Quarry Site Design Example

This is a quarry with road approach. The survey of the original was done with a Total Station. The road was surveyed after and merged with the survey of the quarry.

Things you can do in this example project file:

- ☐ View the Quarry and Road in Three Dimensions
- ☐ Calculate Stockpile Volume
- ☐ Determine Volume from further Excavation of the Slopeface
- ☐ Widen the Haul Road (RoadEng required)

View the Quarry and road in Three Dimensions:

1. *Open* **Quarry Merged.terx.**

2. *View | New Window | 3D* This will open a 3D window of the quarry.

3. If you hold down the left mouse button you can rotate the view of the quarry in three dimensions. Use you mouse wheel to zoom in and out.
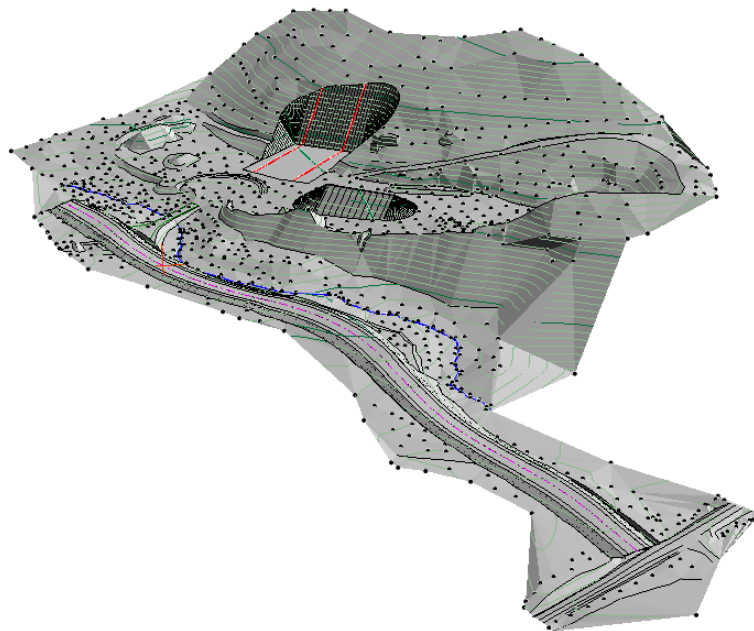

Figure 1 – Three Dimensional View of The Quarry

Calculate Stockpile Volume:

The volume features in Terrain works by comparing the difference between two surfaces.
For this exercise we will determine the volume of the stockpile at the quarry base.
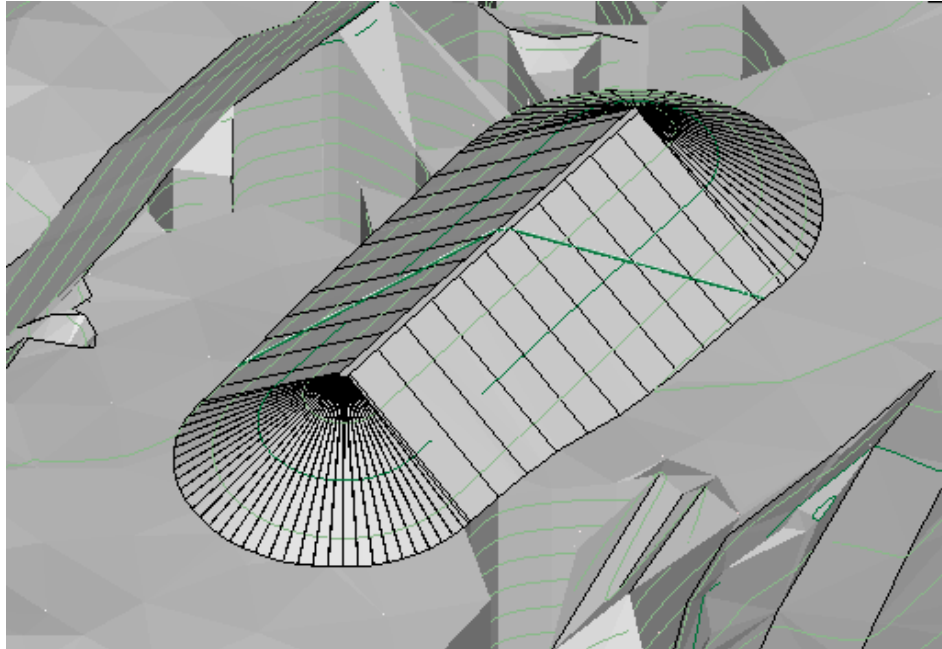

Figure 2 – Image of Stockpile

1. This example is in Imperial (ft.). To check the Units use the following precess: *Setup | Module Setup | Units* tab.   Ensure units: *Imperial (ft.)* | Press *OK*.   The elevations in this file will not make sense if metric is used.

