22. Proposed & Final TIN Creation

This exercise shows the basic steps for building cross section data and forming a proposed and a final TIN for our project roadway. The final tin is the surface as it would be after construction of the roadway; in other words, a combination of the current existing surface and the proposed roadway development.

The proposed tin can be used to help develop side road tie ins. In chapter 23, we will use the proposed tin which we develop in this chapter with the Draw Profile tool to illustrate cutting a profile across multiple surfaces at one time.

Data from the final TIN file is used for both culvert and storm drainage design. In conjunction with the GEOPAK DTM Tools, drainage areas and water flow can be carefully mapped out. With culverts, it is used to set preliminary invert elevations and to cut tail water sections. For storm sewer design, it automatically gets elevations at the gutter line and sets up the spread section at inlets. There are other methods of generating this information but the use of a final TIN is the preferred method.

T.D.O.T uses GEOPAK to create final TIN digital terrain models from proposed cross section graphics. It is important to include cross section data generated at all critical locations. These may include any of the following:

- Superelevation rate transition limits
- Beginning and ending of width transitions
- Locations where typical section changes
- Side road data
- Intersections with large radii should be cross sectioned around the radius
- Ramp data on roadways with interchanges
- Curb Ramps (cross section immediately before & after with 2 within central pathway)

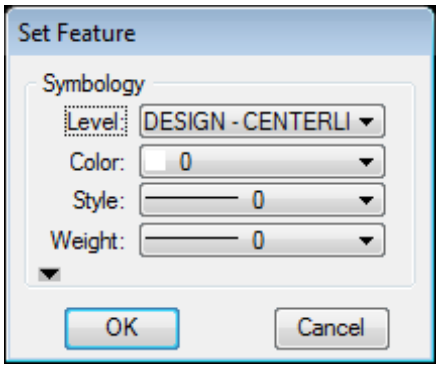
If side roads, ramps or large intersection radii are involved, it will be necessary to repeat some steps to gather data from these additional areas. Due to the time available for this class, we will not include side roads in our final tin.

I.) Generating Cross Section Data

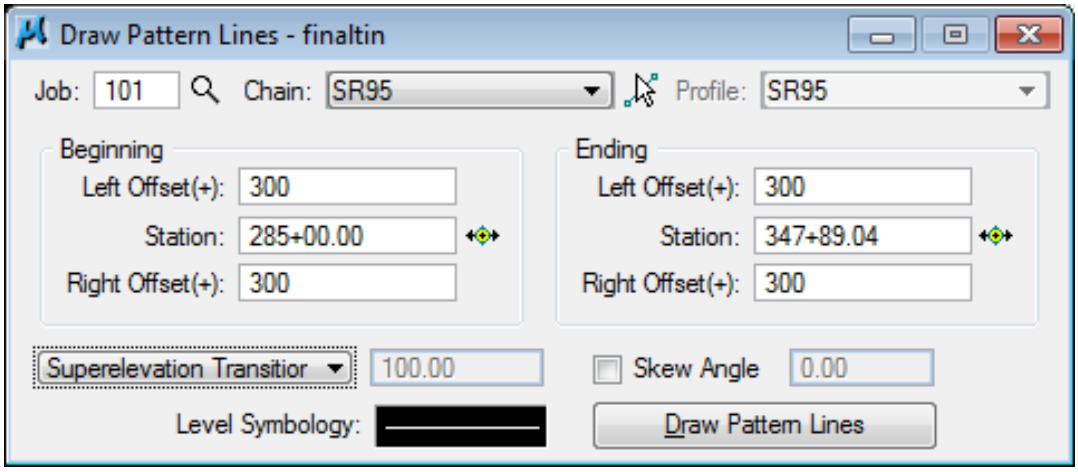
1) Create two new DGN files, FinalTINPatterns.dgn & FinalTINXSections.dgn, for generation of cross section data, one for patterns from DGN seed file Seed2D.dgn and one for cross sections from seed file SeedXS.dgn.

2) Open the MicroStation file FinalTINPatterns.dgn. Access the Project Manager workflow dialog. Click on Draw Pattern and create a new run finaltin

Double click on the symbology review window to make the following settings. Level name is DESIGN – CENTERLINE – Proposed.



Our roadway includes superelevation, so reference the super shapes DGN file ROSR95SEShapes.dgn using the Coincident World setting. In the Draw Pattern dialog, set the placement option to Superelevation Transitions and hit Draw Pattern Lines. This generates pattern lines at all critical superelevation locations.

