TerrainTools®

Terrain Tools Forestry - Cable Harvesting Tutorial

Version 10

Softree Technical Systems Inc.

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1. Getting Started

This manual is formatted as a hands-on tutorial, which can be used by novice or experienced users. Step by step examples use prepared documents and data files to illustrate tools needed for common Terrain Tools Forest Engineer and RoadEng® tasks.

Installation

The tutorial files referred to in the following examples can be installed from Softree's Support web site: Go to the *Support-Documentation Updates* page on Softree's web site:

https://support.softree.com/product-updates/Documentation-Tutorials

Documents

The tutorial files (data sets) will be installed in the folder below by default:

C:\Users\Public\Documents\softree\trainingV10\Terrain

It is possible to change this folder at install time; you can also copy it to a new location afterwards if you wish. We will refer to the install folder as **<Terrain>** in the examples below.

Recommendation: To make accessing files easier as you work through the tutorial, we suggest pinning the <Terrain> folder to your Quick Access menu. To do so, open Windows Explorer, navigate to the folder <Terrain>. Right-click on the folder, select "Pin to Quick Access". This will now make the folder available on the left-hand side of Windows Explorer (see figure below).

Don't Save Files (in most cases)

Most of the following examples end with the phrase: "… do not save changes". If you modify the tutorial files, they will no longer work with the steps in the exercise; this will prevent you, or someone else, coming back and doing the exercise again.

If a file gets modified, delete the files in the training folder. Then re-install the tutorial files (per the original steps).

C:\Users\Public\Documents\softree\trainingV10\Terrain

Defaults and Layouts

The setup and layout files are stored the folder below by default:

C:\ProgramData\Softree\Terrain

It is possible to change this folder, so we will refer to it as **<Defaults and Layouts>** in the examples below. A folder containing training specific files has also been added to this location:

<Defaults and Layouts>\

Note: You can always determine the actual **<Defaults and Layouts>** folder by running the Terrain Module, selecting menu *Module* | *Setup* and clicking on the *Install* tab.

If RoadEng was installed, the default folder will be:

C:\ProgramData\Softree\RoadEng10

Function Groups

Some RoadEng® and Terrain Tools® products have certain features; we classify these optional features by *function group*.
To view the features enabled with your license:

1. Select *Setup* | *Module Setup* and click on the *General* tab.
2. Click on the *Menus...* to open the Menu Customization Dialogue box.

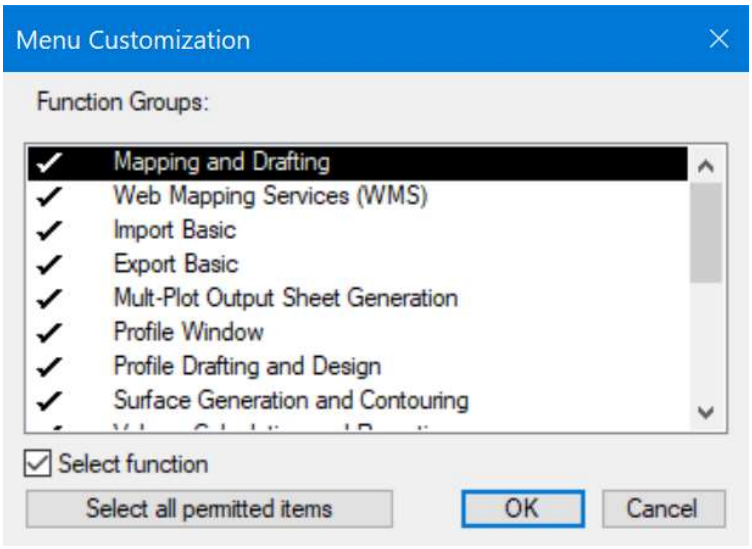

Figure 1-1 : Function groups displayed in the Menu Customisation dialogue

On-line Help

Help information is available by choosing the *Help* menu or pressing ***<F1>*** on your keyboard. The On-line Help includes detailed technical information about menus, dialogue boxes, and operation of the program. It may be useful to refer to the On-line Help while working through the examples in this manual.

Additional help is available through the Softree Knowledge Base:
https://www.support.softree.com/knowledge-base

Tutorial Units

Most examples in this tutorial are in Imperial Units (feet). To correctly follow the examples, ensure Imperial (ft) units are enabled in the *Setup* |*Setup Module Setup* | *Units* tab | Units: *Imperial (ft)*. If other units are used they will be specified at the start of the example. The procedures and concepts described apply to all unit systems.

Screen Layouts

Screen layouts are small files that save display options (window positions, labels, scales etc). Many of the examples in this training manual include a step to retrieve a screen layout; this change provides multiple view options in one quick step.

The *screen layout* drop-down control can be found in the Standard toolbar in all modules (figure below), *View* | *Screen Layout*:

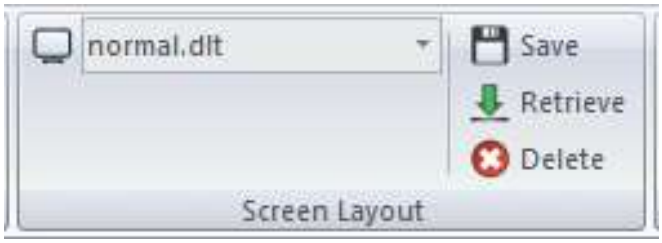

Figure 1-2: Accessing Screen Layouts Group

With the drop-down expanded, you can:

- <Right-click> on a screen layout in the *Screen Layouts* tool bar item to: Change Properties, Delete, Copy, Save

- <Right-click> on a folder (Softree or Custom) in the Screen Layouts tool bar item to:
  - Change properties (only the *Custom* folder can be changed here)
  - Paste a screen layout that was recently copied
  - Save new layout (define name and description)

The *Custom* folder is often defined on a network drive so that the layouts are accessible to all users.

- The *Save screen layout* button allows you to save a screen layout anywhere but only those in the *Custom* or *Softree* folders will appear in the *Screen Layouts* tool bar.
- The *Retrieve screen layout* button allows you to open a screen layout file anywhere including those in the *Custom*, *Training* or *Softree* folders.
- The *Delete screen layout* button opens up the screen layout folder where you can multiple layouts to delete.
- You can change the *Softree* folder from the menu *Module* | *Setup, Install* tab. Do not do this unless you understand the consequences; more than just screen layouts are stored in this folder. The most common change is to put *Settings and Layouts* into your *Documents* folder (private to one user only).

Note: Screen layouts were updated in Version 9. Softree recommends 'updating' any legacy user screen layouts to update their behavior. Version 9 layouts work better when moved between monitors of differing screen resolutions.

To 'update' your screen layouts:

If your legacy screen layout contains multi-plot information, please open your legacy screen layout in the multi-plot window first:

Select *Multi-Plot* tab | *Add New* ▼ | *Retrieve Other Layout.* Select ***Multi-Plot Old Screen Layout (.dlt)*** from the file type drop-down in the *Retrieve Screen Layout Dialogue*. Select your legacy layout. Once open, press *Save Chapter* in the Multi-Plot ribbon.

Conventions

The following conventions are used throughout the manual:

- Menu functions are delimited by a line "|". *File* | *Open* means to click on Terrain *File* button in the corner of the menu bar and then select *Open* from the drop-down menu. Dialogue box control (like buttons) and heading names are *italicized*.
- The symbols "< >" contain keyboard functions. For example, < shift-enter> means: hold down the *Shift* key and press the *Enter* key.
- File names and path names are ***bold and italisized***.

2. Cable Analysis Introduction & Equipment Setup

To use this tutorial, you should be well versed in Terrain Module functions such as:

- Selecting features
- Drawing/editing features.
- Displaying profiles

Tutorials on these functions are available in the Terrain Tools PDF.

The **Cable Analysis Module** calculates the behaviour of cable yarding systems. You provide a ground profile, a logging system (cable configuration, cable working tensions and weight as well as carriage weight) and a calculation type. You can then display graphic or tabular results including tensions, load capabilities and ground clearance. The proposed cable alignment and the calculated cable deflection is usually referred to as a deflection line. Throughout this chapter deflection lines will be referred to as D-Lines.

See the Cable Analysis On-line Help for details on modelling techniques and limitations. Calculations that require modelling (all except the *simple third point* method) assume a quasi-static load with no ground interference (flying load).

The examples in this section require a license for one of the Softree products that includes Cable Analysis: ***Terrain Tools Forestry*** or ***RoadEng Forest Engineer***.

Note: While most of the units in this example are metric, cable logging equipment often originates in the United States. For that reason, the inputs for creating new equipment and logging systems are in imperial units.

Adding Custom Equipment and Logging Systems

To evaluate a D-Line for acceptable deflection, clearance, load, and tensions you must use a *Logging System* that models what is in the field. In the example we add a new piece of *Equipment* (to represent a yarder) and then and the create a new *Logging System* that uses this yarder.

Note: See Getting Started section for file install folders (**<Terrain>** and **<Defaults and Layouts>**)

1.  File | Open <Terrain>\Cable**CableAnalysis.terx**.
2. Select the *Cable-Analysis* tab in the ribbon bar, then click on the  *Equipment* button. The *Equipment* dialogue box shown below will appear

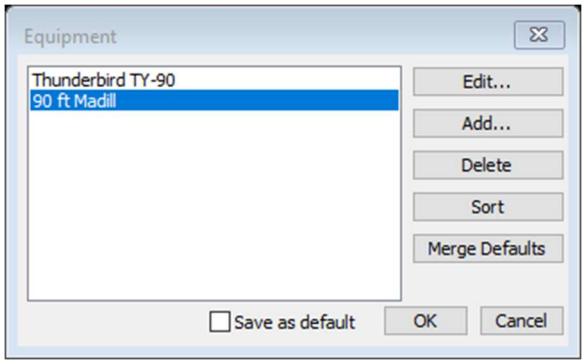

Figure 2-1: *Equipment* dialogue box

3. In the *Equipment* dialogue box, press *Add*. The *Equipment Edit* dialogue box will appear.

Figure 2-2: *Equipment Edit* dialogue box.