2. Step one is to create the surfaces.   Select the base of the pile, *right click | Copy*.

3. Open another instance of Terrain (double click on Terrain icon).   *Home | Paste* button.

4. You can see the outline of the base of the pile. You have to turn this into a TIN surface: *Terrain Modeling | Generate TIN.*   Ensure *Calculate triangles* is checked.   Check *Include all*.   Press *OK*.

5. Check the model in 3D [icon] to ensure that it has no holes in it.

6. Save the surface as base of the pile.   [icon] *File | Save As*   name file: **Base of Pile.terx**

7. Create the next surface the top of the pile.   Select the outside of the pile again in the original file.   *Right click... | Select Feature(s) > By Boundary...* A dialogue box will pop up.   Select Features *Inside*.   Press OK.
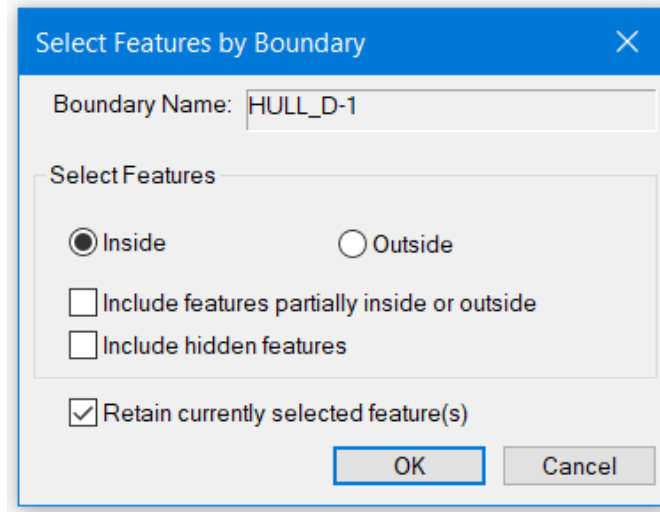
Figure 3 – *Select Feature by Boundary Dialogue Box*

8. Open the instance of Terrain where the base surface was created. ⬤ *File | New.* Do not save the changes to current Terrain.

9. *Home | Paste* button.

10. Create the next surface *Terrain Modeling | Generate TIN*:   Ensure Calculate triangle is checked and Include all is checked.

11. Press the 3D button to view model and ensure that it has no holes in it.

12. Save the surface as top the pile.   ⬤ *File | Save As*   name file: **Top of Pile.terx**

13. Determine the volumes: *Terrain Modeling | Calculate Volumes* button. For Calculation of Surfaces, check the button *Volume between 2 surfaces*.   Press the *Browse* button select **Base of Pile.terx**.   Press *OK.*
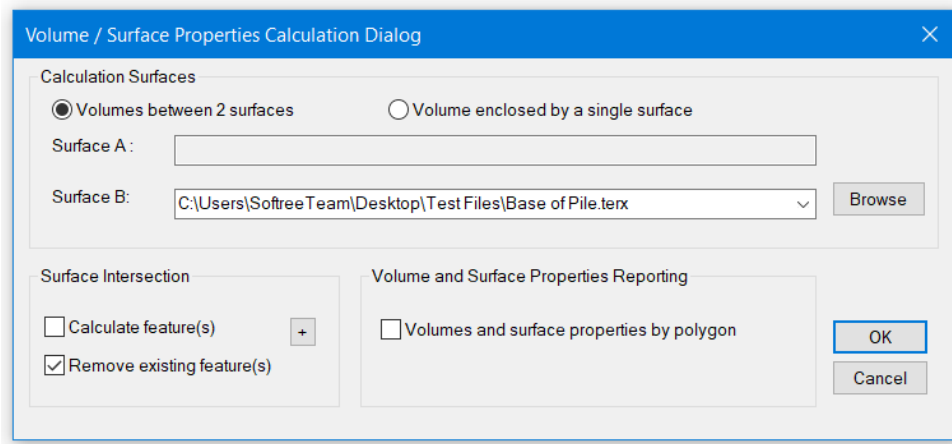
Figure 4 – Select Feature by Boundary Dialogue Box

14. Determine the volumes: *Terrain Modeling | Calculate Volumes* button. For Calculation of Surfaces, check the button *Volume between 2 surfaces*. Press the *Browse* button select **Base of Pile.terx**.

