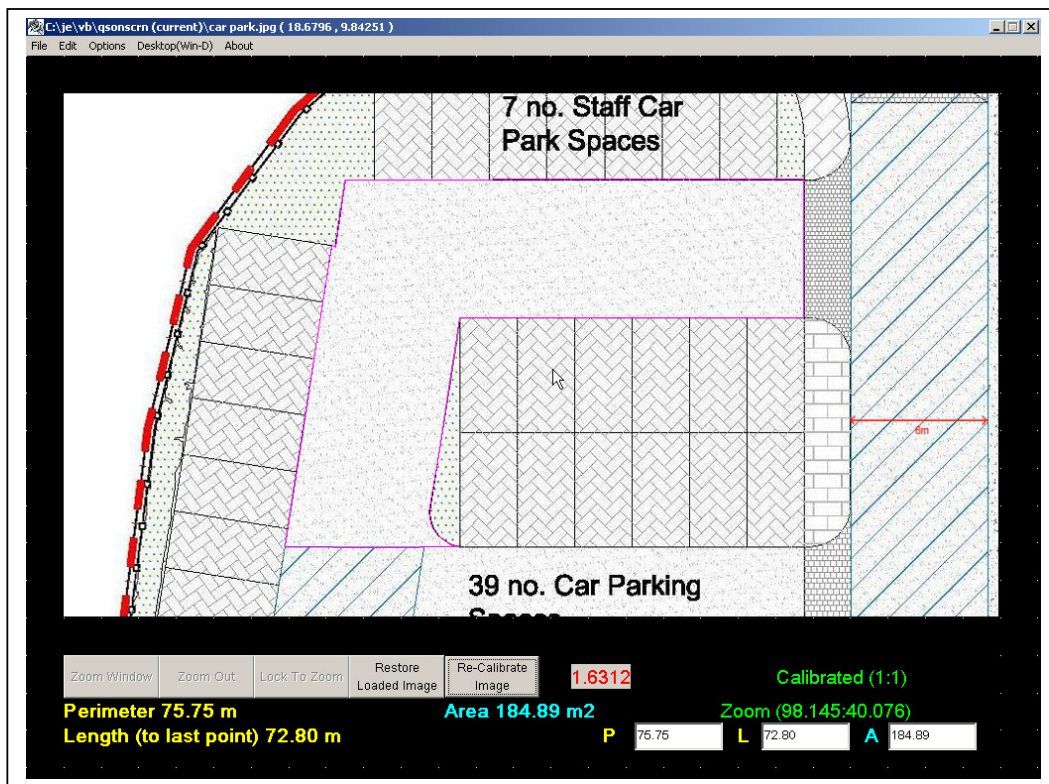
If you want to adjust any of the details, simply click on the “Adjust Details” button to get the levels popup back. From there you can click on “Edit Level” or “Remove Level” to adjust or remove any of the levels you have already placed by

selecting the appropriate level reference from a dropdown list. Adjust or remove as many levels as you wish and/or place additional levels and/or change the site strip and construction depths used to calculate the cut and fill volumes. If you want to have a look at the calculations in Excel (or the like) then click on “Export Levels

Data” which will create a comma separated value file. This should open automatically if selected in Excel .

Now we’ll try an example using the same car park drawing as we did in the original areas and lengths tutorial.