4. Fill in all of the parameters as shown in Figure 2-3 below and press *OK* to return to the previous window.

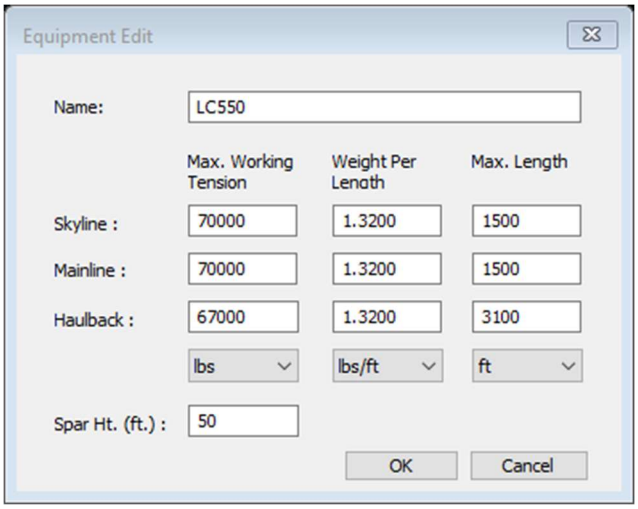

Figure 2-3: New equipment parameters in the *Equipment Edit* dialogue box.

5. *Skip this step if you do not want to change the default settings on this computer.* To avoid having to re-enter the custom equipment parameters for future projects, check the *Save as default* box in the *Equipment* dialogue box.
6. Press *OK* to return to the main screen.

7. Select Cable-Analysis tab in the ribbon bar, then click on the *Logging Systems* button. The *Logging Systems* dialogue box shown in Figure 2-4 below will appear.

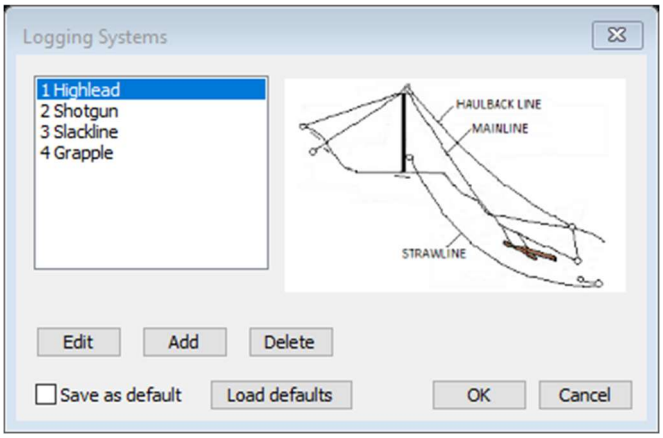

Figure 2-4: *Logging Systems* dialogue box.

8. Select *Add* to open the *Logging Systems* dialogue box.

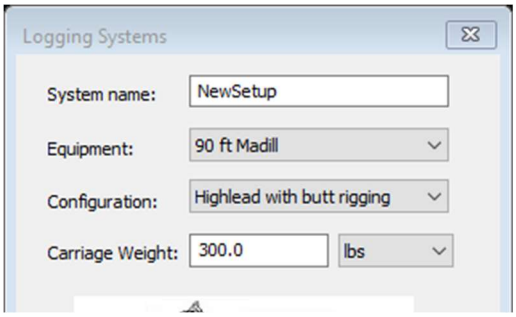

Figure 2-5: New *Logging Systems* dialogue box.

9. Change the parameters in the *Logging Systems* dialogue box to the parameters shown in the figure **Error! Reference source not found.** and press *OK* to return to the previous screen.

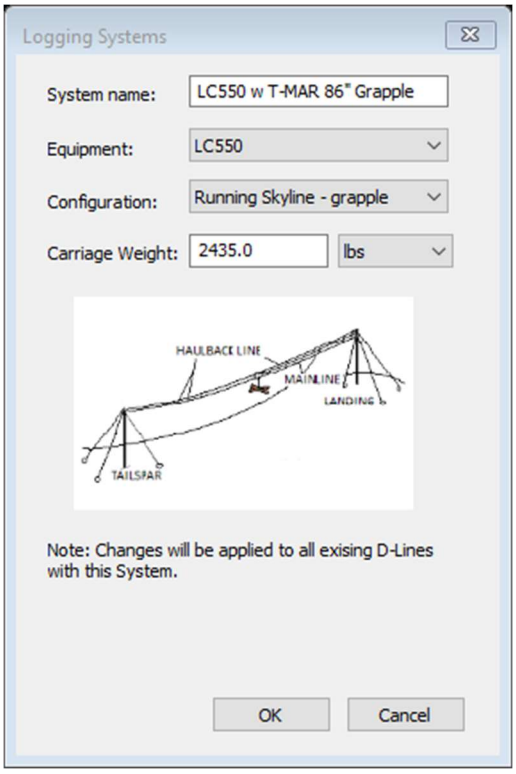

Figure 2-6: New parameters in the *Logging Systems* dialogue box

Note: A *Logging System* is the combination of *Equipment* (a yarder) and cable *Configuration*.

10. *Skip this step if you do not want to change the default settings on this computer.* To avoid having to re-enter system parameters for future projects, check the *Save as default* box in the *Logging System* dialogue box.
11. Press *OK* to return to the main screen.
12. Choose *File* | *New*, do not save changes.

3. Cable Analysis on a Draped Feature

Once the desired equipment and logging system parameters have been entered you may start analyzing various cable roads for deflection, clearance, load, and tensions. In the following example you will analyze the deflection of a predefined cable road using the previously defined equipment and logging system.

1. *File* | *Open* <Terrain>\Cable**CableAnalysis-1.terx**.
2. Select the feature named *Deflection1-0* by clicking with the selection cursor or by using the *Select - By name* function found in the *Home* ribbon.

The Profile window has been set up to display this *draped* feature, the ground profile is defined by the surface model.

3. Select the *Cable-Analysis* tab in the ribbon bar, then click on the *New* button. The *D-line System* dialogue box shown in Figure 3-1 will appear.

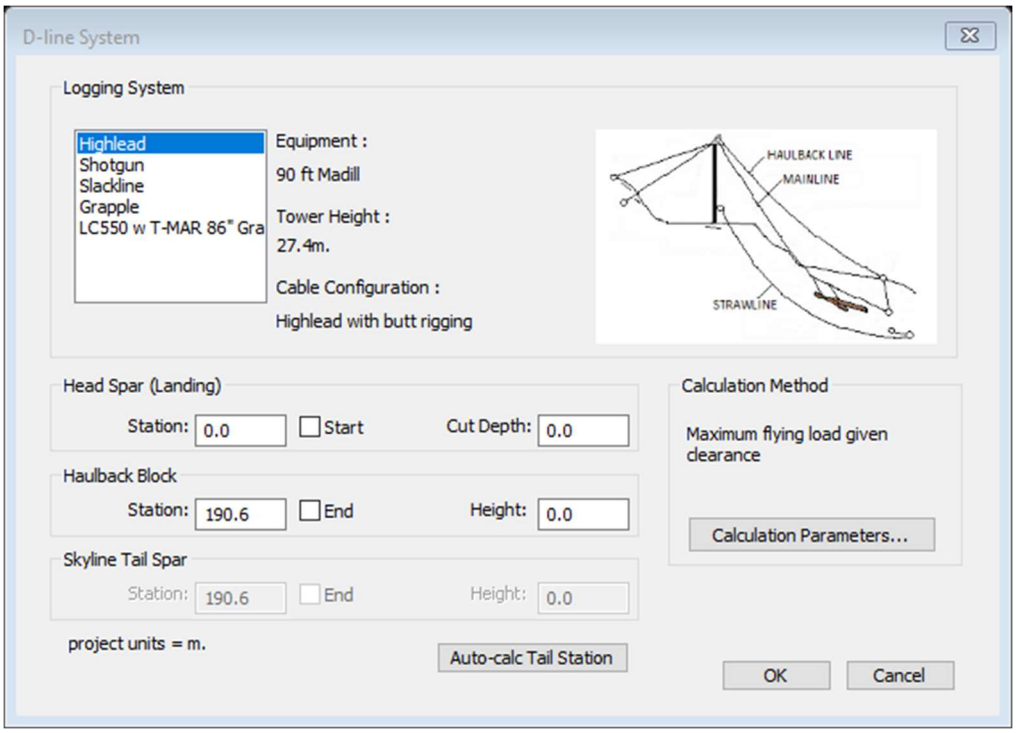

Figure 3-1: *D-Line System* dialogue box.

Note: The *New*, *Edit* and *Delete* buttons in the *Cable-Analysis* ribbon operate on the *selected* features.

4. Press the *Calculation Parameters* button to open the *D-Line Calculation Options* dialogue box.

5. Change the parameters to match those shown in Figure 3-2 below (*Simple third point*, **8**% *Deflection*) then press *OK* to return to the previous dialogue box.

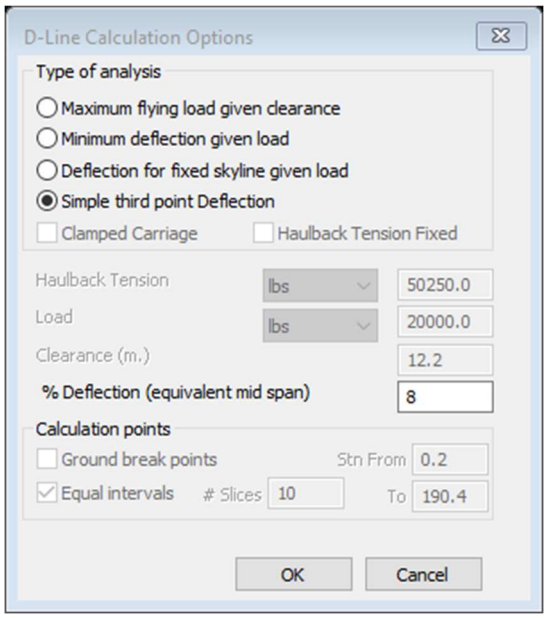

Figure 3-2: New parameters in the *D-Line Calculation Options* dialogue box.

6. In the *D-line System* dialogue box, change the parameters to those shown in Figure 3-3:
   - Select the correct Logging System.
   - Set *Head Spar* to use *Start* of feature.
   - Set *Haulback Block* to use *End*.
   - Set *Haulback Block Height* to ***4.0***
   - Press *OK*.

