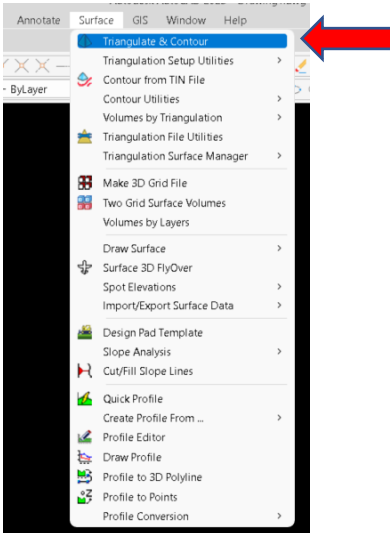# Triangulate & contour settings

Table of Contents

1   INTRODUCTION

At the heart of nearly every land design project is at least one terrain model. These models go by several names and one of the most common is that of a "TIN" or Triangulated Irregular Network; another common name is that of a "DTM" or Digital Terrain Model. Since accurate representations of a surface model are significantly important to most land development projects, having a thorough understanding of the Triangulate & Contour controls is very important.

Like most of Carlson software there are '**Load Settings**' & '**Save settings**', attached with this guide is a basic 'Triangulation Settings 2023.tri' file that can be loaded to create 0.5m and 1m contours.

2 TRIANGULATE & CONTOUR

Under the SURFACE tab there is the 'Triangulate & Contour' tab that is used to create Triangulation lines, Triangulation faces, slope arrows, .tin files and contours.

3 Triangulate Tab

The **Triangulate** tab provides options and settings that control the creation and analysis of the **TIN** itself.

Load the attached 'Triangulation Settings 2023.tri' in the '**Load Settings**' button, these are basic settings to get started.
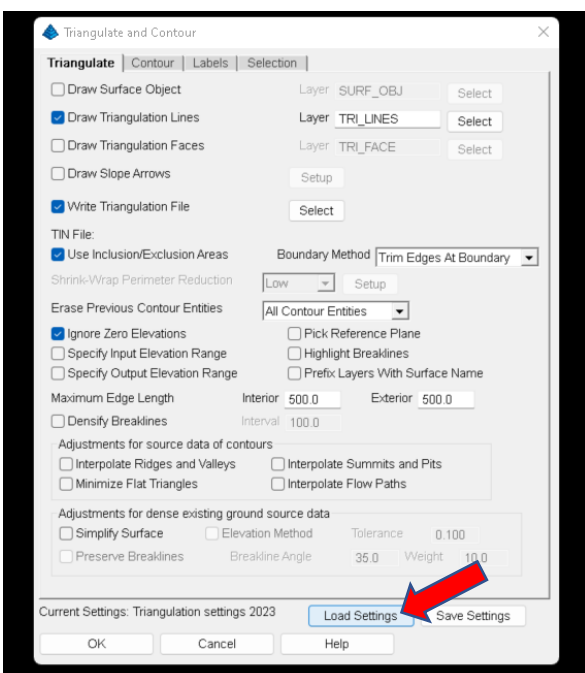
Draw Surface Object: This option draws the triangulation faces as a Carlson Surface Object.

Draw Triangulation Lines: When enabled, the program will draw the triangulation using simple line entities at the appropriate elevation(s). Use the **Select** button or specify the layer for these lines.

Draw Triangulation Faces: When enabled, the program will draw the triangulation using a collection of 3D Face entities. These 3D Faces can then be used rendering routines such as *HIDE* and *SHADE* or in Carlson routines such as 3D Viewer Window, 3D Surface Fly-Over and Slope Zone Analysis. Use the **Select** button or specify the layer for these 3D Faces.

Note that having both Lines & Faces selected will increase the size of your drawing.