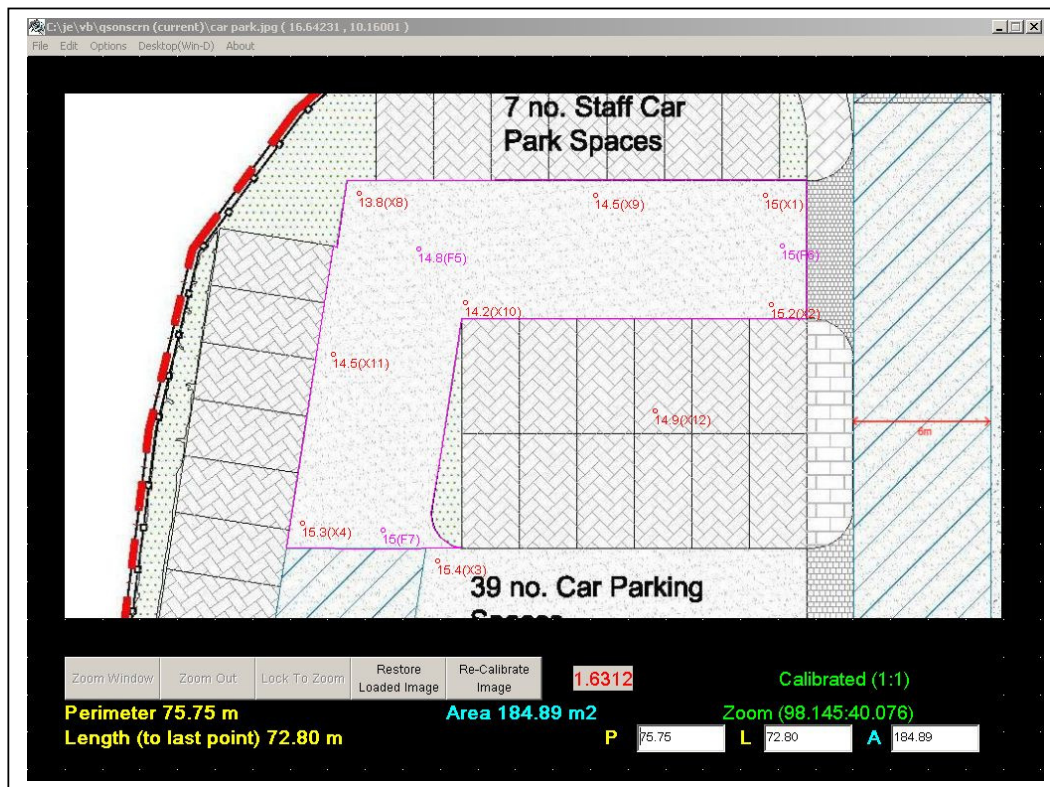
Load and calibrate the drawing (car park.jpg) then zoom in and outline part of the car park.



In this outline we get 184.89m<sup>2</sup> compared to the 185.27m<sup>2</sup> outlined as a separate

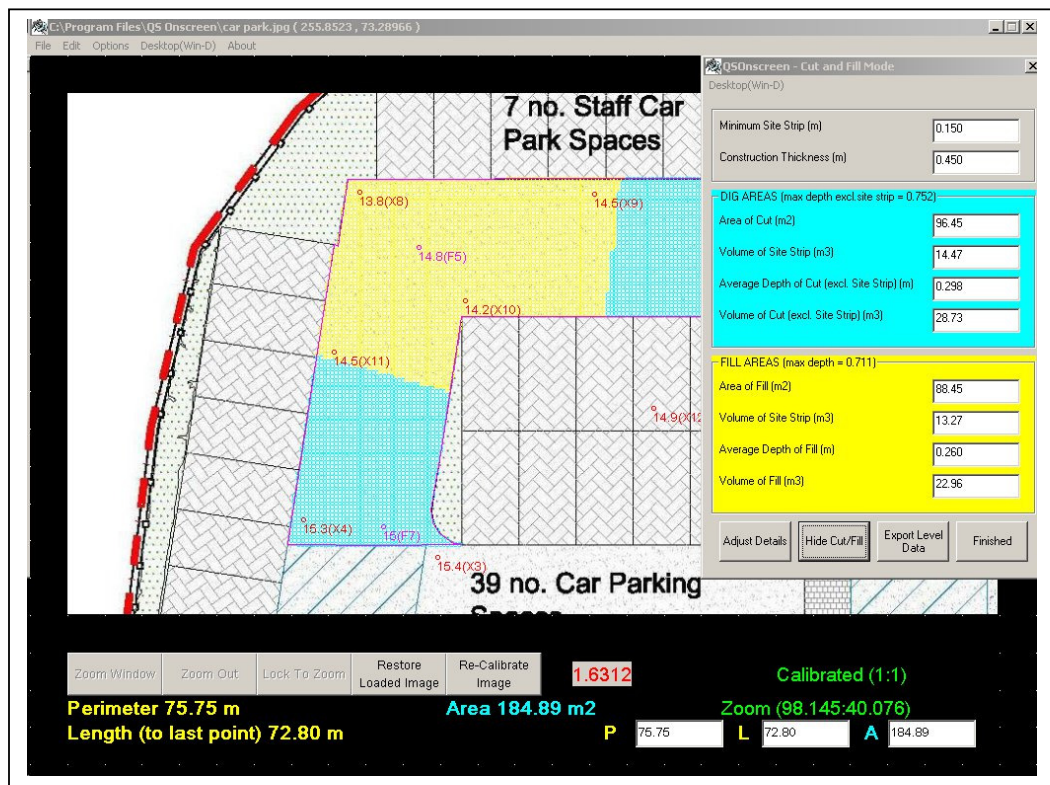
operation in the original tutorial. A difference of about 0.2% which is acceptable.

