That CAD Girl

jennifer dibona

website: www.thatcadgirl.com
email: thatcadgirl@aol.com
phone: (919) 417-8351
fax: (919) 573-0351

Volume Calculations

Initial Setup

- You must be attached to the correct Land Desktop project database.
- You must have two good surfaces built in Land Desktop: typically an existing ground and proposed ground surface.

Overview Steps

1. Create or set current stratum
2. Define site
3. Calculate volumes
    a. Grid volume method
    b. Composite volume method
4. Generate volume report or table
5. Import grid volume ticks
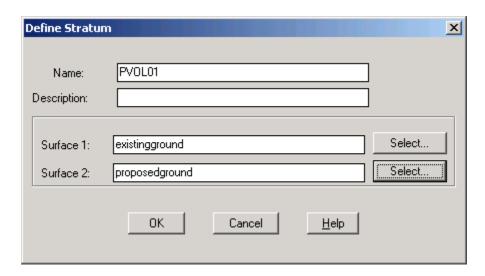

Create or Set Current Stratum

A <u>stratum</u> is a pair of surfaces. When defining a stratum, you are prompted to select "Surface1" and "Surface2".

Because running volumes sets up a subtraction of one surface from another, it is important that Surface1 be the ORIGINAL CONDITION or EXISTING surface and that Surface2 be the MODIFIED CONDITION or PROPOSED surface. This ensures that cut volumes show as cut volumes and fill volumes as fill. For example:

Stratum	Surface Elev at a Point	
PVOL01		
Existing Ground = Surface1	Elev 110.00'	Surface2 – Surface1 = cut or fill depth
Proposed Ground = Surface2	Elev 108.00'	108.00 - 110.00 = (-) 2.00' = cut 2.00'
PVOL01		
As Built Surface Feb 1, 2006 = Surface1	Elev 123.50'	Surface2 – Surface1 = cut or fill depth
As Built Surface Feb 28, 2006 = Surface2	Elev 127.00'	127.00 - 123.50 = (+) 3.50' = fill 3.50'

Go to Terrain> Select Current Stratum. If this is the first stratum defined in this Land Desktop project, you will be prompted to "Define Stratum".

Typically, it is sufficient to give a generic name for the Stratum. You can also provide a Description and then you must enter the name of the surface for Surface 1 and Surface 2 or use the "Select…" button to choose from the surfaces currently defined for the project.

Define Site

In this step, you will be prompted to define a rectangular area inside of which you will be calculating volumes.

Go to Terrain> Site Definition> Define Site.

You will first be prompted for a rotation angle. If the project generally lies in a North-South or East-West orientation it will be adequate to leave the site rotation angle at 0-degrees. But, if the site is oriented along a different axis, you might want to change the rotation to be more parallel with the site orientation. You can either pick two points to define this axis or type in an azimuth angle.

Next, you are prompted for the Site Base Point. This point should be well outside the largest of the two surfaces and to the lower left of the project site.

Next, you are prompted for Grid M size and Grid N size. The M grid direction corresponds to X and the N grid direction corresponds to Y. You will want the grid sizes to be equal and the smaller the grid size the better the accuracy of the calculations. For most subdivision or site projects, a 5 or 10 grid size is sufficient.

Next, you are prompted for the Upper Right Corner of the site. When selecting this point, it MUST be above and to the right of the Site Base Point. This sounds logical, but if the site has been rotated, you may have to be careful in picking the opposite corners of the rectangle. You will also notice that your crosshairs have been locked into a snap/grid based on your defined M and N grid sizes so that the upper right point can only be set at a multiple of the grid sizes.

Assuming the site has been defined as you wish, you can answer "No" when prompted to change the size or direction of the grid/grid squares.

Unless you want to keep the outline of the site in the drawing, you can answer "Yes" when asked whether to delete the old site outline. Land Desktop does not need this outline in the drawing.

Next, you are asked to assign a name to the site. The project name is usually sufficient.

Calculating Volumes

There are two main methods of volume calculations in Land Desktop: Grid and Composite. I recommend running volumes twice using both methods. The calculated cut and fill volumes should be within 10% of one another. However, always use Composite Volumes when reporting volumes for the project.

Each of these methods will require the creation of a "Volume Surface" or "Volume Results Surface" during the process. This surface is different from a typical "Terrain Surface" that is created and built through Terrain Model Explorer. Although you can view the results of a Volume Surface through Terrain Model Explorer, a Volume Surface can only be created using the Grid or Composite method of calculation and not through Terrain Model Explorer.