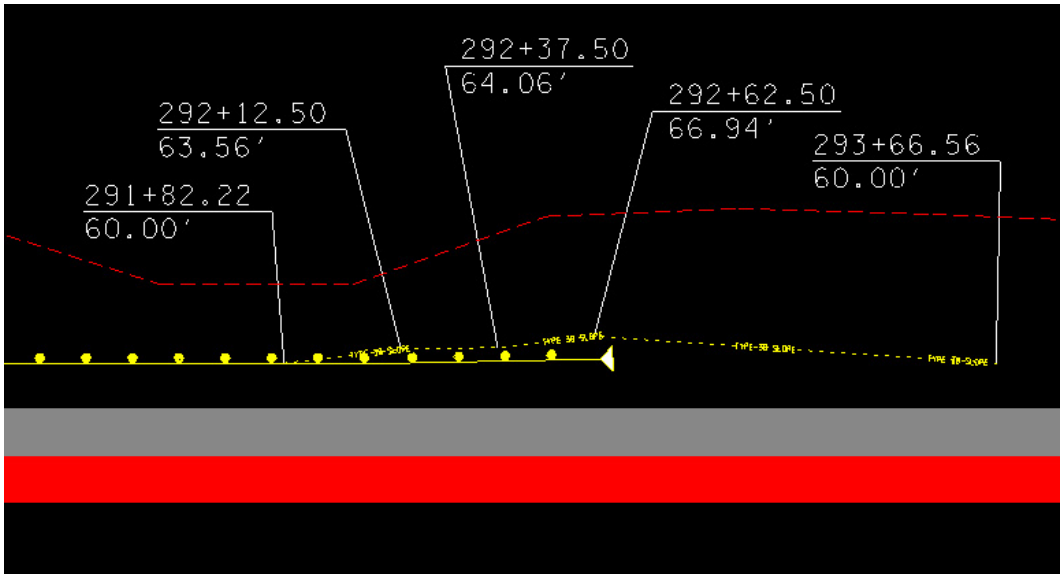


3) Our roadway includes width transitions and a location where the typical section changes so click on Superelevation Transitions and change to Once.

Our pavement transition stations are 316+75 & 327+75 and the typical section changes at 328+25. In the next step, we will place regular pattern lines at a 5' interval so these will be covered then.

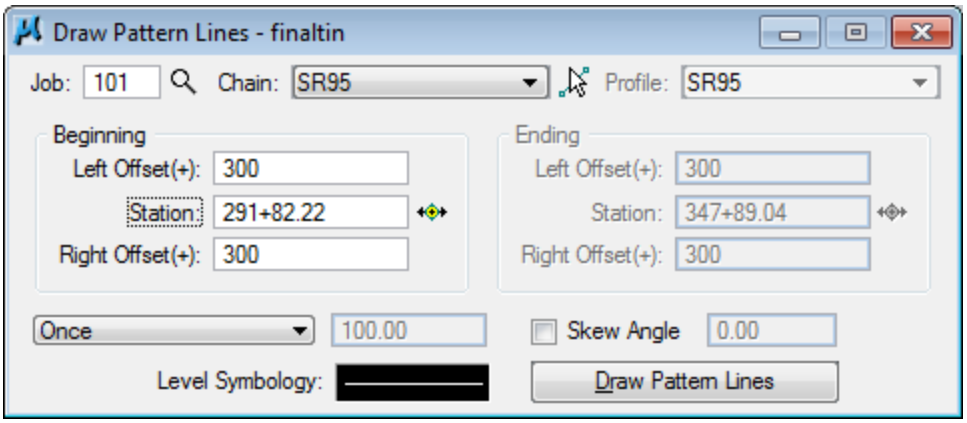
We do have a shoulder transition where the Type 38 terminal pad is located near station 292+50 on the left. We don't know the exact stations but using the Label Station/Offset **tool**, we can snap to each of the five control points of the pad to set their stations. The Label Station/Offset tool is found under **T.D.O.T. → Tools → Place Station Offset Label**.

Attach file ROSR95Proposed.dgn as a reference using Coincident World and turn on level DESIGN - TRANSPORTATION - GR Special Slope Limit Lines. Go to the guardrail terminal area near 292+50. The stations should be found to be 291+82.22, 292+12.50, 292+37.50, 292+62.50 & 293+66.56. Refer to standard roadway drawing S-GR-38 for Type 38 terminal pad layouts.

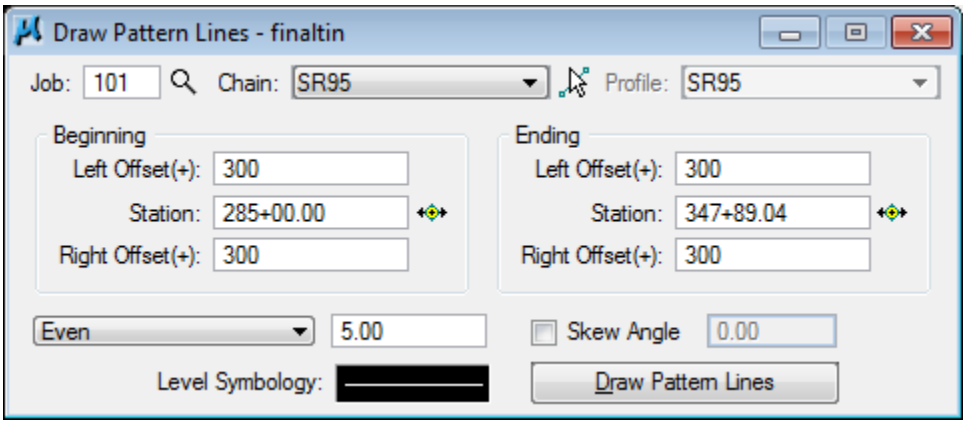


In addition, we need to place lines at locations where the superelevation rate is .000.There are four locations where this is the case, **308+55.12, 322+75.11, 331+39.67** and **337+22.58**.