15. A dialogue box will open displaying the volume of the pile. Refer to dialogue box below.
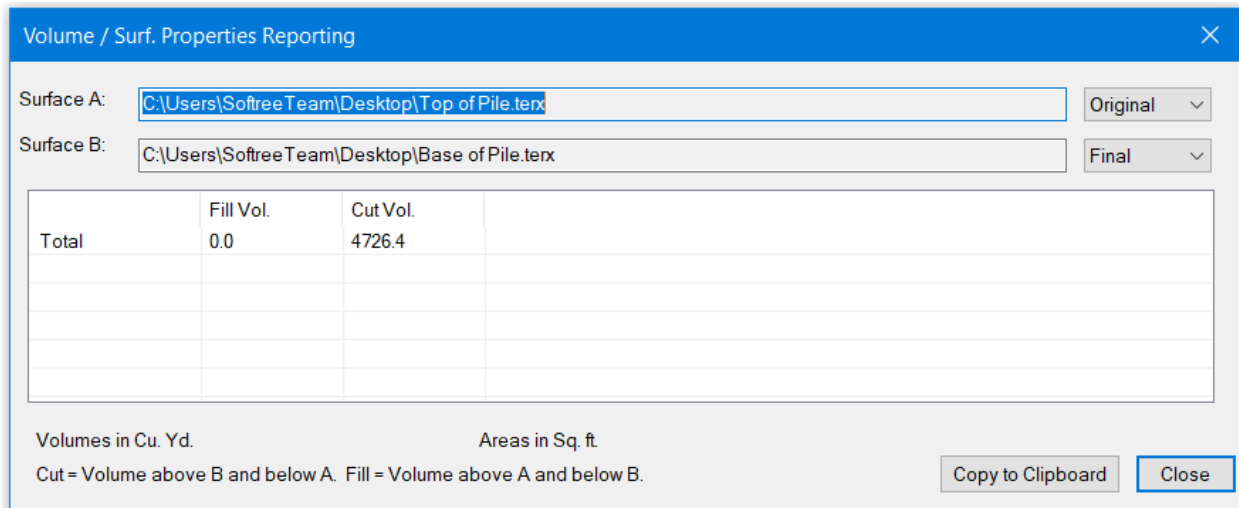

Figure 5 – Volume / Surf. Properties Reporting - Stockpile Volume

Determine Volume From Further Excavation of the Slopeface:

1. By panning and zooming around the quarry look at the Eastern slopeface.   You should find an area where a loader has been excavating material. Refer to figure 5 below:
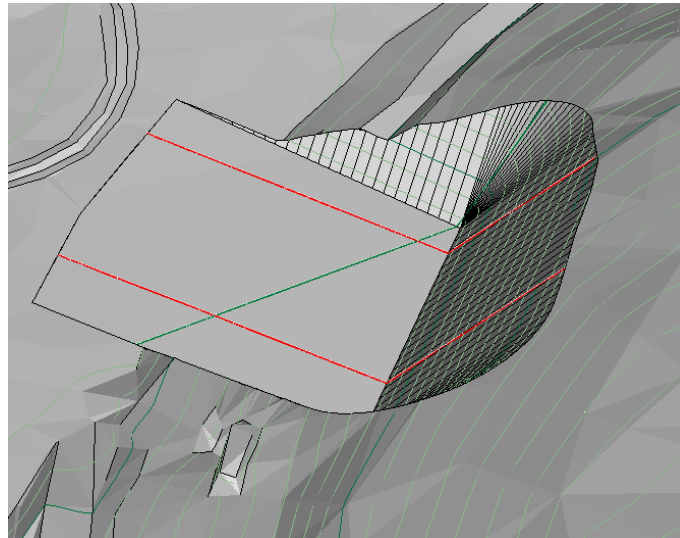

Figure 5 – Existing Excavation of Eastern Slopeface

2. Save the entire file.   *File | Save as:* **Quarry Surface.terx**.

3. Open the Feature Properties Panel: *View | Add to Panel* button | select *Feature Properties* from dropdown.

4. We will use the grading feature to increase the size of this excavation:

   First we need to draw the increased pad the loader will excavate.   Bring up the plan view by pressing the plan button [icon].   Select the two corner extents of the current excavation as shown in figure 6.   Right down the coordinates of these points.