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Entering levels with a calibrated image loaded is exactly the same as with no image loaded except that we are now dealing in m<sup>2</sup> and m<sup>3</sup> instead of “area units” and “volume units”.

In this more detailed example you can see that the existing ground slopes down from right to left and back up from top to bottom. The finished level does likewise but with lesser falls and less detail given in the levels. Press “Calculate” to see the results.



Drag the results window to one side if required to get a clear view of the cut and fill demarcation.

Click on “Adjust Details” if you want to go back and change anything and click on “Finished” to remove the results window when you are done.

That’s it! If you want to save all the details for future use, select “Save Data File” on the file menu. You can reload all the data and/or change any of the calculation parameters by

selecting “Open Data File” on the file menu. If you get fed up with reminders to save your data, you can restrict these from the options menu so that they only appear if you have previously loaded some saved data. All the information in this car park example is contained in the data file “car park.qso” which accompanies the program. Try loading it and adding or removing some of the levels to see what effect it has on the cut and fill.

## **QSOscreen Measurement Utility**

\* QSOscreen comes with its own printscreen facility operated by pressing Ctrl+P on the keyboard. I usually have my default printer set to pdf file so I can save pdf screenshots showing all the cut and fill lines along with the relevant earthworks calculations.

\*New in version 3.5 – There is a facility on the edit menu to import levels into your currently loaded outline from a previously saved outline provided that the two zoomed images are derived from the same drawing and overlap in some way. Only those levels which are within the scope of the loaded image will be imported and the remainder ignored. So if you were to create a “master” site plan of the entire area and import levels into it whenever you do an outline, the master can then be used to export from whenever you do any subsequent outlines. QSOscreen uses a MD5 hash of the drawing files to ensure that zoomed images are derived from the same drawing when used to copy levels between outlines.

### **So how does it all work?**

To get the best results it is important to understand what the program does with all the levels you input so you can determine the most appropriate points to enter levels and how many are required for any given situation. Although “existing ground levels” are mentioned in the following descriptions, the same principles apply equally to finished ground levels. The interpolation routines are identical in both cases.

In all cases, levels are interpolated to a  $1\text{mm}^2$  grid over the outlined area onscreen and at all these gridpoints cut (+) or fill(-) depths are calculated from the interpolated existing level, the interpolated finished level, the minimum site strip and the construction thickness. All points are weighted (1 to 9) according to how many of the immediately surrounding gridpoints are also inside the drawn outline, thus those points along the edge will be of less significance than those closer to the centre. All similar to established manual grid measurement procedures.

If you only enter one existing ground level, the site is taken as flat with all gridpoints given that level.

If you enter two existing levels, gradients are calculated using a linear interpolation (or extrapolation) from the two placed level points.

If you enter three existing levels, gradients are calculated using a bilinear interpolation (or extrapolation) from the three placed level points. The exception to this is if the three points become close to forming a straight line (rather than a triangle) in which case the interpolation is dealt with as separate two point interpolations.

If you enter four or more existing levels, the program will sequence through (up to 35) different combinations of three levels starting with the nearest level points first until a valid interpolation triangle is found (ie. the gridpoint is inside the triangle formed by the level points). Up to 35 combinations means that all combinations of the 7 nearest level points are tested. If no valid interpolation is found after all the combinations, the program will revert to the nearest three level points and extrapolate to find the gradients.

As can be seen from the detailed example, the chosen level points do not need to fall inside the outlined area. Level points selected outside the outline are equally valid.

For best results, place level points as evenly as possible and pick up all high points and low points. If you are entering a lot of levels or it becomes difficult to read onscreen with your trace image loaded, you can always temporarily hide or restore the trace image using the option on the file menu or pressing (toggle) the shortcut Ctrl+R

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For less experienced users, the cut(+) or fill(-) depth at any given point is the assessed reduced level less the assessed formation level where the reduced level is the existing ground level less minimum site strip and the formation level is the finished ground level less construction thickness.

Cut'n'Fill Depth = Reduced Level – Formation Level

Reduced Level = Existing Ground Level – Minimum Site Strip

Formation Level = Finished Ground Level – Construction Thickness

J. Egan  
E-Quantities Ltd.  
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