Enter each of these stations and each time hit Draw Pattern Lines to place a pattern line there.



4) Change the placement option to Even and set the interval for pattern placement to 5**.** Reset station values to the beginning and end as shown below in the Draw Pattern Lines dialog and hit Draw Pattern Lines.

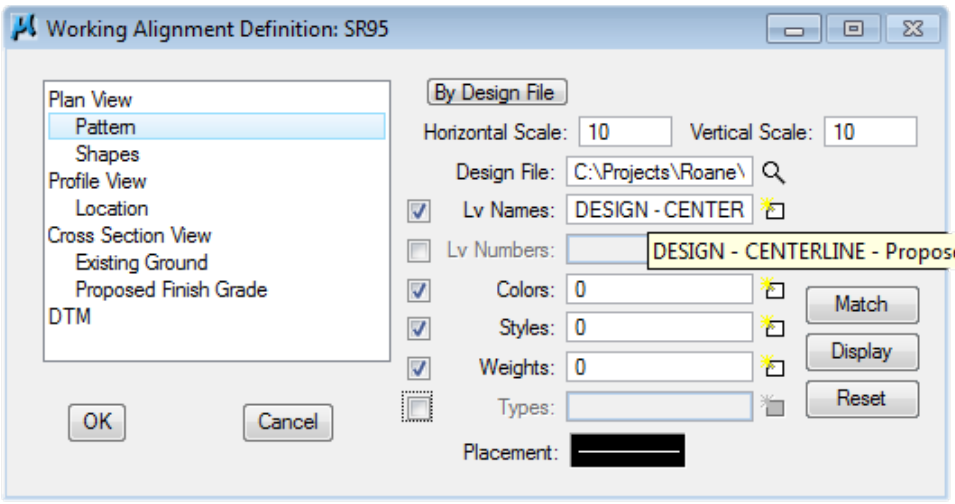


NOTE:
An interval increment of 5’ or some other small value is recommended in order to ensure that an accurate proposed tin is formed from the cross section data.

5) Close the Draw Pattern Lines dialog and save settings on the run.

6) Make a copy of the working alignment run SR95 and call it 95FINAL. We will set it up for producing the final TIN. Open the copied run.

Click on the Define button for working alignments. Access the Pattern dialog and set the filename to FinalTINPatterns.dgn and reset search criteria to match the ones used for your pattern lines.

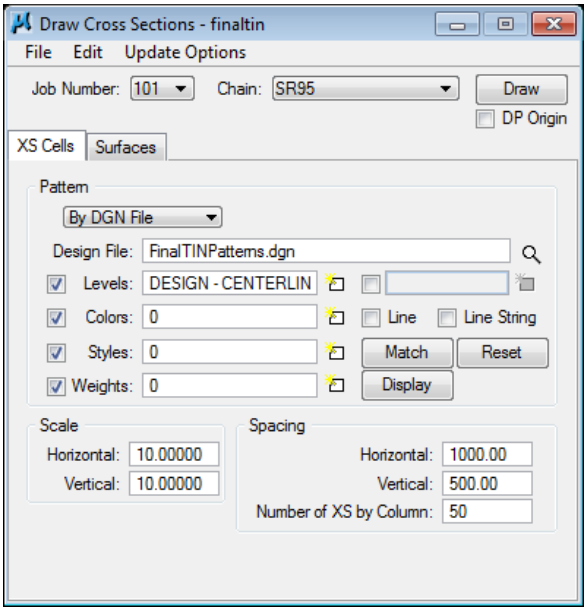


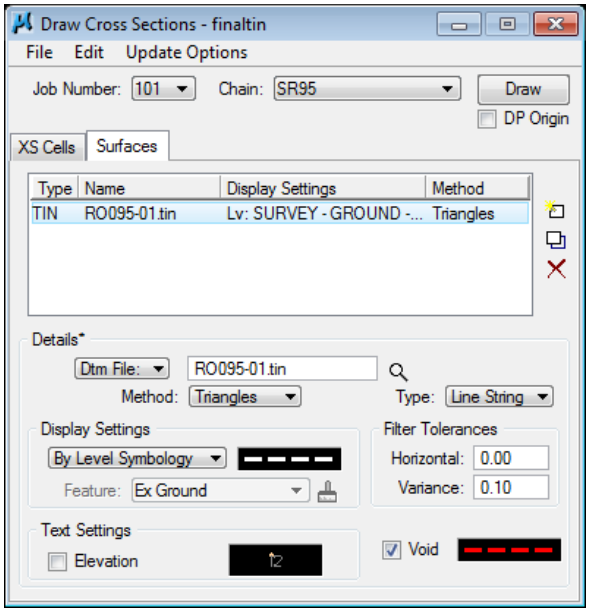
Click OK to save the settings.

7) Open the MicroStation file FinalTINXSections.dgn. Access the Project Manager workflow dialog again and click on Existing Ground Cross Sections. Create a new run named finaltin. Most settings are automatically made from entries in the working alignment definition.