Figure 6 – Corner of Excavation

5. Visualize the extents of the bottom of the excavation, the shape of a rectangle (refer to Figure 9). Use your mouse to move to how large you would like to extent the excavation and write down the coordinates of these points. Now you have the coordinates for the bottom of the excavation, or in other words the part the loader will make flat. Refer to Figure 7.

Description	X-Coordinate	Y-Coordinate	Elevation (ft.)
Existing SW corner of excavation	10138.2	4775.0	4108.0
Existing NE corner of excavation	10197.5	4870.7	4107.8
New NE corner of excavation (elev. same as old)	10245.0	4844.2	4107.8
New SW corner of excavation (elev. same as old)	10192.8	4746.4	4108.0
Existing SW corner of excavation	10138.2	4775.0	4108.0

Figure 7 – Table of New Feature Coordinates (New base Loader will create)

6. Now we will draw in the base of the new excavation as new feature. *Home | New Feature* button (ensure Displayed; Connected; Elevations; Modelled boxes are checked) | *Keyboard...* button type in the coordinates as in the figure above. After ever line press the *Add* button.
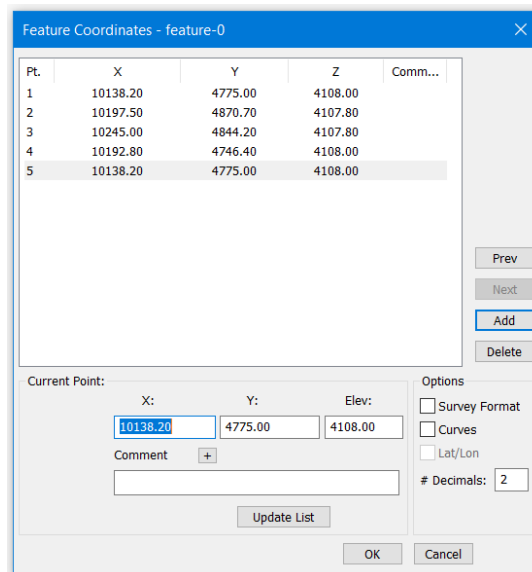

Figure 8 – Coordinates of Base entering in to Feature Coordinate Dialogue
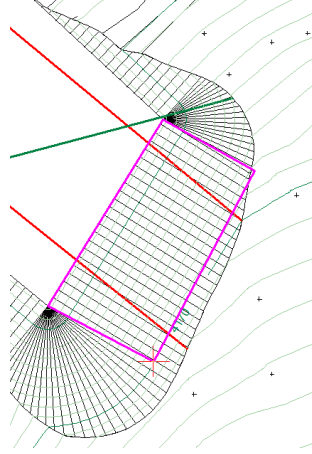
7. Press OK to close dialogue.

Figure 9 – *New Feature Depicting The Base of The Excavation*

8. Select the feature copy it and paste it in another instance of Terrain (double click on Terrain icon to open it). In the new Terrain: *Home | Paste* button.

9. Create a TIN Surface. *Terrain Modeling | Generate TIN* ensure *Calculate triangles* is checked and *Include All*.

10. Press the 3D button to view model and ensure that it has no holes in it.

11. Use the grading tools to determine the volume of material excavated: *Terrain Modeling | Grading*. Browse for the target surface **Quarry Surface.terx.**

   Check the boxes:

   - Interpolate Spacing: **5.0**;
   - Set breakline property;
   - Set Daylight to TIN boundary;
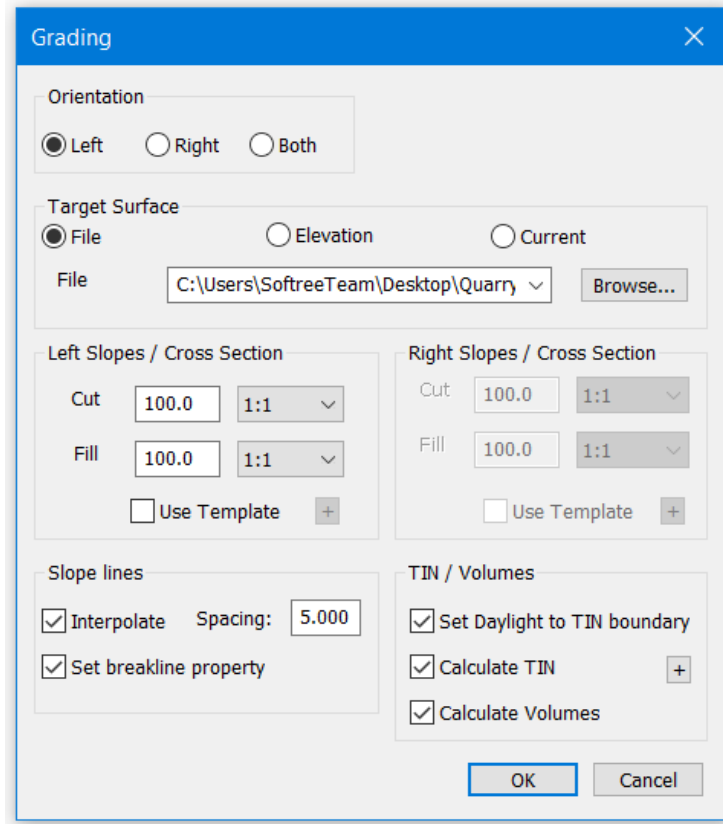   - Calculate TIN;
   - Calculate Volumes.

Figure 8 – Grading Dialogue with Slope line and TIN / Volumes Checked

12. Say Continue to the Softree Warning.

13. A Volume / Surf. Properties Reporting Dialogue Box will open displaying the volume of the excavation.   Refer to Figure 9.
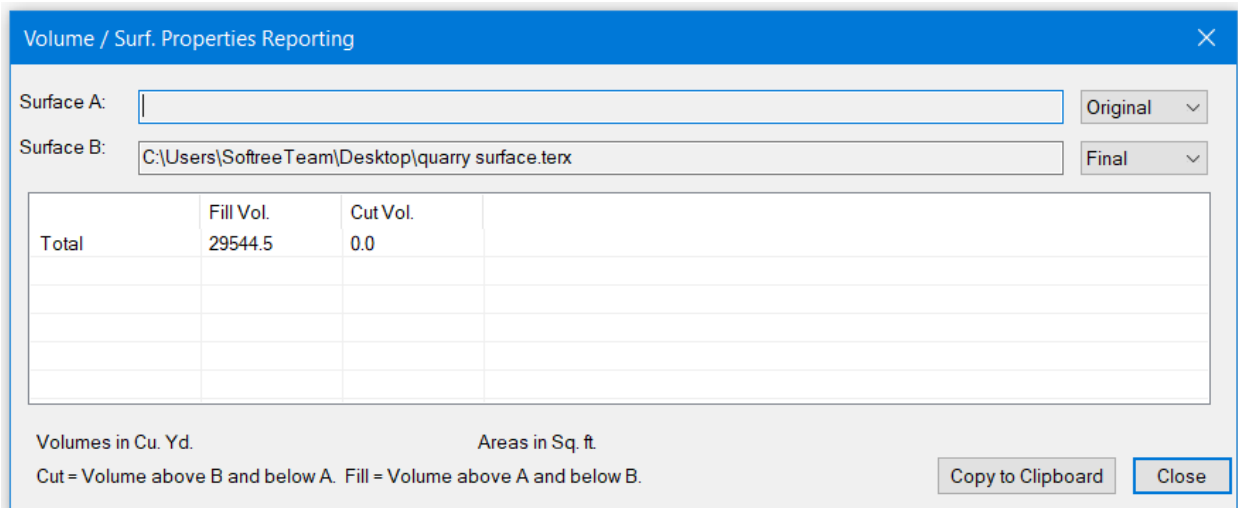

Figure 9 – Volume / Surf. Properties Reporting Displaying Cut Volume

14. One can display the image of this excavation against the original surface.   *Right click* in the Terrain window, select *Active Window (3D) Options…* | Press *Backgrounds…* button | Add… button select **Quarry Surface.terx** | *Open* | Press *OK*.