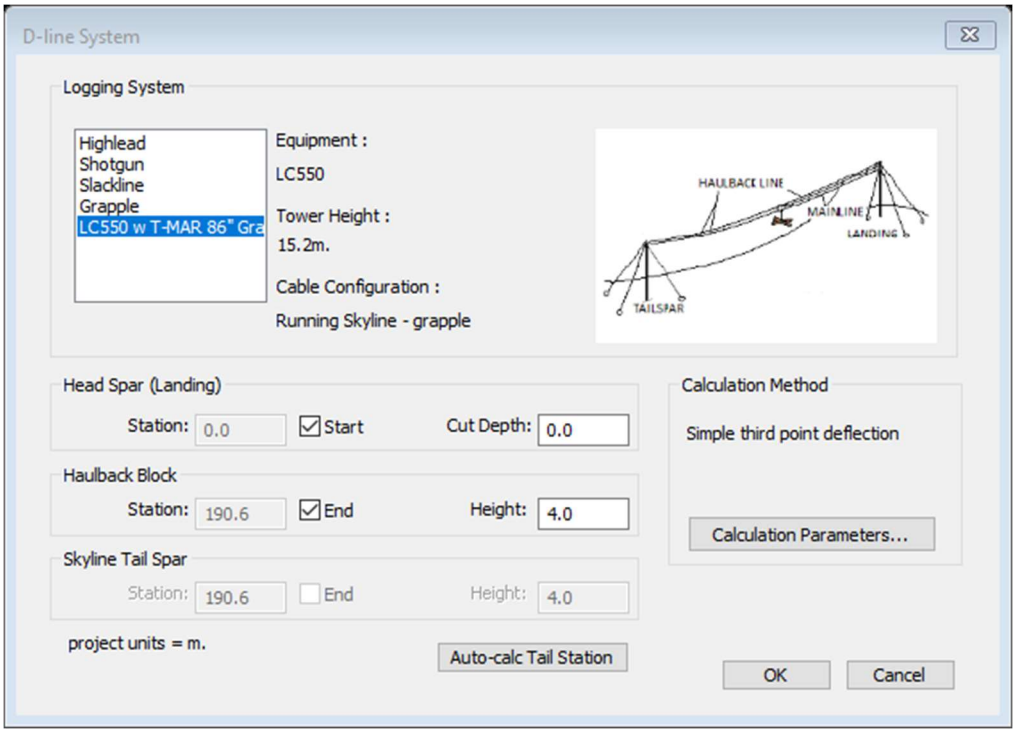

Figure 3-3: New parameters in the D-line system dialogue box

Note: In the *D-Line System* dialogue box, the location and height of the Head Spar, Haulback Block, and, if applicable, Skyline Tail Spar can be customized.

With the *Start* box checked in the *Head Spar (Landing)* section, the yarder will be placed at the start of the selected feature (usually station 0). Uncheck the *Start* box to specify the station explicitly. The *Cut Depth* value can be used to account for earthworks at the landing; use a negative value when fill has raised the landing elevation above the profile.

With the *End box* checked in the *Haulback Block* section, the block will be placed at the end of the selected feature. Uncheck the *End* box to specify the station explicitly. Alternatively, you can press the *Auto-calc Tail Station* button and the haulback block *Station* will be set to the furthest position where the deflection line clears the ground (clearance can be set by pushing the associated + button). The haulback block *Height* can also be specified.

The Skyline Tail Spar parameters are configured in the same manner as the Haulback Block parameters

In both the plan and profile view, a D-line is shown that does not clear the reference surface as it first contacts the ground near station 0+065. This ground interference is shown as intersecting lines in the profile view and by the change from a green to red in the plan view as shown in Figure 3-4.

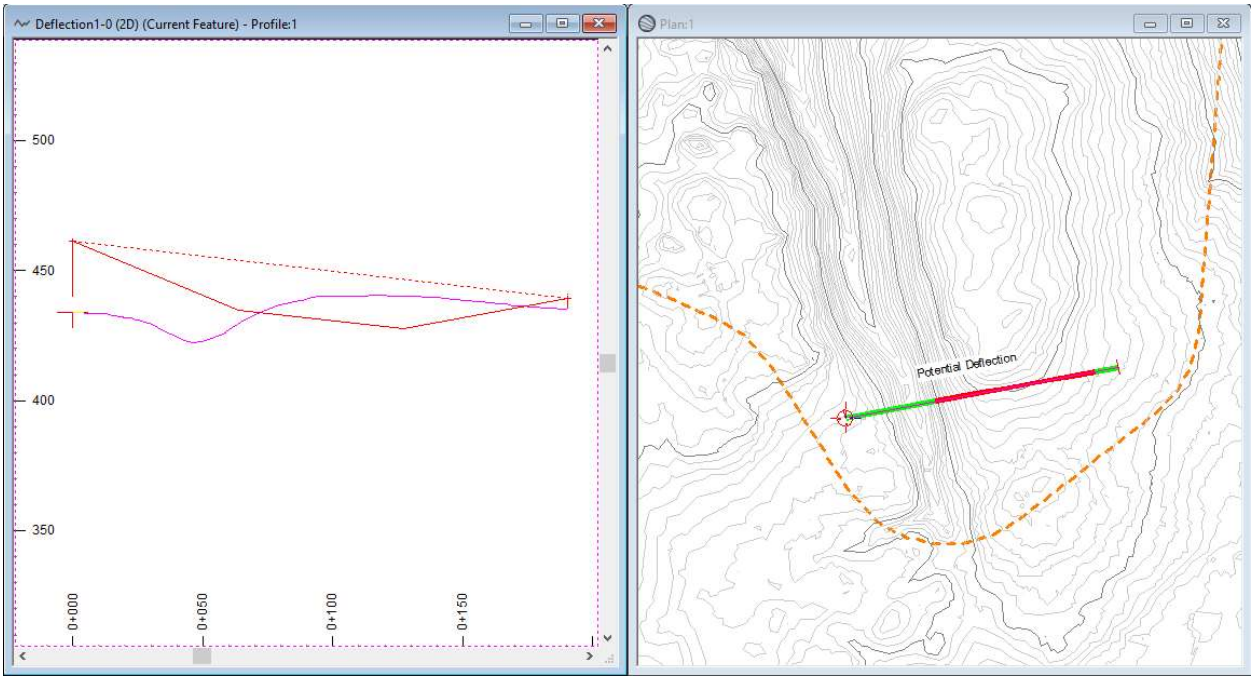

Figure 3-4: Profile and plan views showing the analyzed D-Line configuration

7. To modify the displayed D-Line configuration press *Edit* in the *Cable-Analysis* ribbon.
8. In the D-Line System dialogue box, press *Auto-calc Tail Station* to set the haulback block at the furthest station where the deflection line clears the ground. Then press *OK*.

The resulting view in the main screen should be similar to the image in Figure 3-5 below.

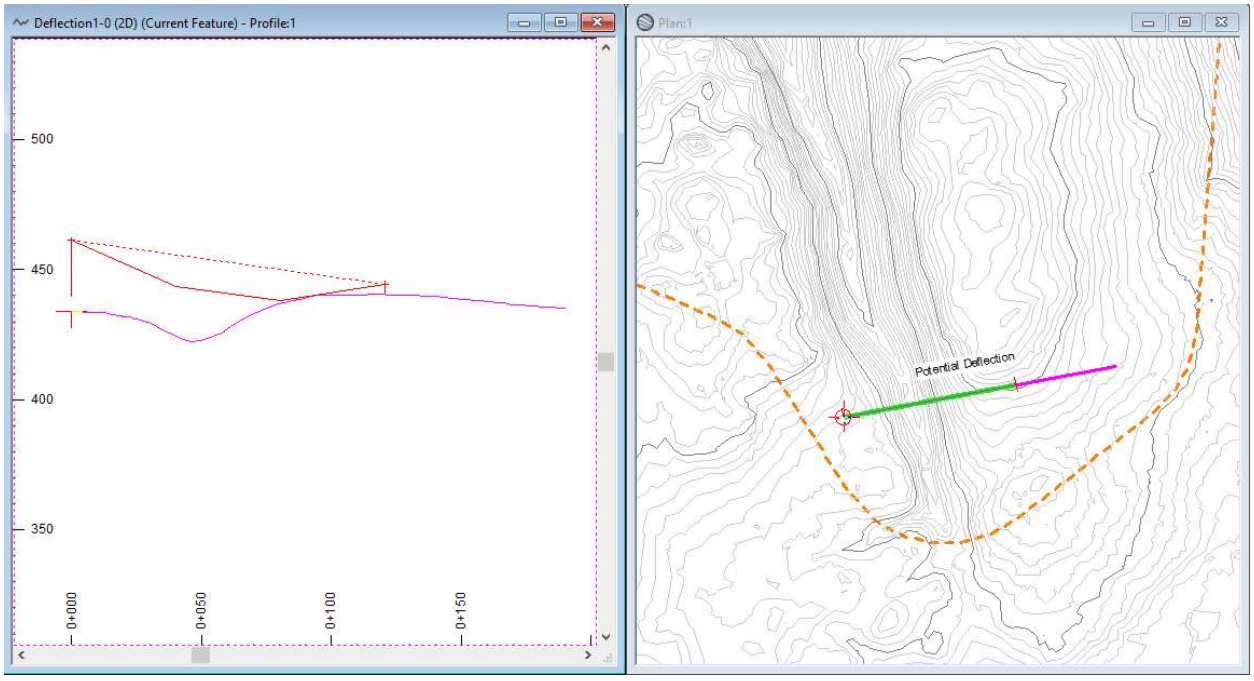

Figure 3-5: Profile and plan views showing the re-analyzed D-Line configuration.

It is possible to move or duplicate the feature in the Plan window to examine the deflection at other locations.

9. *Optional:* Move the end points of the Deflection1-0 feature and notice how the Profile updates to show the new ground profile.
    - Press  *Edit* in the *Cable-Analysis* ribbon.
    - Press *Auto-calc Tail Station*.
    - Press *OK* to see the new tail position.

Note: The example above uses simple third point deflection to approximate cable deflection, but 3 other analysis methods are available for cable analysis in the software. The functionality of the four methods is summarized below:

Maximum Flying Load Given Clearance

You define the carriage clearance from ground (which defines the deflection at each calculation point) and the computer calculates the maximum load that can be lifted at each point. The load is limited by the working tensions in the cables.