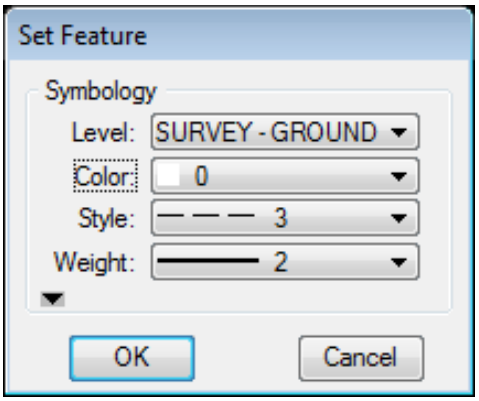
Make sure Type under Surfaces is set to Line String and set symbologies for existing ground and void areas by double clicking on symbology view windows. Both use level SURVEY - GROUND - Top of Ground.

After setting surface values, click the Modify Surface Settings option to the right of the surface list.

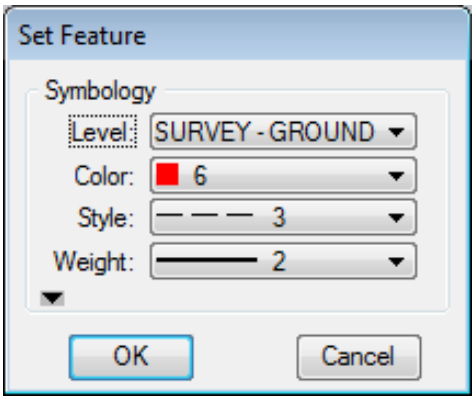




Exist. Ground



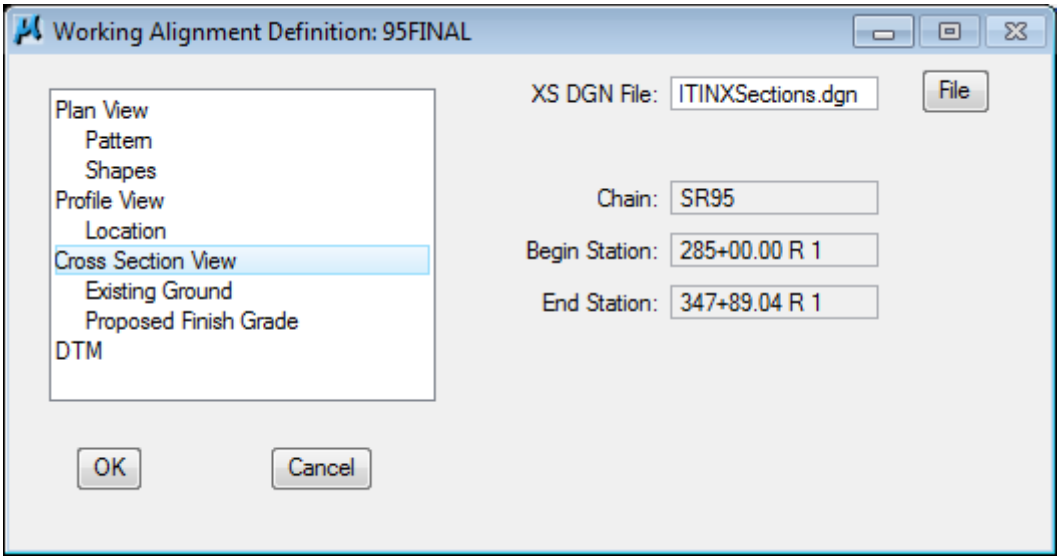
Void



When all settings are made, click on Draw.

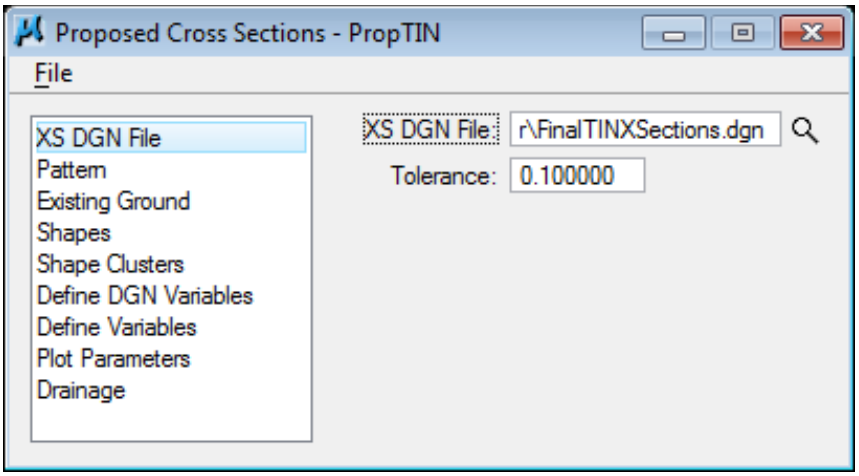
8) Close the Draw Cross Sections dialog and save settings on the run.

9) Finish setting up the working alignment. Access the Cross Section View dialog and set the filename to FinalTINXSections.dgn.