Draw Slope Arrows: When enabled, slope arrows are created within the triangles indicating the downhill dip direction as illustrated below.
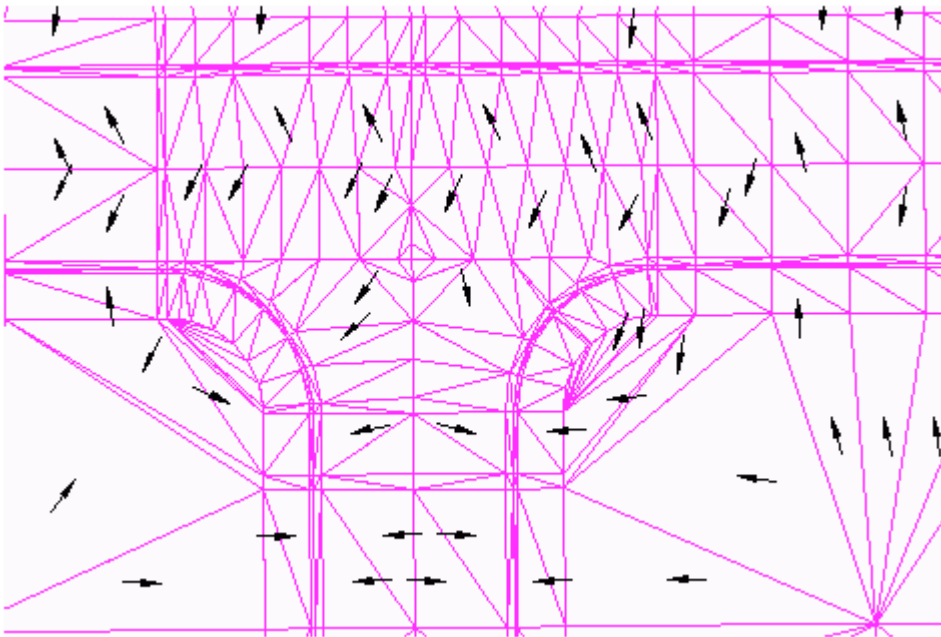
Write Triangulation File: When enabled (strongly suggested), an external surface model file is created which can subsequently be used for volume calculations, the creation of profiles, cross-sections and graded pads. Carlson currently provides two file types to store the DTM data created by the Triangulate & Contour routine:

1. *.TIN - The TIN file format is the default and preferred file format due to its compact file size and organizational efficiency. The Carlson TIN format is governed by Carlson and is in a binary (non-human readable) format.
2. *.FLT - The FLT file format is a legacy ASCII-based (human-readable) file format and is used in some older machine control applications.

Use Inclusion/Exclusion Areas: When enabled, the program will prompt you for '**Inclusion**' and '**Exclusion**' polylines and prevents the use of the '**Shrink-Wrap Perimeter Reduction**' option. These are used to further control the area of activity for triangulation and contouring. The inclusion and exclusion polylines must be closed polylines and when used, must be drawn before using *Triangulate & Contour*.

- When selecting Inclusion/Exclusion polylines, you may select any number of Inclusion polylines and any number of Exclusion polylines. Selecting multiple Inclusion polylines results in "islands" of terrain data within a given TIN file.
- If *Triangulate & Contour* reports zero points found and fails to do anything when you're using Carlson points, then those points are probably located at zero elevation. To fix this problem, make sure that Carlson Point Inserts is toggled on in the Selection tab. This will enable *Triangulate & Contour* to read the elevation from the elevation attribute of the point.

Boundary Method: This option controls whether edges that cross the inclusion or exclusion perimeter are trimmed or removed. Use the Remove option if you don't want the triangulation to interpolate across the perimeters. Use the Trim option if you want the triangulation to fill the area up to the perimeter.

Shrink-Wrap Perimeter Reduction: This option produces an inferred Inclusion region around the data to be selected and mimics the results of the Shrink-wrap Entities command. Under the Setup, there is an option to draw the shrink-wrap perimeter polyline on a specified layer.

Erase Previous Contour Entities: In the event that a TIN needs to be recreated and Carlson-produced contours are in the drawing, three options exist that allow you to control whether or not the contour data should be removed from the drawing:

- **Off** - All existing Carlson-generated contours are left intact in the drawing. If these contours satisfy all of the triangulation requirements, they can be utilized by the Triangulation algorithm.
- **Current Surface** - Only the Carlson-generated contours that are associated with the active Triangulation file are removed from the drawing.
- **All Contour Entities** - All Carlson-generated contours are removed from the drawing, regardless of the surface model that created them.

Ignore Zero Elevations: When enabled, this option will filter out all data points and entities at an elevation of zero from the triangulation data set.

Max Triangle Length: Two bounds are provided to limit the length of the "legs" within a triangulation network. Based on the available data, if the edge length of a triangle exceeds the respective bound, the triangle will not be formed:

- **Exterior**: This value applies to triangulation lines around the perimeter of the triangulation area.
- **Interior:** This value applies all the other triangulation lines. Generally, you would have the Exterior value larger than the Interior value.