This analysis shows the largest payload that can be lifted to a given height above ground. Although a large load may be lifted near the tail hold, it may not be possible to transport it back to the landing.

Note that no load can be lifted above the tight skyline position (chord) so some points may be impossible to calculate and will be left out of the results.

Minimum Deflection Given Load

You define the load and the computer finds the minimum deflection possible to lift the load without exceeding the working tensions of the cables.

This analysis is used to simulate the transport of the load to the landing when the skyline or haulback is dynamically adjusted; appropriate for a *running skyline*. The carriage location shows the maximum possible clearance.

Deflection for Fixed Skyline Given Load

You specify the midspan deflection and load, the computer calculates the cable tensions and actual deflection for all the calculation points. Cables are allowed to exceed their working tensions.

This analysis is used to simulate the transport of the load to the landing when the skyline is fixed. The carriage location information shown in the Profile window is similar to the results of a chain and board analysis.

Simple Third Point Deflection

A specified deflection is applied at the two third points on the proposed D-Line to produce a simple geometric representation of the system. There is no calculation of tensions or loads.

10. *Optional:* Experiment with some of the other calculation types:

- Press  *Edit* in the *Cable-Analysis* ribbon.
- Press the *Calculation Parameters* button.
- Set a *Type of analysis* and modify parameters of interest.
- Press *OK* to see the new calculation.

11. Choose  *File* | *New*, do not save changes

4. Exploring Multiple Areas of Deflection

The *Explore Deflection* tool was created to explore multiple cable roads from a single point (usually a landing). This tool builds upon the concepts previously introduced and can be used to instantly analyze deflection in multiple directions from a single point. The following example will show you how to configure and use the *Explore Deflection* tool.

1. *File* | *Open* <Terrain>\Cable**CableAnalysis - 1.terx**.

2. In the *Cable-Analysis* tab press the *Enable* button (this button is only available if the Plan window is active – click in the Plan title bar to activate). The *D-Line Explore Options* dialogue box will appear as shown below.

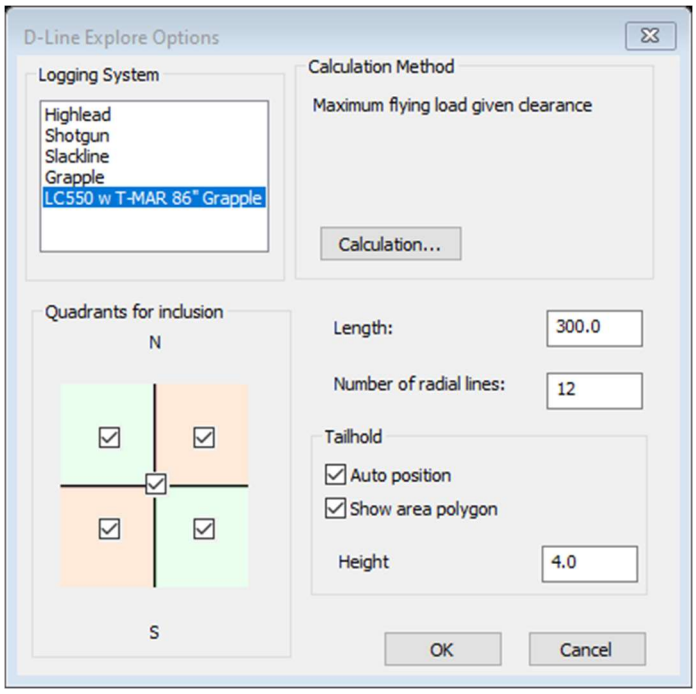

Figure 4-1: The *D-Line Explore Options* dialogue box.

3. Ensure the settings match those shown above:
   - Select the *Logging System*.
   - Set Length to **300**, the *Number of radial lines* to **12**.
   - Set both *Auto position* and *Show area polygon*.

   Set the *Tailhold Height* to **4.0**.

Note: The D-Line Explore Options can be customized to suit your project.

The *Logging System* list shows the systems previously defined (See Adding Custom Equipment and Logging Systems). Select whichever logging system Is appropriate.

The *Quadrants for inclusion* indicate where to draw exploratory D-Lines. If you turn off a check box, the associated quadrant will not contain D-Lines.

The *Length* is the maximum distance from the landing D-Lines may extend.

The *Number of radial lines* indicates the number of D-Lines that will be drawn from the landing (assuming lines are to be drawn in all quadrants).

The *Tailhold* options have 3 components, *Auto position*, *Show Area Polygon*, and *Height*.

The *Auto position* checkbox indicates where the tailhold will be located. If the box is checked the tailhold will be placed at the last station along the proposed line where minimum clearance is maintained (clearance can be set by pushing the associated + button). If it is not checked, the tailhold will be placed at the end of the proposed D-Line (defined by *Length*).

If the *Show area polygon* box is checked a polygon will be drawn connecting the points where ground clearance exists back to the landing on the proposed lines. This may be used to approximate the yardable area.

The *Height* option indicates the height above ground where the tailhold will be attached.

4. Press the *Calculation* button and the *D-Line Calculation Options* dialogue box will appear as shown in Figure 4-2:

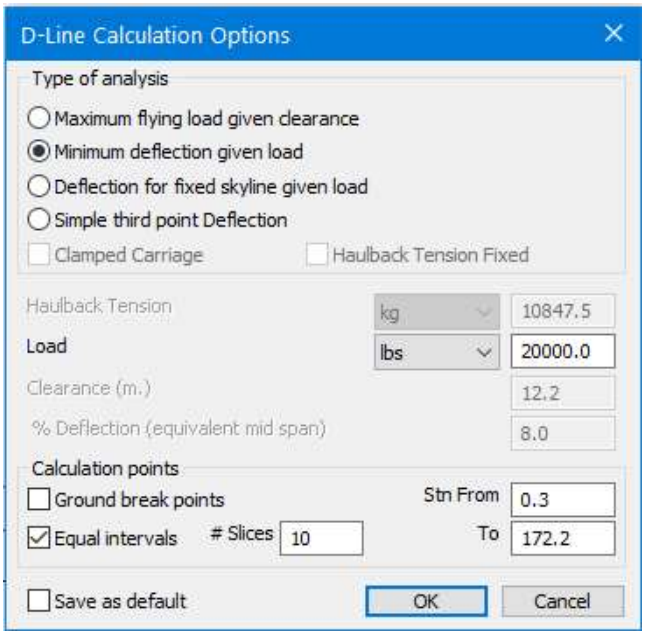

Figure 4-2: The *D-Line Calculation Options* dialogue box

5. In the *D-Line Calculation Options* dialogue box, change the type of analysis to *Minimum deflection given load* and set the load to 20000 lbs. as shown above. Leave the remaining settings as their default values.
6. Press *OK* to return to the *D-Line Explore Options* dialogue box; press *OK* again to return to the main screen.
7. In the Plan view, the curser symbol ✳ will have changed. Click near the center of the topo surface to see radial D-Lines extending out from that point as shown in Figure 4-3.

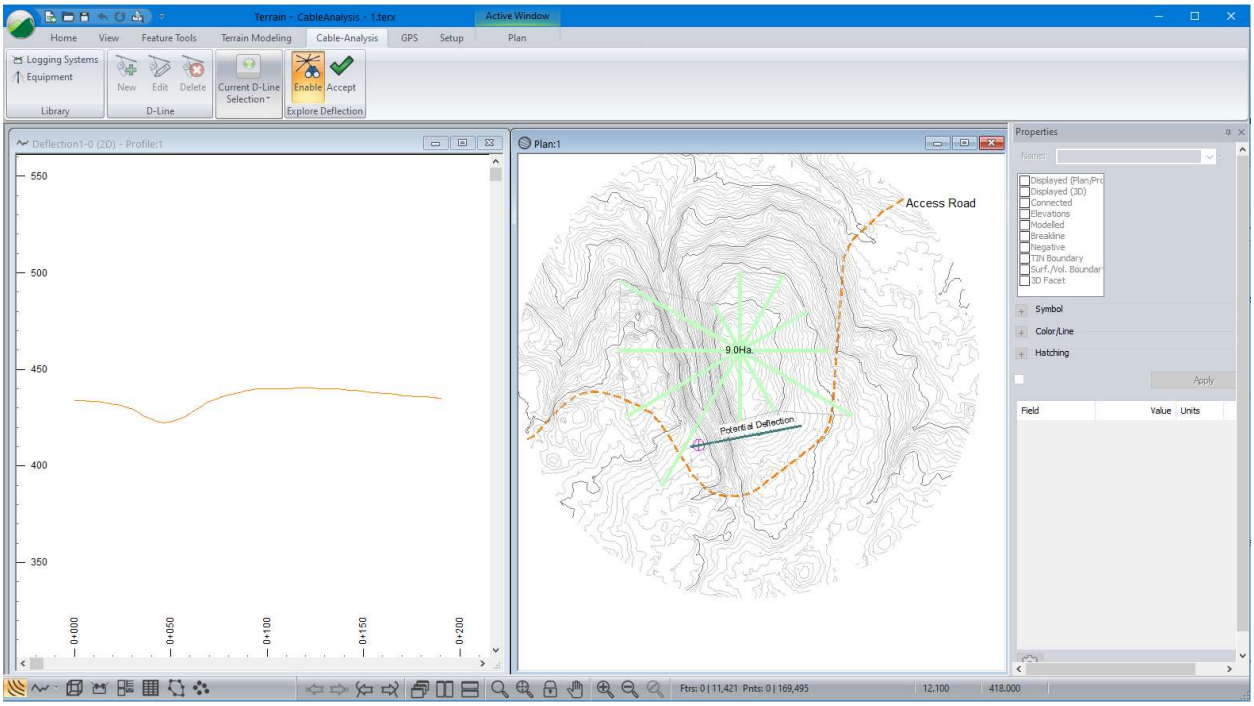

Figure 4-3: View of the Explore Deflection tool in use.

In the Plan view, the green lines extending out from the chosen point indicate the maximum distance that clearance is maintained while using the assigned parameters. You can click again at another location and the radial lines are updated to reflect the conditions at the new site.