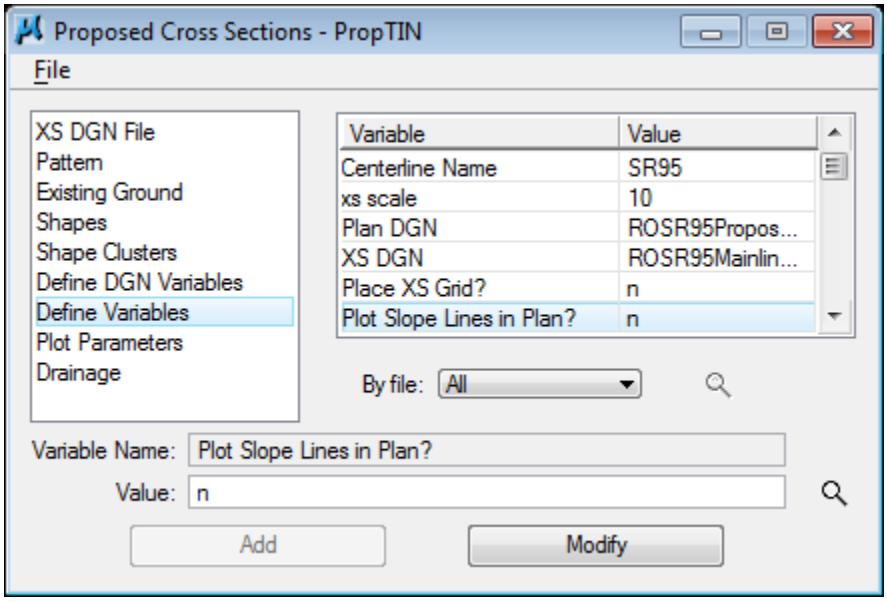


Click OK to save the settings.

10) Access the Project Manager workflow dialog again, click on Proposed Cross Sections and copy the run Final which you set up previously to generate regular roadway cross sections and call it PropTIN. Open the copied run.



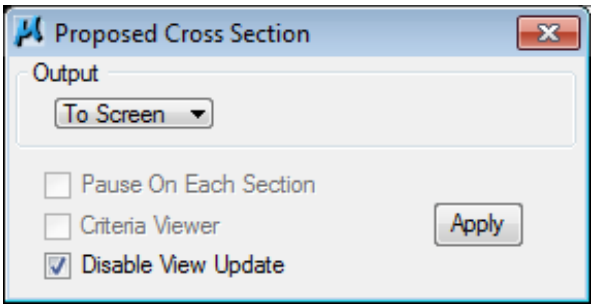
11) In the Define Variables dialog of Proposed Cross Sections reset the XS DGN filename to FinalTINXSections.dgn and set Place XS Grid? & Plot Slope Lines in Plan? to N.



12) No other changes need to be done to the run so we are ready to generate the proposed cross sections.

Go to the drop down option File → Run on the Proposed Cross Sections dialog. In the Proposed Cross Sections run dialog, make sure Pause On Each Section is clicked off.

Depending on the length of a project the proposed cross sections may take some time to run due to the large number of cross sections being generated. Click on the Disable View Update option so that it doesn't have to update the graphic display constantly.



Click Apply.

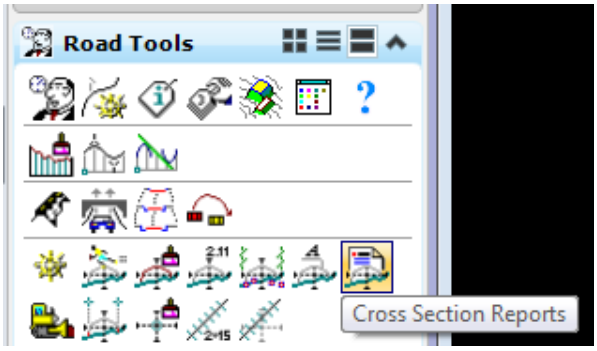
13) Once cross sections are completed, exit the Proposed Cross Sections dialog and be sure and click Yes when prompted to save the settings just made.

II.) Build Proposed & Final TIN

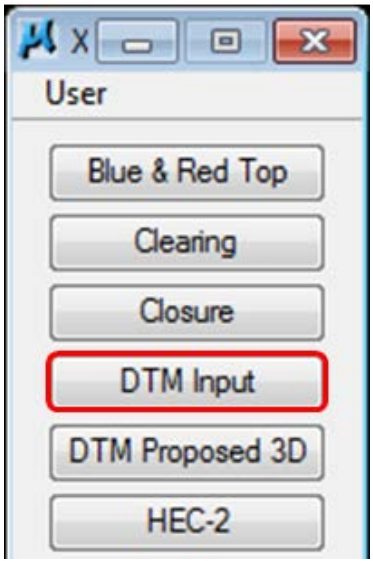
1) Open FinalTINXSections.dgn

2) Open the XS Reports dialog.

It can be accessed from Project Manager button Reports and XS Quantities, from the MicroStation menu bar drop down location Applications →GEOPAK → Road → Cross Sections → Reports or from the cross section task group under Road Tools.

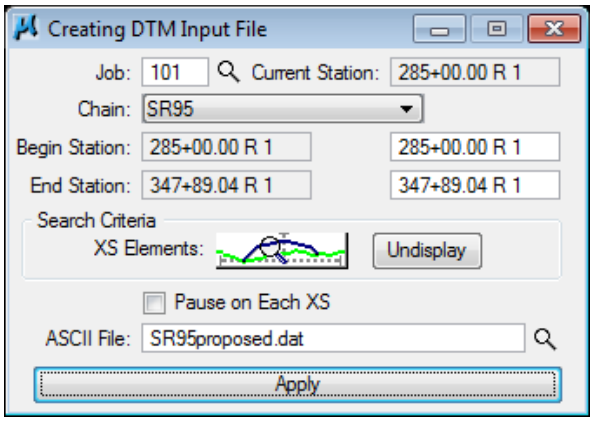


3) On the XS Report dialog, toggle on the Highlight option at the bottom and select the option DTM Input.