Densify Breaklines: This option subdivides linework segments for the input data so that the maximum length of the segments is the specified Interval. This option is similar to the Densify Polyline Vertices command except that the entities are not modified in the drawing. Having shorter breakline segments is often helpful for holding the breaklines in the TIN and making more regularly sized triangles.

Simplify Surface: When enabled, this option reduces the digital size of a surface without significantly compromising the integrity or accuracy of the surface itself. The most common application to enable this option is when using very large datasets, such as smoothed contours. Its use is less applicable to design surfaces or surfaces based on surveyed points, but it can still be utilized.

4 CONTOUR TAB
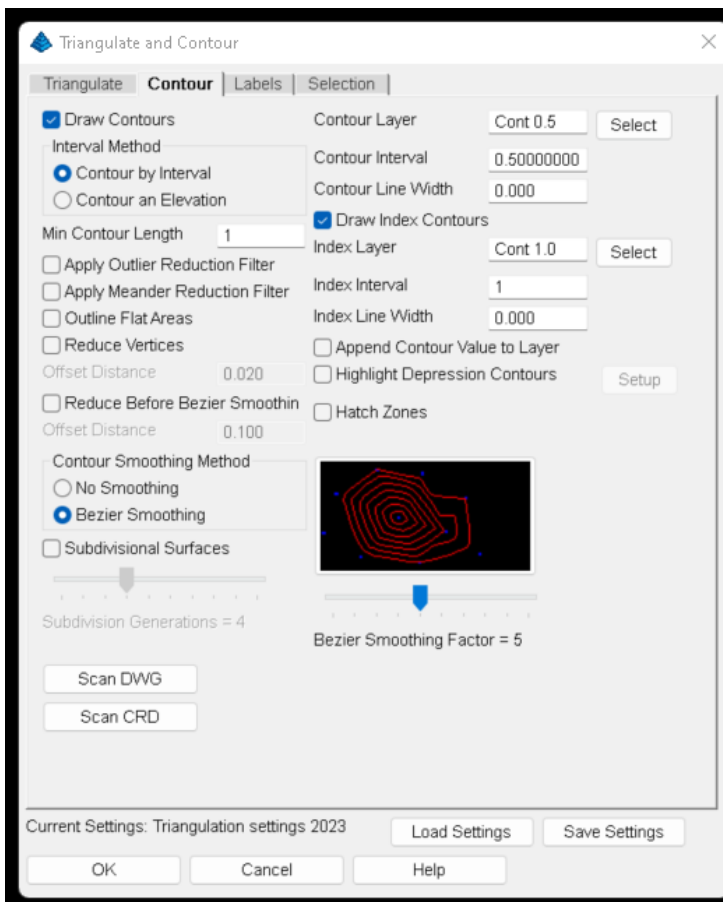
Draw Contours: When enabled, the program will draw contour lines using the designated settings after triangulation process is complete. Otherwise, only the designated Triangulation operations are performed. If this option is disabled and contours are subsequently desired, use the Contours from TIN File command.

Interval Method: Indicate the desired elevation(s) for contours to be drawn:

- Contour by Interval: Specify the desired interval (*e.g.* every 1 meters) into the *Contour Interval* field.
- Contour an Elevation: Specify a desired elevation (*e.g.* a floodplain elevation or other unique elevation of interest) and set the desired value into the *Contour Interval* field.

Contour Layer/Index Layer: Specify the layer to which the contours/index contours are to be drawn.

Contour Interval/Index Interval: Specify the interval to which the contours/index contours are to be drawn