8. Click again near the edge of the surface so that some of your 300m D-Line features fall off the model. You will be prompted with the message below (unless you have already disabled it). Set the *Don't display this message again* check box, then press *OK*, to prevent future warnings in this session.

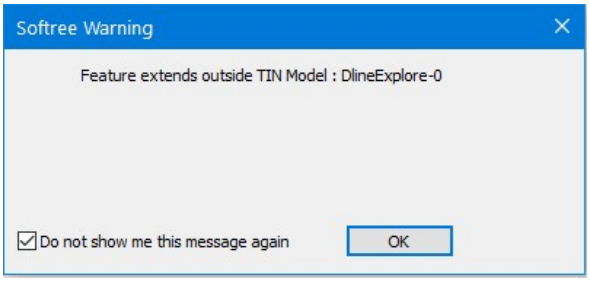

Figure 4-4: Draped feature warning

9. Continue clicking in the Plan window until you find a location you would like to save. Then press the *Accept* button in the *Cable-Analysis* ribbon.

This will save the radial lines as new features in the terrain file and they will no longer appear faded. All the new features are named "DL_Explore" and are numbered sequentially from the easternmost ray in a counter-clockwise direction. An example is shown below in Figure 4-5.

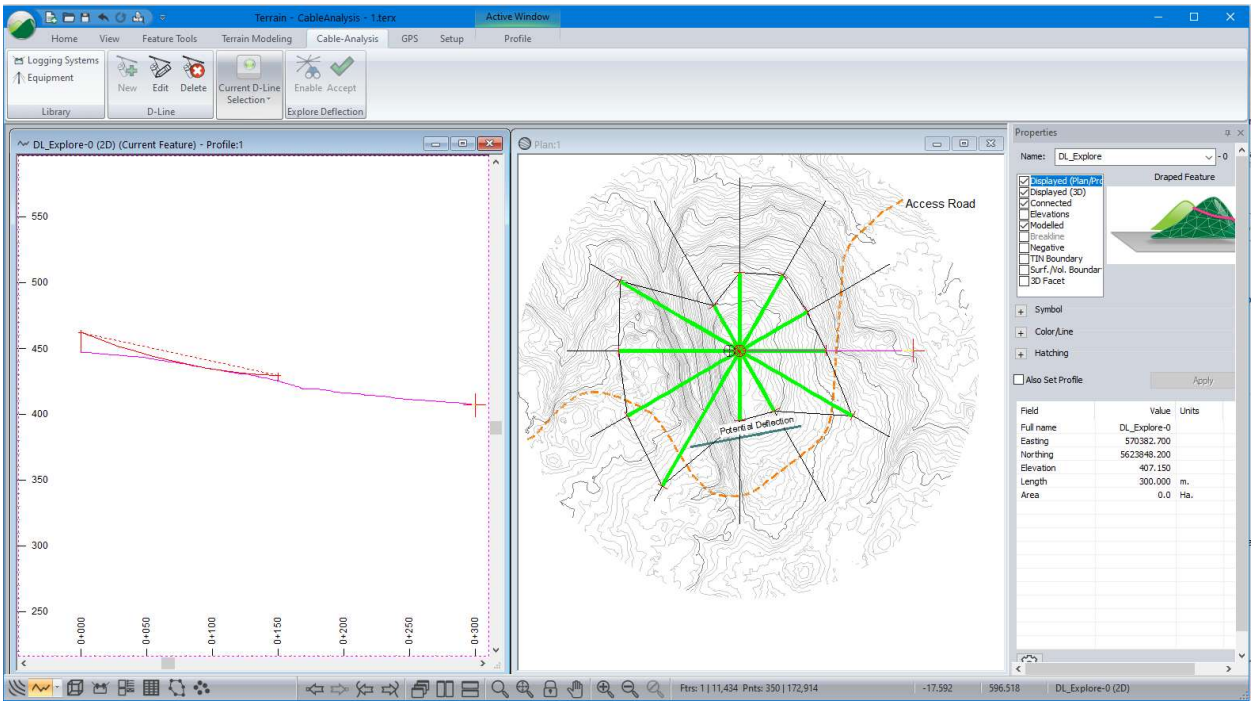

Figure 4-5: Radial lines as they are displayed after accepting an *Explore* operation.

10. Select one of the new radial lines. Click on a feature using the selection cursor or use *Select - By name* found in the *Home* ribbon.

Note: Avoid selecting the end point of a feature that is outside the topo surface as this will scroll the Profile off the screen. Use the *Previous* and *Next Point* buttons to scroll all windows to show this point. These buttons can be found in the status bar at the bottom of the screen or in the *Profile* or *Plan* ribbon tabs.

11. *Right-click* in the Profile window and select *Active window (profile) options*. This will open the dialogue box shown in the figure below.

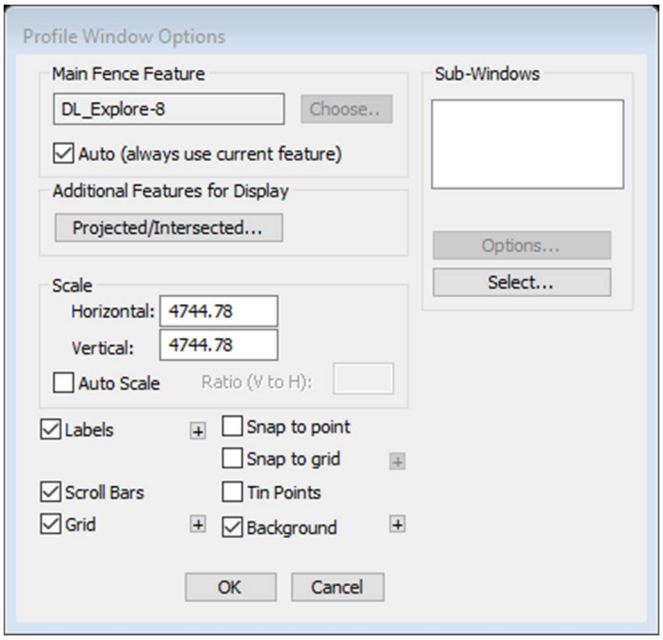

Figure 4-6: *Profile Window Options* dialogue box with *Auto* checked for the *Main Fence Feature*.

12. In this example, the *Auto (always use current feature)* checkbox is set. Press *OK* to return to the main screen.
13. Select another DL_Explore feature and the Profile window will update to show it.

If you wish to edit the cable system used in one or more D-Lines, you must select the associated feature(s) then press the *Edit* button in the *Cable-Analysis* ribbon.

14. Choose *File* | *New*, do not save changes.

The Cable Data window and Profile Sub-windows

More detailed calculation information can be displayed in the Cable Data window and Profile *Sub-Windows*. In this example we are using the *Minimum deflection given load* calculation type (figure below) so values such as cable tension are calculated.

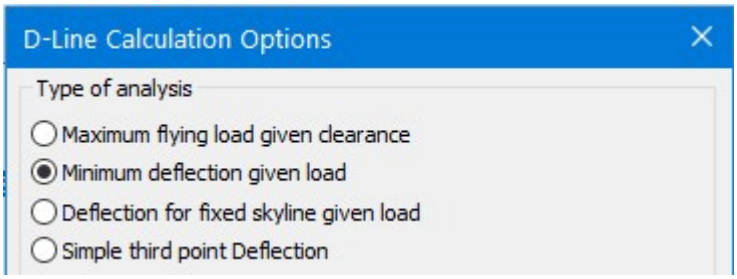

Figure 4-7: *D-Line Calculation Options* dialogue showing the four calculation types

If you choose *Simple third point Deflection*, only geometric values such as ground clearance are calculated.

Configuring the Cable Data Window

The Cable Data window shows numeric D-Line information in a tabular format. The following steps show how to create and configure a Cable Data window.

1. *File* | *Open* <Terrain>\Cable**CableAnalysis - 2.terx**.
2. To add a cable data window, select the *View* ribbon, click the *New Window* drop down and select *Cable Data*. A blank Cable Data window will appear.
3. Right click in the new Cable Data window and select *Active Window (Cable Data) Options*. The D-Line Data Options dialogue will appear as shown in the figure below.

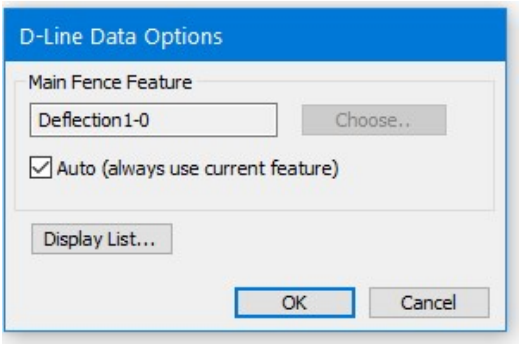

Figure 4-8: *D-Line Data Options* dialogue with *Auto* checked for the *Main Fence Feature*.

1. To automatically show data for the selected D-Line, ensure the Auto (always use current feature) check box is set (similar to the Profile window options).
2. Press the Display Lists button to show the dialogue box below.

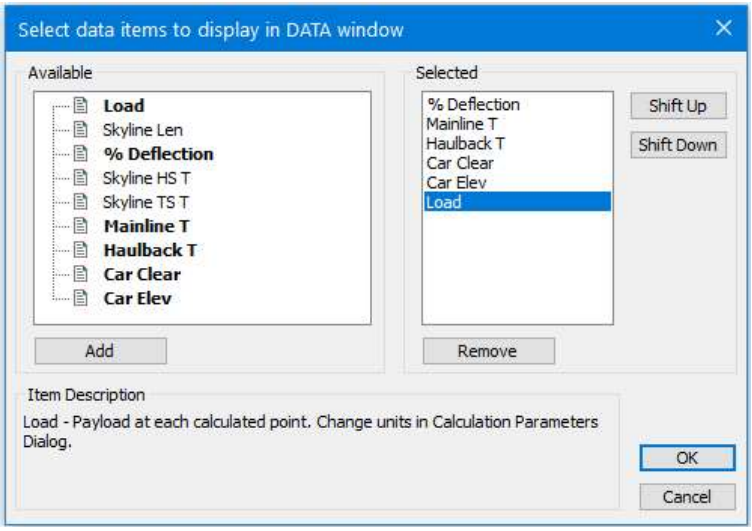

Figure 4-9: Example configuration in *Select data items to display in DATA window*.