The Volume Surface is a "delta" surface. It is based on the difference in elevation of the stratum surfaces at each surface point. Each point on the volume surface represents a cut or fill depth at that point.
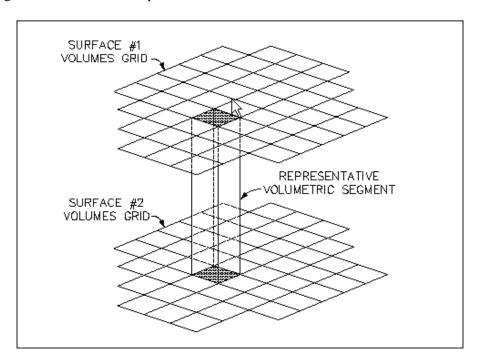
> Example:
>
> At a particular point, the elevation of the existing ground surface (Surface 1) is 110.00 and the elevation of the proposed surface (Surface 2) is 108.00. That same point on the volume surface will have an elevation of -2.00 which represents a 2.0' cut when subtracting Surface 1 from Surface 2.

Grid Volume Method

From the Land Desktop Help Files:

> The Grid method calculates volumes using a grid overlaid on the two surfaces that comprise the current stratum. This method is most accurate when the grid spacing is less than the average surface data spacing.
>
> The following illustration shows this process:

> The Grid method breaks the site into a series of grid cells in rows and columns that are determined by the Define Site command. The Grid method uses the M and N size that you specify when you define the site to determine the dimensions of the grid cells. The Grid method samples the elevations of the existing and proposed surfaces at the corners (or grid nodes) of each cell.

The Grid method uses approximations controlled by the grid spacing. When you use grid-based volumes, make sure the grid spacing is not too large, which might result in imprecise volume estimates.

Go to Terrain> Grid Volumes> Calculate Total Site Volume. Select the correct Site.

In the Grid Volume Settings dialog box, enter cut and fill volume adjustments if necessary. These adjustments can also be made manually at a later time. Pick OK to close the box.

Next, you will be prompted for a New Surface Name for the Volume Results Surface. The Volume Surface compares the elevation of each stratum surface at each grid point.

From the Land Desktop Help files:

If you have already built a grid volume surface for the current stratum and site, the program prompts you to use the name of the new surface and overwrite the existing surface. If you click "No", the program prompts you for a new surface name. If you give the name of another existing surface, you are prompted to overwrite that surface. If you click "No", the prompt for a new name is repeated until you specify a valid surface name that is either new, or existing that you want to overwrite.

After you have specified the new volume surface name and pick "OK", the cut and fill volumes are returned at the command line.

Composite Volume Method

Go to Terrain> Composite Volumes> Calculate Total Site Volume

In the Composite Volume Settings dialog box, enter cut and fill volume adjustments if necessary. These adjustments can also be made manually at a later time. Pick OK to close the box.

Next, you will be prompted for a New Surface Name for the Volume Results Surface.

From the Land Desktop Help files:

If you have already built a grid volume surface for the current stratum and site, the program prompts you to use the name of the new surface and overwrite the existing surface. If you click "No", the program prompts you for a new surface name. If you give the name of another existing surface, you are prompted to overwrite that surface. If you click "No", the prompt for a new name is repeated until you specify a valid surface name that is either new, or existing that you want to overwrite.

From the Land Desktop Help Files:

When you calculate the volumes using this method, instead of using a grid, the Composite method re-triangulates a new surface based on points from both surfaces. It uses the points from both surfaces, as well as any location where the triangle edges between the two surfaces cross. The command then calculates the new composite surface elevations based on the difference between the elevations of the two surfaces.   This method is the most accurate, giving the exact volumes between the two surface definitions

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After you have specified the new volume surface name and pick "OK", the cut and fill volumes are returned at the command line.
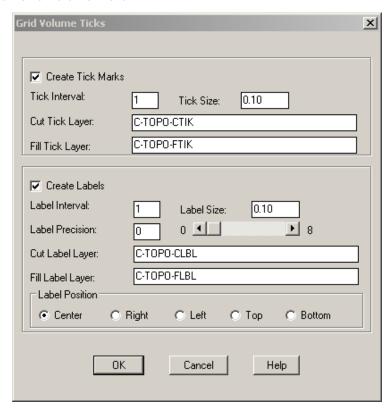

Generate Volume Report or Table

Go to Terrain> Volume Reports> Site Report to create a printable text document showing the different volume calculations by method.

Go to Terrain> Volume Reports> Site Table to create an Autocad text table to be inserted into the drawing.

Import Grid Volume Ticks

After running volumes for a particular stratum, you can import cut and fill volume ticks at some or all grid points. Cut and fill ticks have two different components that may be imported independently or together: tick marks and labels. Tick marks are a plus or minus representing Fill and Cut, respectively. Labels show the actual depth of cut or fill at that grid point.

Go to Terrain> Grid Volumes> Grid Volume Ticks

a. Select the check box next to "Create Tick Marks" to show ticks.
b. Select the check box next to "Create Labels" to show labels.
c. Set the tick and label intervals. An interval of "1" means that ticks or labels will be shown at every grid point. An interval of "2" would show ticks or labels at every OTHER grid point.
d. Set the tick and label size. These values are plotted size and will be multiplied by the horizontal scale factor set in Drawing Setup.
e. Set the label precision to show the desired number of decimal places.
f. Set the cut and fill tick and label layers.
g. Set the label precision. If set to Center, the labels will be middle center justified on the grid point. If set to Right, the labels will be middle right justified.