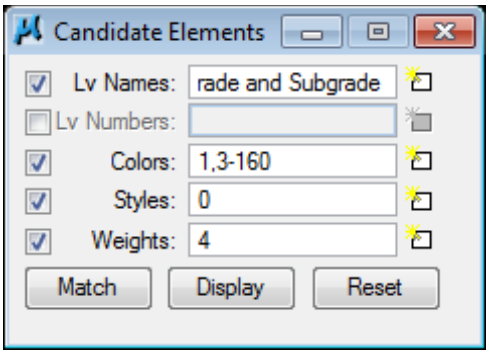
NOTE:
The option DTM Proposed 3D can be used generate the same data but it includes an option for ground line data which we should not use since it will only pull existing ground data from the cross section. We will add all ground data we need in the final TIN from the existing TIN file.

4) This opens the Creating DTM Input File dialog. Make settings as shown below. Set the ASCII filename to SR95proposed.dat, click on the XS Elements button to set the Candidate Elements symbology.



Color 2 (subgrade) and color 161 (curb, gutter, sidewalk & wall bottoms) should not be included. The only data desired from proposed cross section graphics is along the finished grade. The level name is DESIGN - TYPICAL - Finished Grade and Subgrade.

Make the settings as shown and use the Display button to check them on your cross section graphics.



Click the red X to dismiss the Candidate Elements dialog and click Apply on the main dialog to start processing.

NOTE:
If your project needs to include data from other cross sections such as side roads or ramps, steps up to this point should be repeated for the other areas. Once done, use Copy & Paste in any text editor to combine the data in one single DAT file.

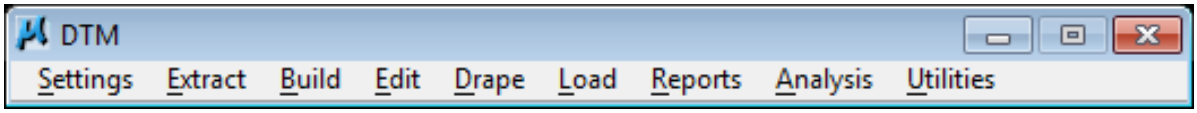
Where roadways meet, intersection EOP lines should be used to limit proposed cross data to the edge of the travel lanes so that it will not be necessary to edit the resulting proposed surface to delete invalid points such as curb or slope points crossing intersections.

When creating bridge deck surfaces, the level DESIGN - SURFACE - Bridge Surface Construction Lines should be included. Lines placed on this level take care of bridge overhangs and gaps which cause problems during surface creation.

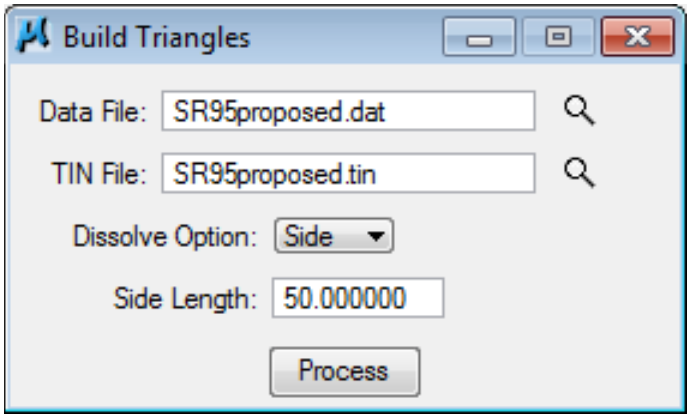
5) Now we are ready to create a proposed TIN file from the data which we have put together. Access the DTM Tools from the MicroStation menu bar drop down location
Applications → GEOPAK → Road → DTM Tools or the Existing Ground button on the Project Manager dialog. Create a new run called final.

You may wish to use either the tool box

or the Menu bar

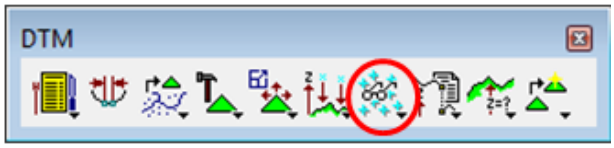


6) Open the Build Triangles dialog and enter filenames as shown below. Set the Dissolve Option to Side and set the side length to 50. This control will prevent long skinny triangles from forming along outside of proposed slopes. Once entered hit Process.