15. Press *Continue* to Warning Message

16. Now you can see you image of the original surface with the excavation behind it.   Refer to figure 10.
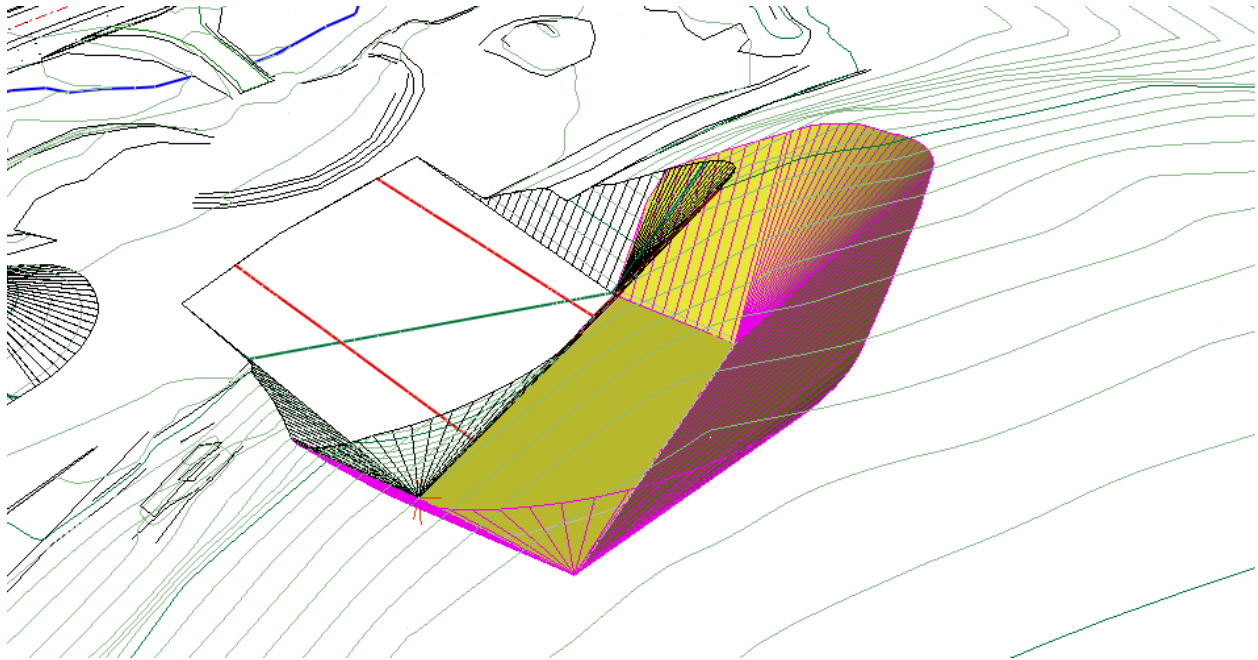

Figure 10 – Image of Excavation with Original Surface Quarry Surface in Background

Widen the Haul Road:

This file has an existing road.   In this example, we will be widening the existing road:

1. Open Location, 🌐 *File | New File |* Press *Browse…* button **quarry surface.terx** *| OK | Next>*
    | Finish button.

2. Press the *plan view* button . Use *View | Cascade* to find the plan view and maximize it.

3. *Right click* in the plan view.   *Right click | Add/Edit IP Tool* and click on red cross and move
    it to the start of the road.

4. Draw in a new horizontal alignment on top of the old road.   With *Add/Edit IP Tool* Selected.
    And the pencil cursor showing   .   Refer to figure below.