Draw Index Contours: When enabled, index (or "major") contours will be created with independent characteristics from the regular contours.
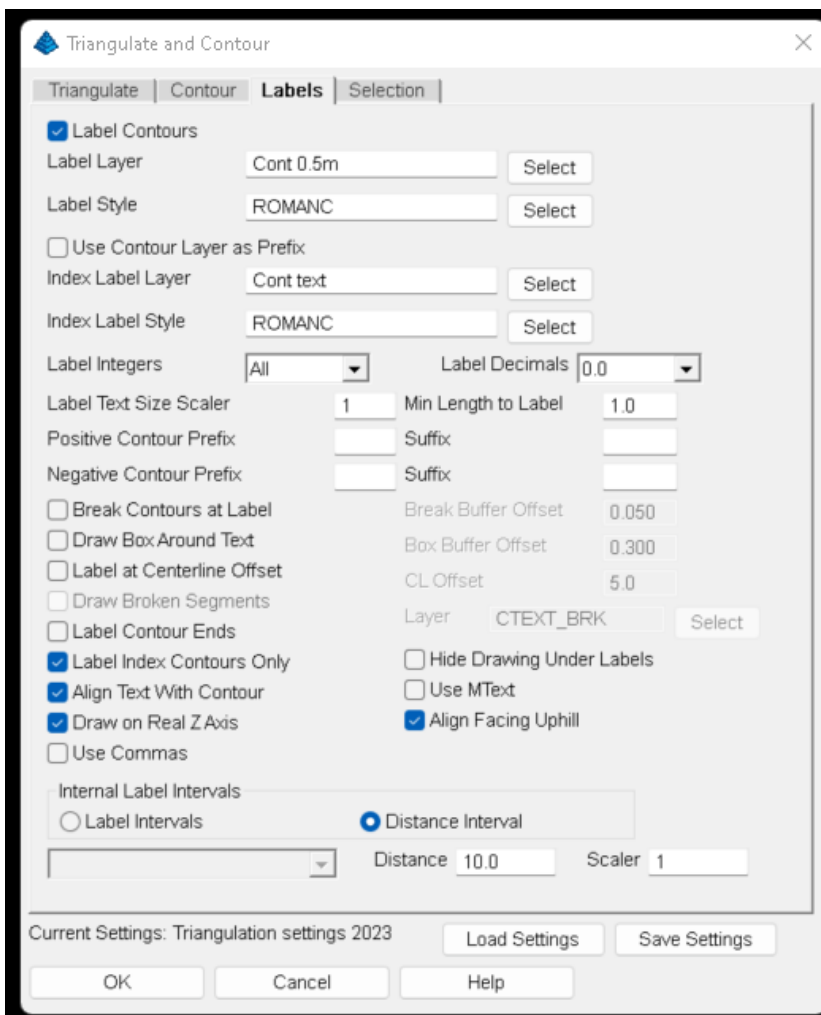
Min Contour Length: Specify the minimum linear threshold that should be used to draw contours.

Reduce Before Bezier Smoothing: When enabled, this option removes extra vertices from the contours before they undergo Bezier Smoothing using the *Offset Distance* value. The Offset Distance is the maximum amount that the polyline can move horizontally when removing a point. Removing points before smoothing gives the Bezier smoothing more freedom to make the contour curvy.

Contour Smoothing Method: Indicate the desired amount of smoothing (often used for existing, natural ground conditions to simulate a "weathered terrain" effect) that should be applied to the contours:

- **No Smoothing:** This option is often used for proposed, man-made surface considerations where the terrain has been shaped with earth-moving equipment. For applications where a "nature-emulated" man-made terrain is desired, refer to the Carlson Natural Regrade documentation.
- **Bezier Smoothing Factor:** This option holds all the contour points calculated from the triangulation and only smooths between the calculated points.
- **Polynomial Smoothing:** This option applies a fifth-degree polynomial equation through the contour data points for a smooth transition between the triangulation faces.

5 LABLES TAB

Label Contours: When enabled, contours will be labelled based on the settings below. If this option is disabled and further contour annotation is desired, utilize the Contour Elevation Label command.

Label Layer: Specify the layer name for intermediate contour labels. To only label index contours, enable the Label Index Contours Only option.

Label Style: Specify the text style that will be used for the contour label text.

Use Contour Layer as Prefix: This option adds the Contour Layer name to the Label Layer name.

Index Label Layer: Specify the layer name for index contour labels.

Index Label Style: Specify the text style that will be used for the index contour label text.

Label Integers: controls how many digits to label to the left of the decimal. For example, if all contours are in the 5000's, then setting for three digits would label the 5280 contour as 280.

Label Decimals: Specify the amount of precision to display on the contour labels.

Label Text Size Scaler: Specify a relative text size scale factor to be applied to the label(s).

Break Contours at Label: When enabled, the contour lines will be broken and trimmed at the label location for label visibility. As an alternative to physically placing a gap into the contour, consider using the Hide Drawing Under Labels option.

Break Buffer Offset: Specify the offset distance which determines the gap between the end of the trimmed contour line and the beginning or ending of the text.

Draw Box Around Text: When enabled, a rectangle is drawn around the contour elevation labels.

Box Buffer Offset: Specify the offset distance which determines the gap between the box and the beginning or ending of the text.