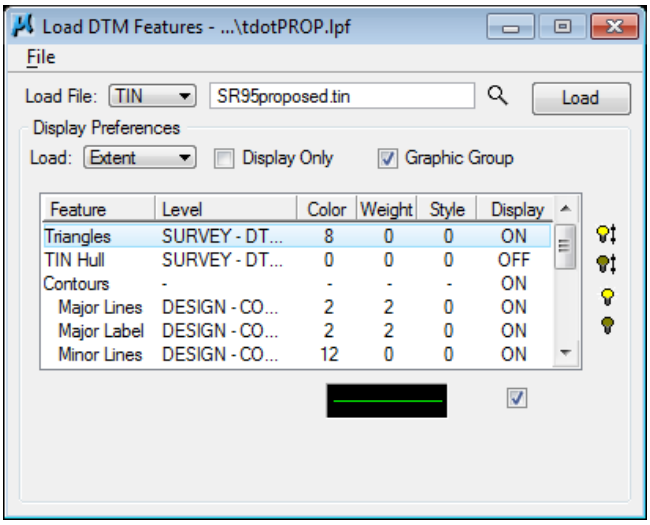
NOTE:
The value entered for the Dissolve Option depends on your job. If cuts and fills are light, a value between 50 & 100 should work. If cuts or fills are large, a larger value should be used to avoid holes in your TIN.

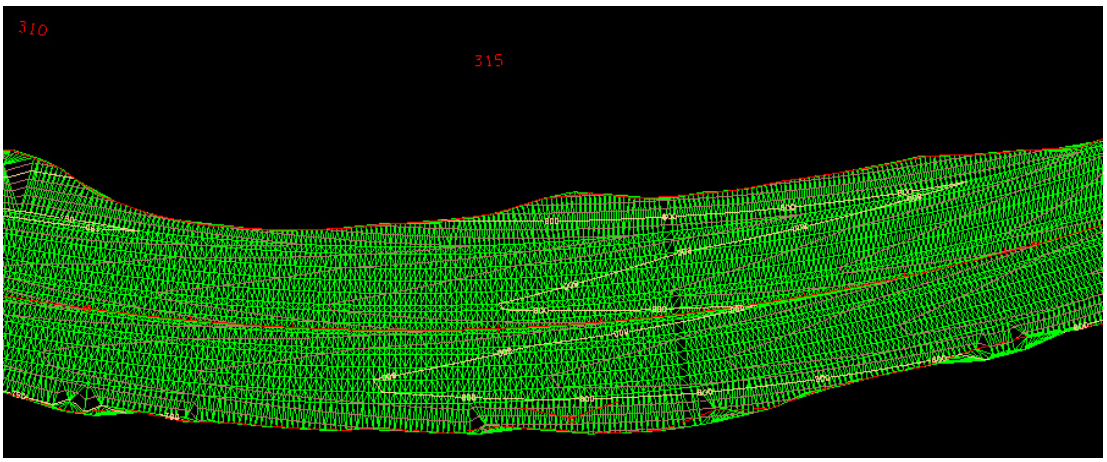
7) Review the proposed TIN file just created. Open the FinalTINPatterns.dgn file or some other scratch DGN file. Use the Load DTM Features tool to load triangles, contours, etc.



Before displaying graphics, go to File → Open in the Load DTM Features dialog and attach tdotPROP.lpf**,** found under C:\Users\Public\Geopak Standards, which is set up for proposed TIN surface displays

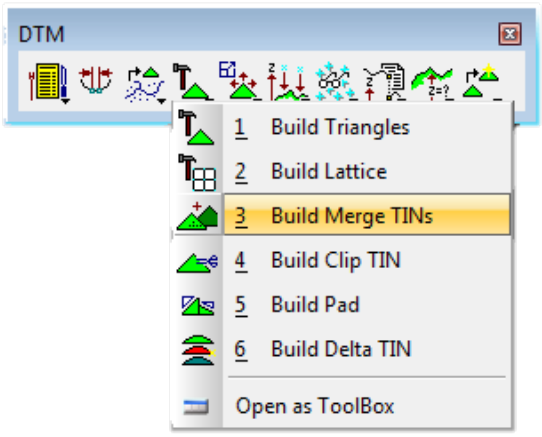
Make sure the proposed TIN includes no holes or long triangles on the sides. You also may wish to create a temporary cross section file and cut some sections to check your proposed roadway TIN.

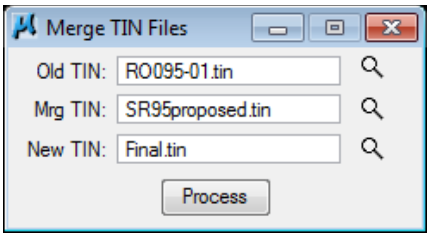




If needed, use the Edit Triangles function under DTM Tools to dynamically delete any invalid points/triangle vertices.

8) Once satisfied with your proposed TIN you are ready for the final step. We need to merge the proposed TIN with the existing TIN to form a complete final TIN. In DTM Tools under Build, open the Build Merge TIN Files dialog. Fill in filenames as shown below and hit Process.