5. Activate the Horizontal Curve Panel .

6. Within the Horizontal Curve Panel press the Next IP until you reach the first IP.
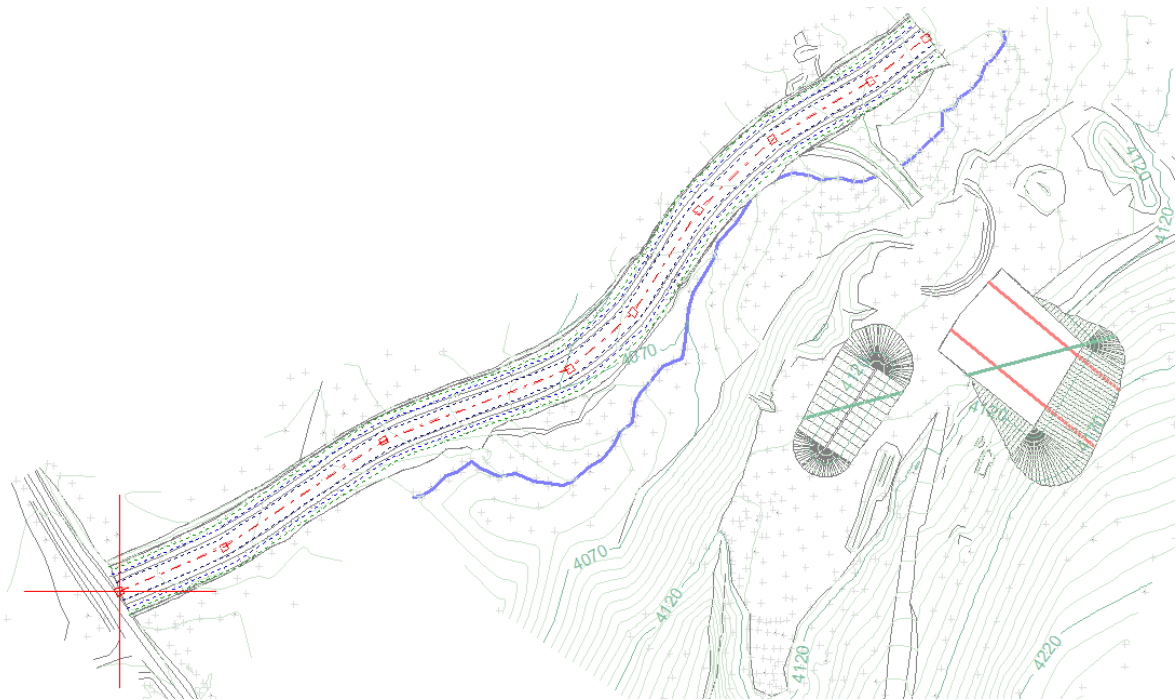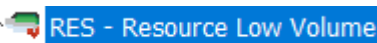

Figure 1.1 – Plan View with Horizontal Alignment

7. *Select* the Circle button within the Horizontal Curve panel, change the radius to **400.0**, press
    Apply button

8. Proceed to the next IP, set the radius to **400.0** and press Apply.

9. Continue along alignment applying the radius of **400.0**, because of the spacing of the IP's you may have to apply smaller radius curves such as **100.0** or **200.0**.

10. You can now adjust the position, the size, and possible add curves to better match the existing centerline of the road.

11. Apply a template to the road.   *Home | Assign by Range* button. In the Assign Parameters by Range Dialogue box, select the *Templates* tab | Select *RES Resource Low Volume* | | From Stn. '..' To Stn. '..' | *Add/Edit* button | Press *OK* | Press *OK* to Update entire design dialogue.

12. *Home* | Press the *Templates* button

13. Expand RES – Resource Low Volume road ⊞ RES - Resource Low Volume   press the plus button.

14. *Right click* on *Roadway* select *Properties...* set the width to **25.0** on the Left and Right sides. Because this in an imperial units template with is something should be aware of.   Set the depth of Layer 1 to **0.0**.

15. *Right Click* on RES – Resource Low Volume | *Properties...* | *Check* Include Volumes and Match existing ground | Press *OK*