3. Select the items shown in the figure above:
    - Select an item in the *Available* list then press the *Add* button to add it to the *Selected* list (or just double click in the *Available* list)
    - Press the *Shift Up* or *Shift Down* buttons to change the order displayed.
    - Select an item in the *Selected* list then press the *Remove* button to delete it (or just double click in the *Selected* list).
4. Press *OK* twice to return to the main screen.

The *Cable Analysis Data* window will appear with the data items appearing as rows and the columns showing the sampled stations. The station columns are based on the calculation points specified in *D-Line Calculation Options*.

Deflection1-0 (2D) - Cable Data:1

Station (m.)	8.4	24.9	41.3	57.8	74.3	90.7	107.2	123.7	140.1	156.6
% Deflection	1.9	3.1	3.7	4.1	4.3	4.3	4.1	3.8	3.1	1.9
Mainline T (lbs)	70000	69000	69000	68000	68000	68000	67000	67000	66000	66000
Haulback T (lbs)	67000	67000	67000	67000	67000	67000	67000	67000	67000	67000
Car Clear (m.)	14.8	20.9	31.2	31.8	24.2	16.3	8.4	1.2	1.1	3.1
Car Elev (m.)	454.5	451.6	449.4	447.7	446.5	446.0	446.0	446.5	447.7	449.4
Load (lbs)	20000	20000	20000	20000	20000	20000	20000	20000	20000	20000

Figure 4-10: Cable Data window

Note: Tensions and load are rounded to the nearest 1000.

In this example, the maximum tensions for the Mainline and Haulback are 70,000lbs and 67000lbs respectively (defined using the *Cable Analysis* ribbon, *Equipment* button). For *Minimum deflection given load* analysis, the load is constant, and the maximum tension allowed in the Mainline or Haulback is applied to minimize deflection. In the first sample at (station 8.4). both cables are at maximum tension; for the rest of the samples, the Haulback maximum tension is limiting the system.

Adding Profile Sub Windows

Some of the information displayed in the data table above can also be displayed graphically as *Sub Windows* in the Profile view. The following steps will add sub windows to your Profile.

5. Right click in the profile window and select *Active Window (Profile) Options* and the *Profile Window Options* dialogue box will appear as shown in Figure 4-11 below.

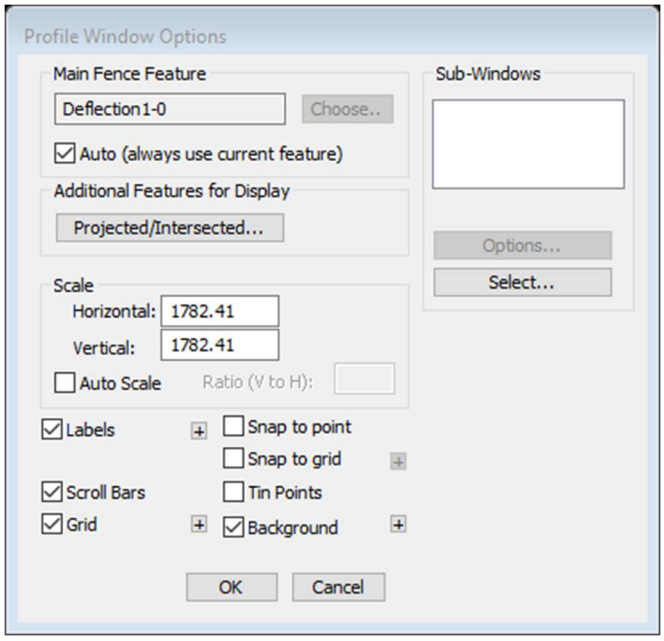

Figure 4-11: The *Profile Window Options* dialogue box.

6. In the *Sub-Windows* portion of the dialogue box press *Select* to open the dialogue box shown below in Figure 4-12

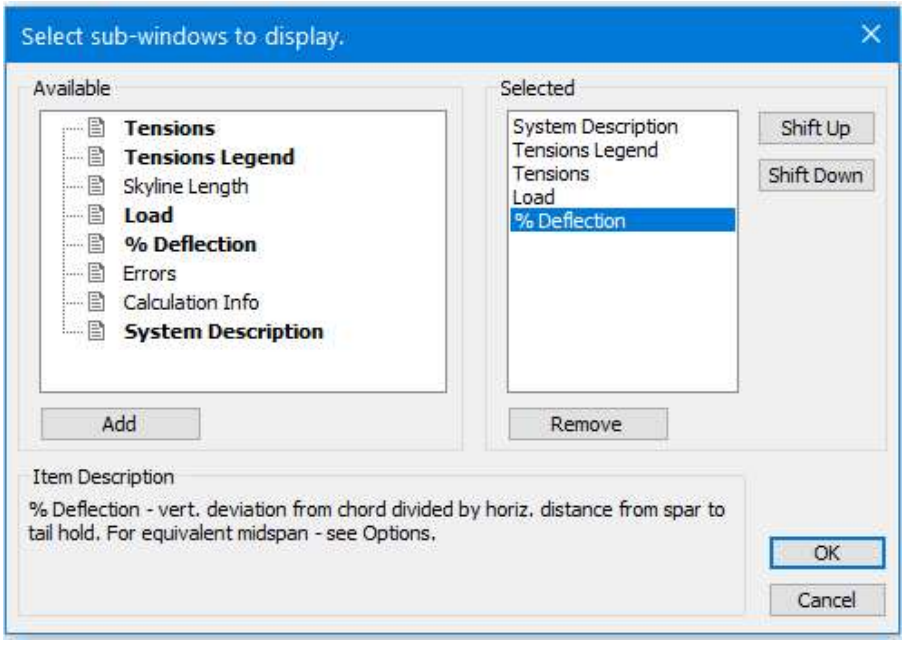

Figure 4-12: The *Select sub-windows to display* dialogue box.

7. Select the five items shown in the figure above.
8. Press *OK* twice to return to the main screen.

The resulting profile window should appear similar to the window shown in Figure 4-13 below.

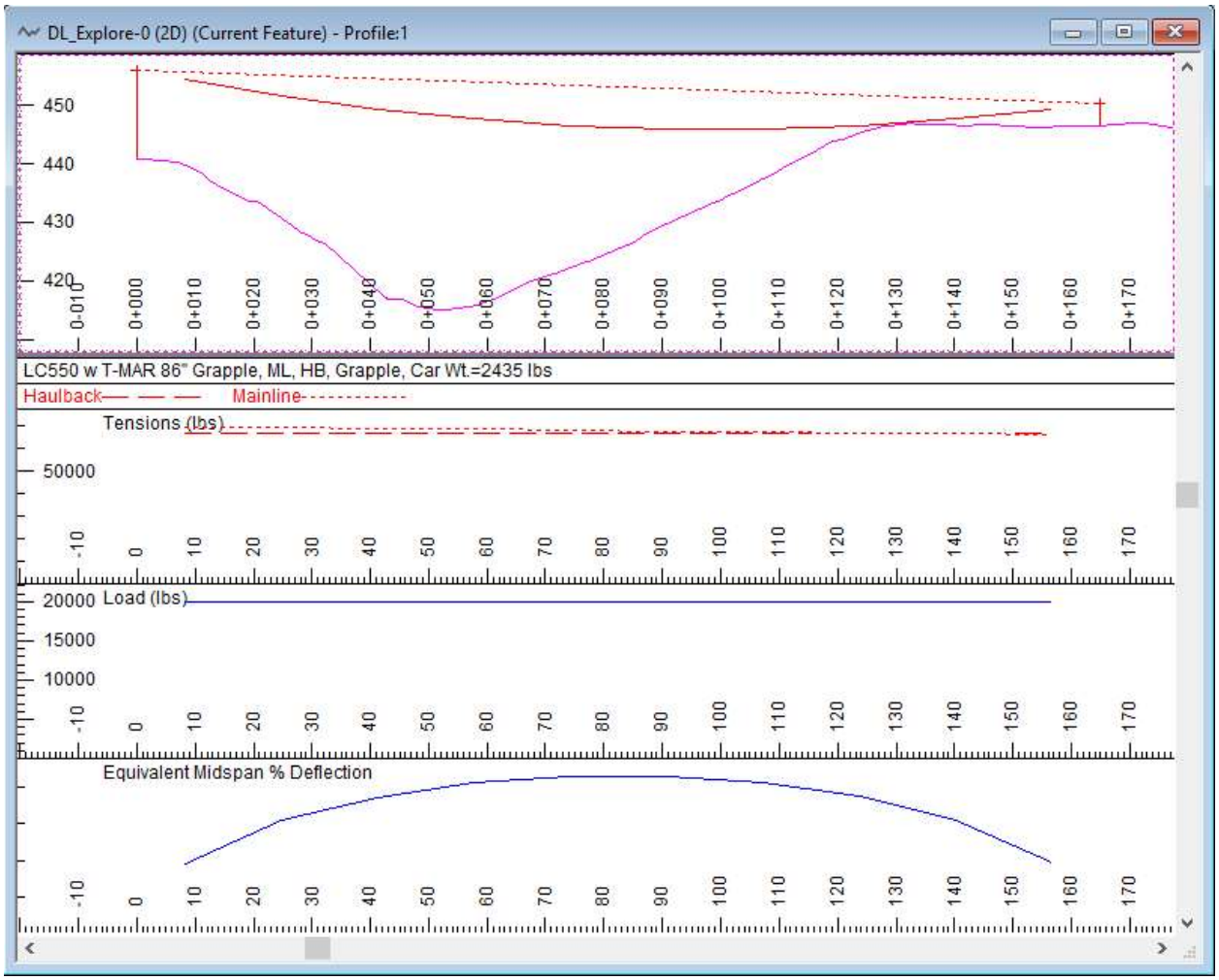

Figure 4-13: The Profile Window with Sub-Windows displayed.

9. Resize the main Profile window to make room for the Sub-Windows:
    - Move your mouse cursor over the grey divider bar under the main Profile window and above the Sub-Windows; the cursor will change ÷.
    - Click and drag to change the position of the divider.
10. Right click in the Profile window and select *Active Window (Profile) Options* to re-open the *Profile Window Options* dialogue below.