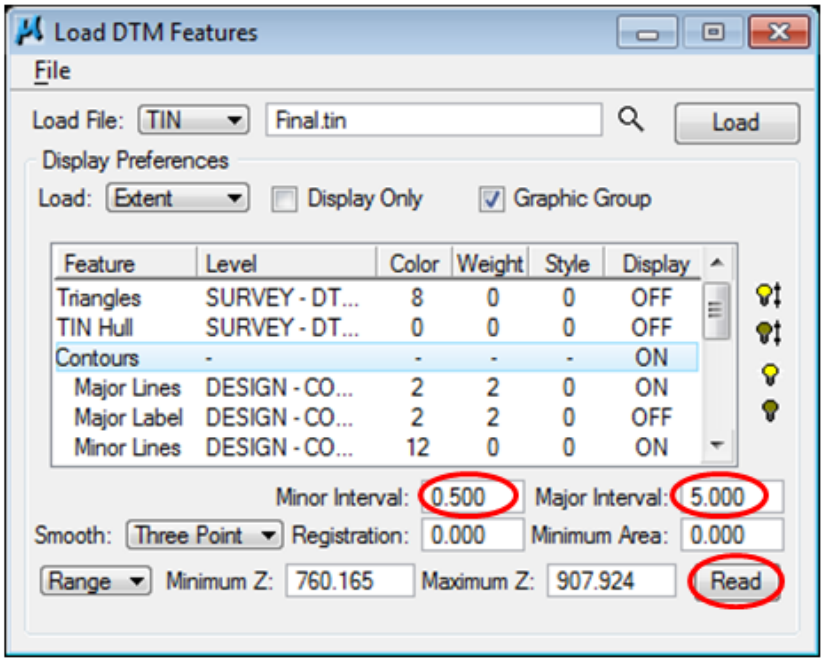
This eliminates all existing points within the area of the proposed TIN file and then combines the proposed data with the remaining existing data in the new TIN file.

NOTE on Long Projects:
Some final TINs created for larger projects may prove cumbersome to use or create. If problems are encountered on larger jobs, it is suggested that some controlling drainage feature such as a ridgeline across the project be located and then used as a dividing line so that two separate final TINs be can be formed that will function on their own.

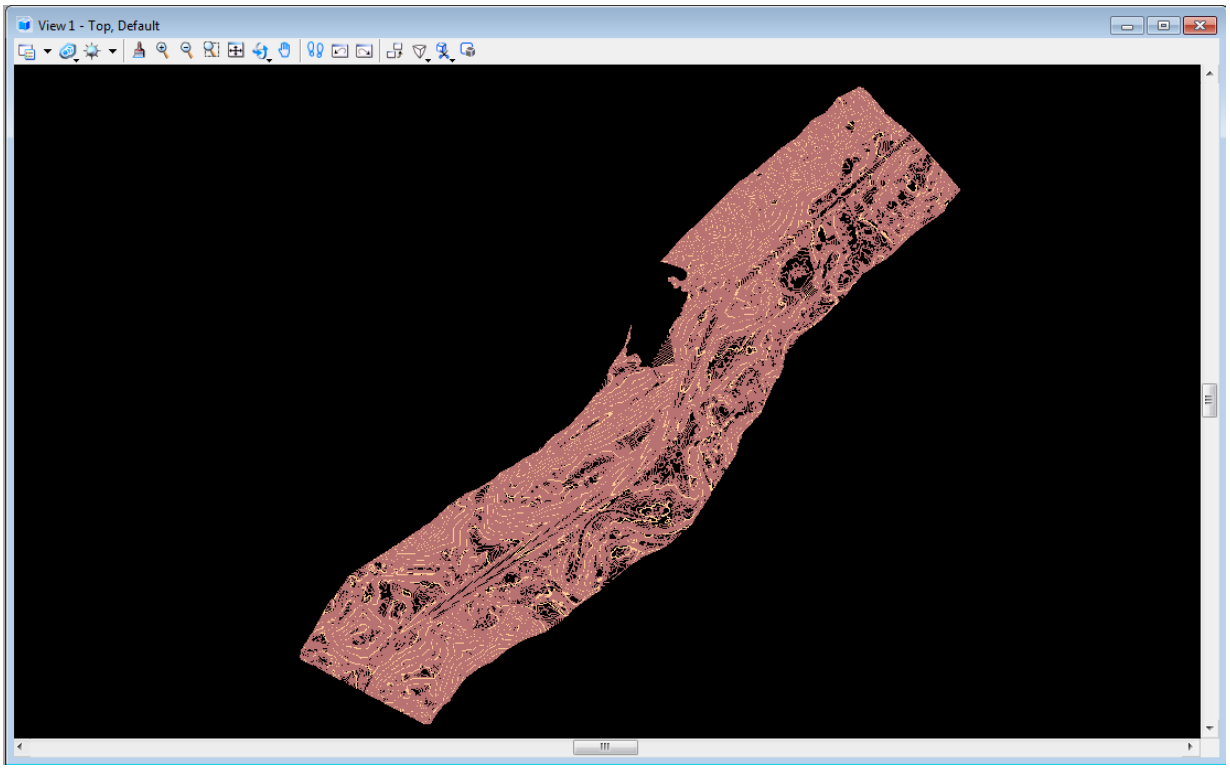
9) Create a new MicroStation DGN file named FinalTIN.dgn using seed file Seed3D.dgn.

At this point review the final TIN by generating final contours in a 3D DGN file.

Open the Load DTM Features tool. Turn off all feature items but Major and Minor Contour lines. Under the main Contour feature make interval settings as shown, Minor:0.5, Major:5. Click read after the settings have been adjusted.



Once set, click on Load.
Delete the Global Origin note text and circle and then Fit View in MicroStation.



Use MicroStation's Rotate View tool and choose Method: Dynamic. Use Zoom commands to check out your surface. This view is looking down through our transition area.