16. Press *OK* to close the Template Editor. Press *OK* to Update entire design.

17. Activate the *Section* window 📐 you can now see the section window.
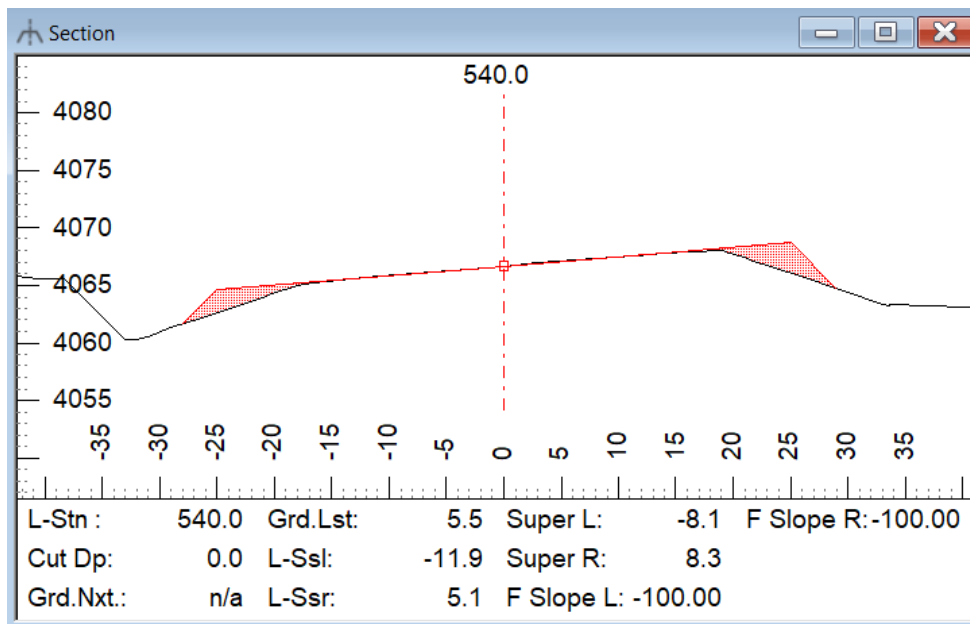

L-Stn :	540.0	Grd.Lst:	5.5	Super L:	-8.1	F Slope R:-100.00
Cut Dp:	0.0	L-Ssl:	-11.9	Super R:	8.3
Grd.Nxt.:	n/a	L-Ssr:	5.1	F Slope L: -100.00

Figure 12 – Section Window Displaying the Areas That Require Fill

18. Activate a data window.   *View | New Window | Data*

19. Re-arrange the windows *View | Cascade.* Arrange and resize the windows such that they appear like they are in Figure 13.
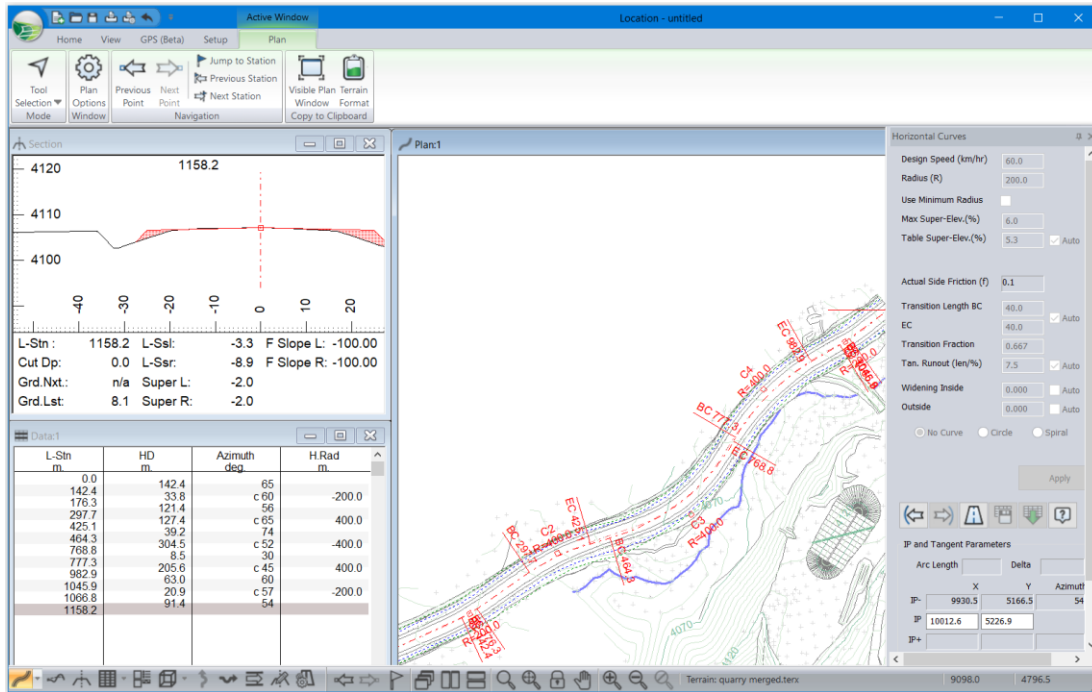

Figure 13 – Design in Location with Windows Rearranged.

20. In the data window *right click... | Data Options... |* Press *Columns... |* Remove all but *L-Stn |* Expand Volumes General and add *Cut V.; Fill V.; Mass H.* | Press *OK, OK.*

21. *Right click... | Data Options... |* click on *plus* under Point Types (Rows) | *Select only* Auto interval points (XX.X m) | press the *Properties...* button | Select Auto interval points (XX.X m) | Type in interval of **20.** Refer to Figure 14.

Figure 14 – Data Window Displaying Cut and Fill Volume and Mass H (Cu m.)

22. This data window is shows that it will take a total volume of 1255.4 Cu. Yd. to widen the road by 10 feet.