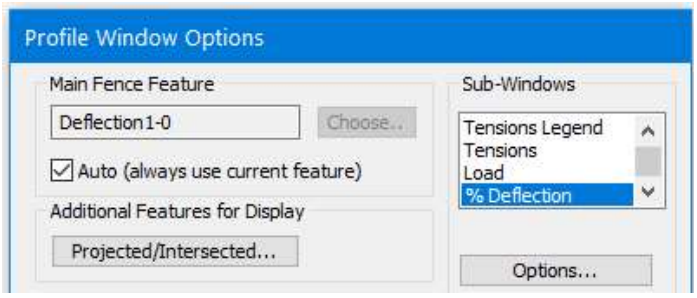

Figure 4-14: The *Profile Window Options* dialogue box with a *Sub-Window* selected.

Many *Sub-Windows* have additional display options.

11. Select *% Deflection* in the *Sub-Windows* list (scroll to the bottom) then press the *Options* button to open the dialogue box shown below.

Figure 4-15: *Sub Window Options* dialogue box for *% Deflection*.

Note: The check boxes for *Horz Axis* and *Vert Axis* turn axis labeling on and off; as the horizontal axis is the same for the main profile and all the graphical *Sub-Windows*, you may want to turn it off.

When *Center Span* is set (the default), the value reported is the equivalent center span deflection for the calculated skyline length at the sample point. In other words, the deflection you would get if you took the same cable length and put the load at the center of the span. This is essentially an alternate measure of cable length between tower and tail (see also *Skyline Length Sub-Window*).

When *Center Span* is clear, the actual deflection at the sample point is reported.

12. Make any changes you want and then press *OK* twice to return to the main screen.
13. *Optional:* Experiment with different calculation types and settings (*Cable Analysis* ribbon, Edit, *Calculation Parameters* button).
14. Choose menu *File* | *New*, do not save changes.

5. Output Sheet Creation for Cable Harvest Plans

Single Deflection Line Output Sheets

So far, we have covered how to analyze cable roads and explore multiple areas for deflection but we have not covered producing formatted drawings to communicate the D-line analysis to others. This example will address how to produce drawings which include illustrations of several view windows, and/or data tables. We will use the *Multi-plot* functionality to produce drawings.

New Multi-plot layouts can be created from scratch (see Chapter 3), however in this example you will create a D-Line output sheet using a previously created multiplot *screen layout*.

1. File | *Open* <Terrain>\Cable**CableAnalysis - 3.terx**.
2. In the *View* ribbon, *Screen Layout* area, choose Training**Training Single DLine MP.ilt**.

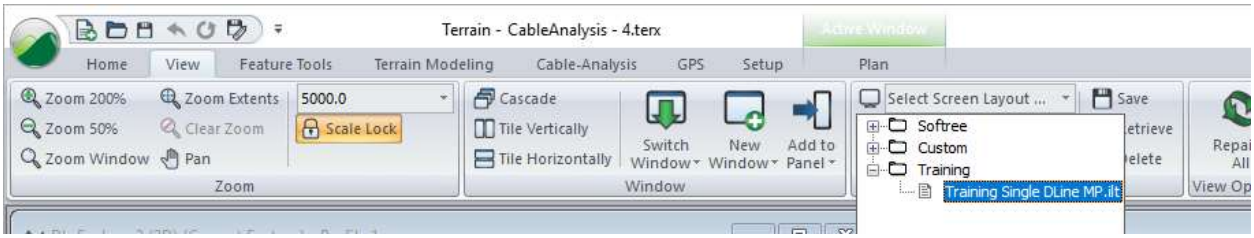

Figure 5-1: Screen layout drop down showing the training folder created during Tutorials install.

When you open a Terrain screen layout, window positions and display options are read from the layout file. In this case:

- Profile Sub-Windows were set up.
- A Cable Data window was created and configured.
- A 3D window was created.
- A Multi-plot window was created and configured
- Windows were arranged in a tile pattern.

Your screen will now appear similar to Figure 5-2.

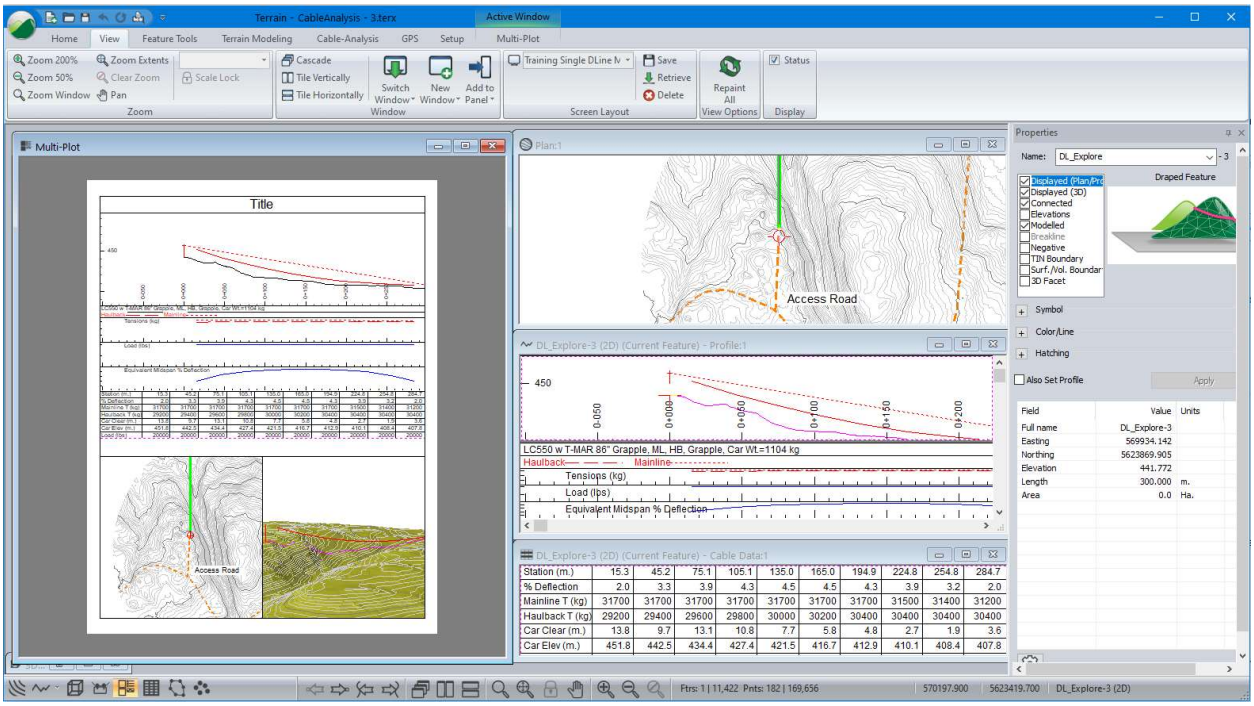

Figure 5-2: Multi-plot window set u using Example Single DLine MP.ilt screen layout.

Note: Screen layout files are designed to be used in different projects; some settings may need to be customized before you are ready to print.

15. If your page does not match the shape of the Multi-plot contents, choose *File | Print Setup* and change your *Printer* and/or printer *Properties* to use a *Letter* (or *A4*) sized page in *Portrait* mode.

The Profile sub-view does not include the entire deflection line being analysed. In the following steps, you will adjust the Profile display.

16. Select the main Profile window (on the right-hand side of the screen) scroll or pan and note that the corresponding Sub-view in the Multi-plot window also scrolls. Try to get the D-Line centered in the window.
17. Right click in the Profile Sub-view in the Multi-plot window (on the left-hand side of the screen) and choose *Profile 1 Sub-view Options* from the context menu (double click also works). The options dialogue box below will appear.

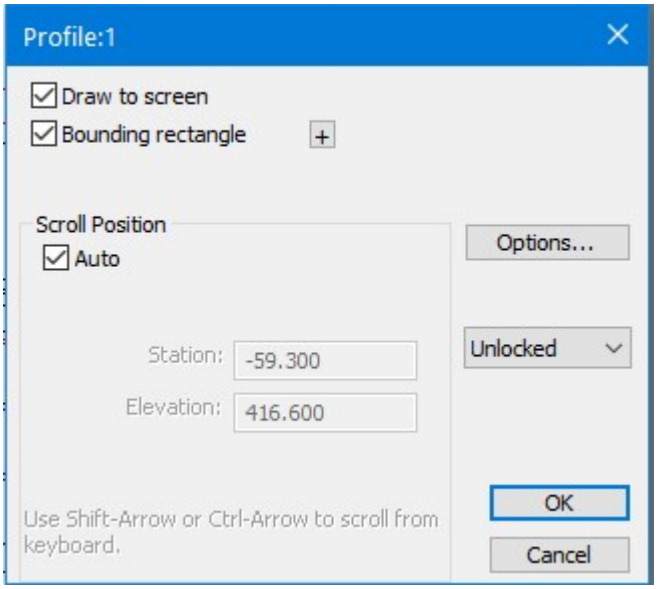

Figure 5-3: Profile Multi-plot Sub-view options

18. Clear the *Auto* check box and note that you can now define *Station* and *Elevation*. This will make the Multi-plot profile independent.
19. Press the *Options* button to show all the options shared with the main Profile window. Press *Cancel* to close this dialogue box

Note: The *Sub-views* in the Multi-plot window display the same settings as the corresponding main window; the options are shared. You can access the shared options from the *Options* button in the Sub-view Options dialogue box or directly from the main window options.

20. Press the *OK* button to close the *Profile Sub-view options*.

Now you can scroll the main Profile window without affecting the Multi-plot. It is also possible to scroll the Multi-Plot Profile window using the keyboard:

21. Click in the Multi-Plot window to select the Profile Sub-view. Then type <*shift-arrow*> and notice that the Profile Sub-view scrolls (direction depends on which arrow key you type).

Similar controls exist for the Plan Sub-view.