Label at Centreline Offset: When creating contours and subsequent plan sheets for roads, enable this option to position the labels at a fixed offset from a centreline. The program automatically uses any polylines in the drawing that are tagged as centrelines. To check whether a polyline is a centreline, use the 'Centreline ID' command. To create a centreline polyline from a centreline file, use the 'Draw Centreline File' command.

Draw Broken Segments: When enabled, the segments of contours that have been broken out for label visibility will be redrawn as independent segments. To join these segments back into the contour, use the Join Nearest command.

Layer: Specify the layer that is to receive the newly drawn broken segments.

Label Contour Ends: When enabled, the ends of "open" contours will be labelled.

Label Index Contours Only: When enabled, only the index contours are labelled. This option is active only when 'Draw Index Contours' has been selected in the Contour tab.

Hide Drawing Under Labels: When enabled, a "Wipeout" entity is placed with the annotation label that will create the appearance of trimmed segments at the contour label, even though the contour line is still fully intact. This feature provides the user with the best of both worlds; you have clean looking contour labels yet the contour lines themselves remain contiguous. This feature will also hide other entities that are in the immediate vicinity of the contour label.

Align Text with Contour: When enabled, the contour elevation labels will be rotated to align with their respective contour lines

Align Facing Uphill: When enabled, the contour elevation labels will still be rotated to align with their respective contour lines, but the labels will be placed in such a manner that the top of the text label will always be toward the uphill side of the contour. This is useful if you only have a few contours.

Internal Label Intervals: Indicate the desired method for contour labels within the contour itself:

- **Label Intervals:** This option will label each contour with a set number of labels.
- **Distance Interval:** This option allows you to specify an interval distance between labels. The distance can be set in drawing units or as a scaler that is multiplied by the drawing horizontal scale.

6 SELECTION TAB
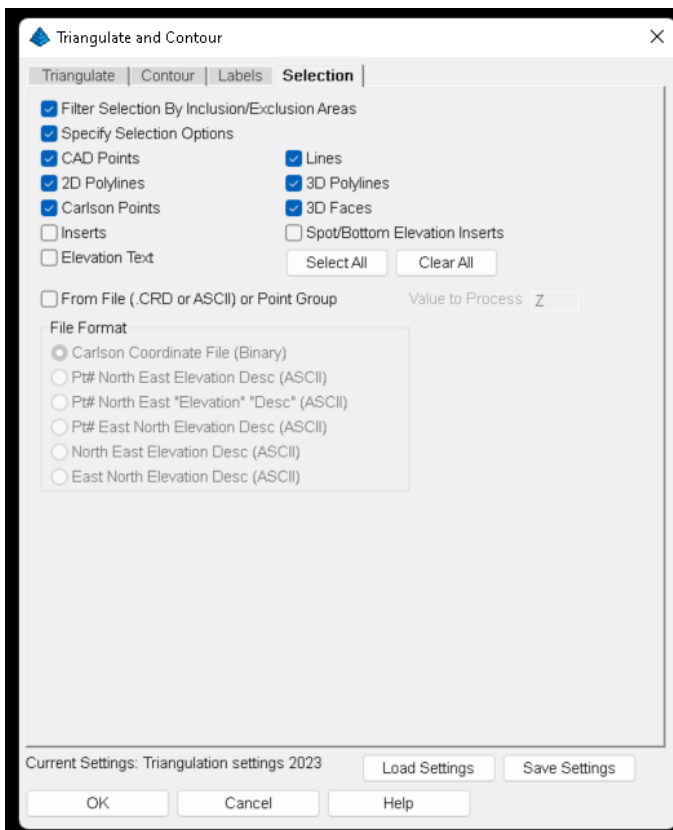
Filter Selection by Inclusion/Exclusion Areas: This option filters out selected entities from the triangulation that are outside the surface area defined by the inclusion/exclusion perimeter polylines. Otherwise, all the selected entities are used for triangulation and then the triangulation is trimmed at the inclusion/exclusion perimeters. Whether to prompt for inclusion/exclusion perimeters is specified on the Triangulate Tab.

Specify Selection Options: When enabled, indicate the type(s) of entities that are to be used during the triangulation process. This is an excellent method of "filtering out" unwanted entity types or enabling the use of desired entity types.

CAD Points, Lines, 2D Polylines, 3D Polylines, 3DFaces, Elevation Text and Inserts (blocks) are standard CAD entities types.