Concepts
Landform is one of the primary elements that landscape architects use to adapt and integrate human activities into the landscape. Every built object eventually comes in contact with the ground plane of landform. And whether it is the man-made landform of an urban plaza or the natural landform of a mountain range landforms are always part of our experience of the environment. Landforms are described by their volumetric form (ridge, valley, plain, hill, depression, etc.) type of slope (convex, concave), and the steepness of their slope (flat, steep, etc.).

On paper landforms are represented using contour lines. A contour line is an imaginary line that connects points of equal elevation. They represent landforms by their direction, spacing and contour interval (the vertical distance from one contour to the next).

Landforms perform both an engineering and aesthetic function. Platforms must be provided for buildings, "level" areas allow for recreational use of outdoor spaces, and proper slopes draining water away from man-made structures. Slopes must be restricted for roads, parking, and walkways. Landforms also serve as focal points in the landscape and can be used to control movement, direct views, and enclose space.

Techniques: Terrain Models
One of Form•Z's unique tools that was specifically designed for landscape architects and architects is the Terrain Model Tool. It allows you to create terrain models by using 2D contour lines and a site boundary. It can create three different types of terrain models including: mesh (and triangulated mesh), stepped, and triangulated contour. A line is a surface object (2D plane) and can be closed or open. A site is also a surface object, which is required to be closed, and may contain holes. The ends of contour lines should cross the site. The system will beep an error message if a contour violates ed contour lines may or may not the site.

Process:
This tool can be used with either the prepick or postpick method. When the prepick method is used:
1. Any number of contour lines are selected first in ascending order
2. The Terrain Model Tool is selected
3. Then the site is picked
To use the postpick method, the contour lines must be placed at their proper vertical elevations and then grouped using the group tool. To execute the Terrain Model Tool in postpick mode:

1. Select the Terrain Model Tool
2. Select the group of contours (with the object topology set to Group)
3. Select the site

The type of terrain model you create as well as a variety of optional parameters can be chosen from the Terrain Model Options dialog or the Tool Options floating palette. The rest of this tutorial will focus on how to create a Mesh type terrain model and a contour type model that can be used to make steps.

**Technique: Mesh Type Model**

Creating Mesh type terrain models involves three parts, creating the contour lines, the site, and setting up the appropriate parameters in the Terrain Model Options. Although not all the other types of terrain models are covered in this tutorial, they are created using basically the same process, just with different parameters in the Terrain Model Options.

1. **Create Or Import The Contour Lines** - The first step of creating any terrain model is to draw the contours that will be used to represent the elevations of the landform. The Terrain Model Tool allows you to use contour lines that are "elevated" to their proper "Z" dimension or all on the same plane, usually on the reference grid at "0" elevation. Contour lines are ALWAYS two-dimensional surface objects, either open or closed. You can use any of the operators to make contour lines as long as you have chosen the 2D surface object type modifier. Remember that all the "open" contour lines must cross over the site boundary. So if you are tracing contours off a scanned image, make sure they all extend beyond the property lines or the site boundary that you will use to create the site object.

2. **Group Contours If Necessary** - In all but the simplest landforms, you will have several contours that are at the same elevation but are not physically connected because of the shape of the site. If they are at their appropriate "Z" elevation they can be used as is. If they are all on the reference grid then you need to group contours that represent the same elevation together (using the Group Tool) before proceeding with the Terrain Modeling process.

3. **Create the site** - Next, using any of the modeling operators and the 2D surface object type,
create the "site" object that represents the limits of the final terrain model. Although you can easily change it later, the color of this site object will also determine the color of the final terrain model. Make sure the site object is closed or it will not work with the Terrain Modeling tool.

4. Set Terrain Model Options -
With the contours and the site completed, you are ready to set up the parameters of the Terrain Model tool. Some of these parameters simply affect the final appearance of the terrain model, others are critical to its proper functioning and include the following:

Model Type –
This allows you to select the type of terrain model you want to create. Choose the default which is "Mesh." Once you have chosen the model type, you also need to specify a couple of other parameters. The first is the size of the mesh or "grid" that will be used to create the landform. Click on the "mesh options" button and type in the appropriate values. Remember, the smaller the mesh, the smoother the landform, but the more polygons will be created and the slower it will render. Use the default of 8' – 0" for the Adventure Garden. When you have finished typing in the value for the mesh size, click OK and return to the Terrain Options dialog. Finally, Select "Fall Lines" in the Interpolation line. This will provide a smooth terrain model that most accurately reflects the shape of the contour lines.

Starting Height -
Even though the contours determine the elevations of the final terrain model, all models must have some "height" or thickness below the first contour elevation. Leave this on the default value of 1' – 0".

Contour Heights -
This is one of the most critical settings and a source of one of the most frequent problems when creating terrain models. The default value of "Use Existing" should be used when the contours are all in their appropriate "Z" elevation. With this option, Form•Z will simply use the elevation of the contour line to interpolate the mesh model. In most cases however, you will have contours that are all on the reference plane (Z = 0). Using the default setting with these contours will result in a mesh that has no elevation (flat). To use contours that are all on the reference plane chose the second option, "Set New: Interval" and type in the appropriate contour interval.

Smoothing –
Checking the "Smooth by interval" tells Form•Z to smooth the contour lines.
as it builds the terrain model to generate the smoothest model it can, even if the original contour lines were all straight line segments.

5. Select Contours in ascending order using pick tool -
   With the Options parameters set, choose the "Pick" tool and select the contours in ascending order. This tells form•Z what the elevations of each contour are since the contour interval determines the vertical distance between each contour and the order of selection determines which contours are higher or lower. Remember, if you grouped contours together, you will need to use the "group" topology level to select the groups in ascending order by clicking on any one of the contours in the group.

6. Select Terrain Model Tool -
   Once all the contours are selected switch from the Pick Tool to the Terrain Model Tool and then click anywhere on the “site object.”

**Technique: Using a Stepped Type Model for Making Steps**

Although stepped type models are not very appropriate for modeling site landforms they can be very useful for making irregular shaped steps that are too complex for the “Stair Tool.” The process is basically the same as making a mesh model but uses a slightly different set of parameters.

1. Create a Outline of the Steps -
   In this case its better to start with the site boundary (an outline of the steps) instead of the contour lines. Using any drawing tools and a 2D object type, outline the steps and make sure you close the object by double-clicking on the first point or triple-clicking on the last point.

2. Draw the Contours (risers) -
   In plan view, lines drawn to represent steps indicate how many risers (vertical step) there are in a set of steps. These lines are the contour lines necessary to build a stepped model with the terrain tool. Using the Vector Line, Segment, or Arc Tools and a 2D object type to draw a “contour” for each step riser. Make sure these lines overlap the edge of the site boundary (step outline).

3. Select Contours -
   Using the Pick Tool, select the contours (risers) in ascending order.

4. Set Terrain Model Tool Parameters -
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   Type of Model: Stepped
   Site (Starting) Height: 1'-0"
   Contour Heights - Set New: Interval = 0'-6 1/2"
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5. Select the Site (Step Outline) - Using the Terrain Model Tool, select the site boundary that forms an outline of the steps.

6. Move Terrain Model Into Place - Once the stepped model has been created it needs to be moved vertically into place. Using the Move Tool (topology set to Object) and the Perpendicular modifier in a 30°/60° axon view, move the steps up.