22. Click in the Multi-Plot window to select the Plan Sub-view. Then type <shift-arrow>. You will be prompted with the message shown below:

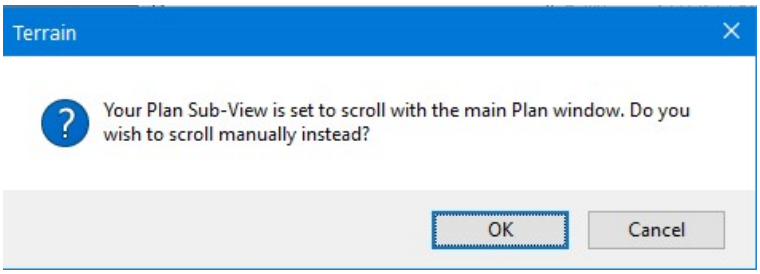

Figure 5-4: Prompt to turn off *Auto Scroll Position* in a Plan Sub-view.

23. Respond *OK*; this is the same as clearing *Auto Scroll Position* in the Plan *Sub-view options* dialog box.
24. Scroll the deflection line to the center of the window using <*shift-arrow*> keys.
25. Type <*ctrl-arrow*> a few times and note that you can also *rotate* the Plan Sub-view.

You may want to display a North arrow in the Plan window if you change the rotation.

Note: It is not recommended that you save a Multi-Plot screen layout with explicit *Scroll Position* settings; use *Auto* instead. If the screen layout were saved at this point, the *Profile* Sub-view would be saved with an explicit *Station* and *Elevation*, similarly the *Plan* Sub-view would be centered on a particular (X, Y) coordinate. If you opened such a screen layout in another project, it is likely that the Profile and Plan Sub-views would be empty.

In this example screen layout, the Multi-plot title is just a placeholder.

26. Change the title to something more appropriate:
    - *Double-click* on "Title" in the Multi-plot or use the right click context menu to open the Rectangle Sub-view options.
    - Change the text to something appropriate. Note the other options available for the *Rectangle* Sub-view.
    - Press *OK* to close the dialogue box.
27. To print or export, select the Multi-plot window and choose *File* | *Print Active Window*. Then select your desired printer or PDF writer. Press *Cancel* to exit the *Print dialogue* box.
28. Choose *File* | *New*, do not save changes.

Multiple Deflection Lines on a Single Output Sheet

Often users prefer to show several deflection lines on one output sheet. This can be accomplished by creating several Profile windows displayed in Multi-plot:

1. *File* | *Open* <Terrain>\Cable**CableAnalysis - 2.terx**
2. In the *View* ribbon, *Screen Layout* area, choose Training\ **Training Multiple DLine MP.ilt**.

Your screen will now look similar to the figure below.

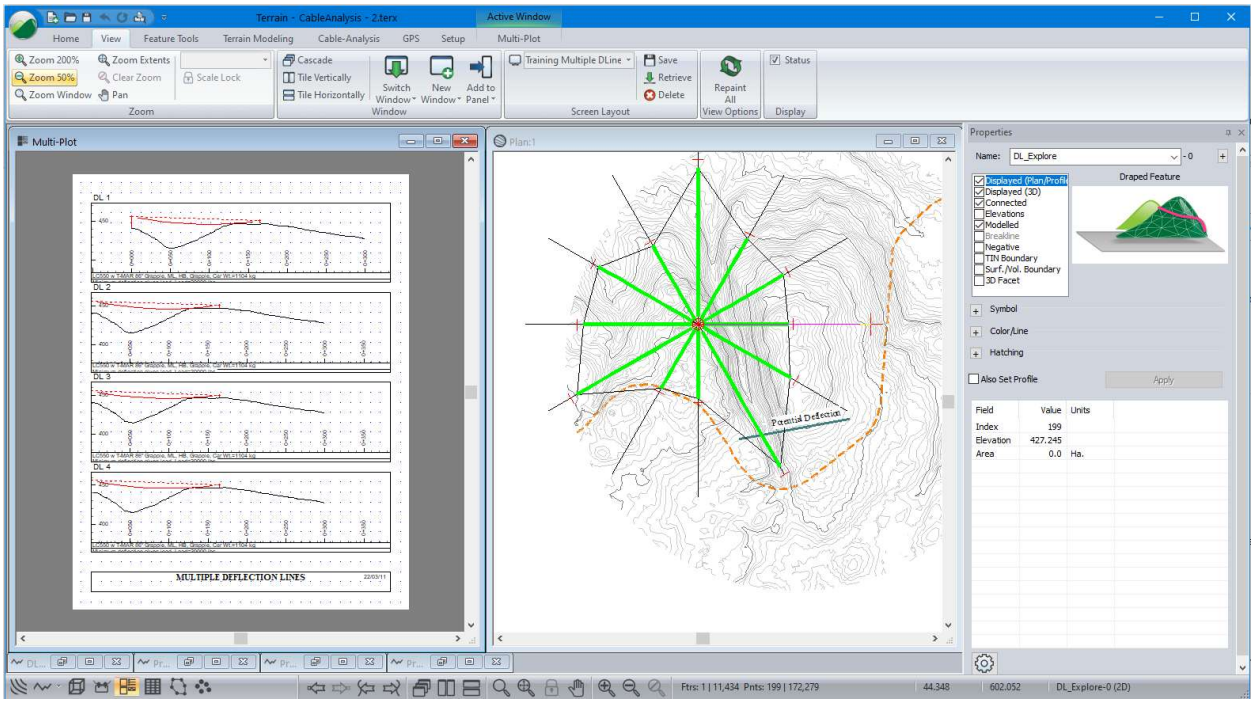

Figure 5-5: Right after reading the Training Multiple DLine MP.ilt screen layout

3. If your page does not match the shape of the Multi-plot contents, choose *File* | *Print Setup* and change your *Printer* and/or printer *Properties* to use a *Letter* (or *A4*) sized page in *Portrait* mode.

Note that there are four *Profile* Sub-views in the Multi-plot and there are four corresponding Profile windows minimized at the bottom of the screen. Also note that all the Profiles are the same; they are all set up to display the current feature (if there was nothing selected, they would be blank). It is impractical to save a screen layout with Profile feature names defined as these names will change from project to project. Refer to the exercise above,

Output Sheet Creation for Cable Harvest Plans
Single Deflection Line Output Sheets, for more information on Multi-plot screen layouts.
In the following steps we will choose which deflection line features are displayed in the four Profile windows.

4. The D-Line feature pointing due East (DL_Explore-0) should already be selected. If it is not, select it by clicking with the selection cursor in the Plan window or by using the *Select - By name* function found in the *Home* ribbon.
5. Right click on the top *Profile* Sub-view and choose menu *Profile 1 Sub-View Options* (or double click) to open the Profile Multi-plot Sub-view options dialogue box.
6. Press the *Options* button to open the shared *Profile Window Options* dialogue (Figure 5-6 below).

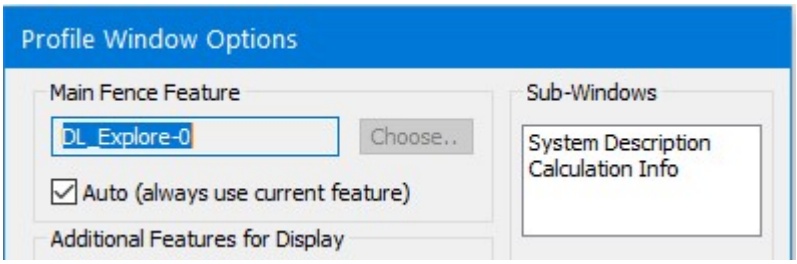

Figure 5-6: *Profile Window Options* with an explicit fence feature.

7. Clear the *Auto* check box to lock in the *Main Fence Feature* name (as shown in the figure above). If you don't have the right feature selected, you can press the *Choose* button to select the feature by name.
8. Press *OK* to return to the Sub-view options dialogue box.

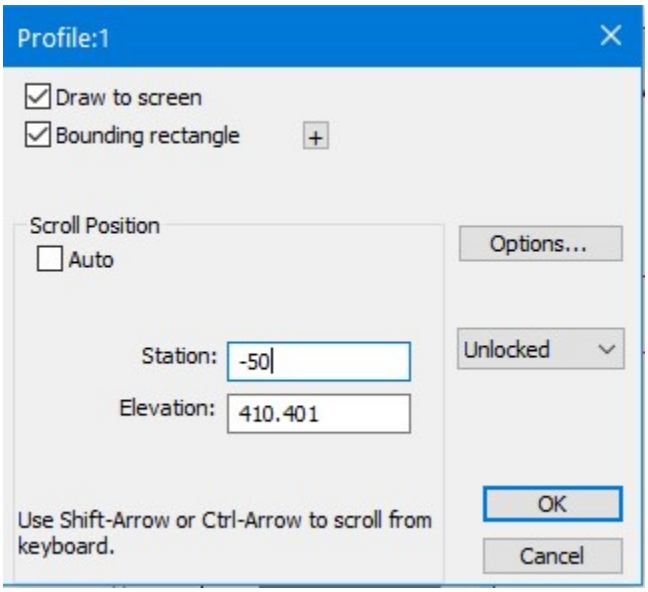

Figure 5-7: Profile Multi-plot Sub-view options with an explicit *Scroll Position*

9. Clear the Scroll Position *Auto* check box and set the *Station* to **-50** as shown above.
10. Press *OK* to return to the main screen.

Now you have the first Profile set up.

11. Repeat the previous steps to set the other *Profile* Sub-views to display the three D-Line features counterclockwise from the first one (DL_Explore-1, DL_Explore-2 and DL_Explore-3).

As in the

Output Sheet Creation for Cable Harvest Plans

Single Deflection Line Output Sheets example above, you may want to modify settings or content for other sub-windows before printing.

12. Choose *File* | *New*, do not save changes.

6. Approximating Multi-Span Cable Yarding Scenarios

For some terrain, cable yarding with intermediate supports is the best solution. The Cable Analysis module does not handle such multi-span setups directly. However, it can be used to illustrate an approximation of a proposed multi-span logging configuration. To do that, each span is treated as an individual logging system and the two displays are overlaid using the Mulit-plot window. This method uses several techniques introduced previously, most prominently creating a new logging setup and displaying multiple deflection lines in a multiplot. The example below provides more details regarding the necessary workflow to illustrate a multi-span cable logging configuration.

1. *File* | *Open* <Terrain>\Cable**CableAnalysis - 4.terx.**

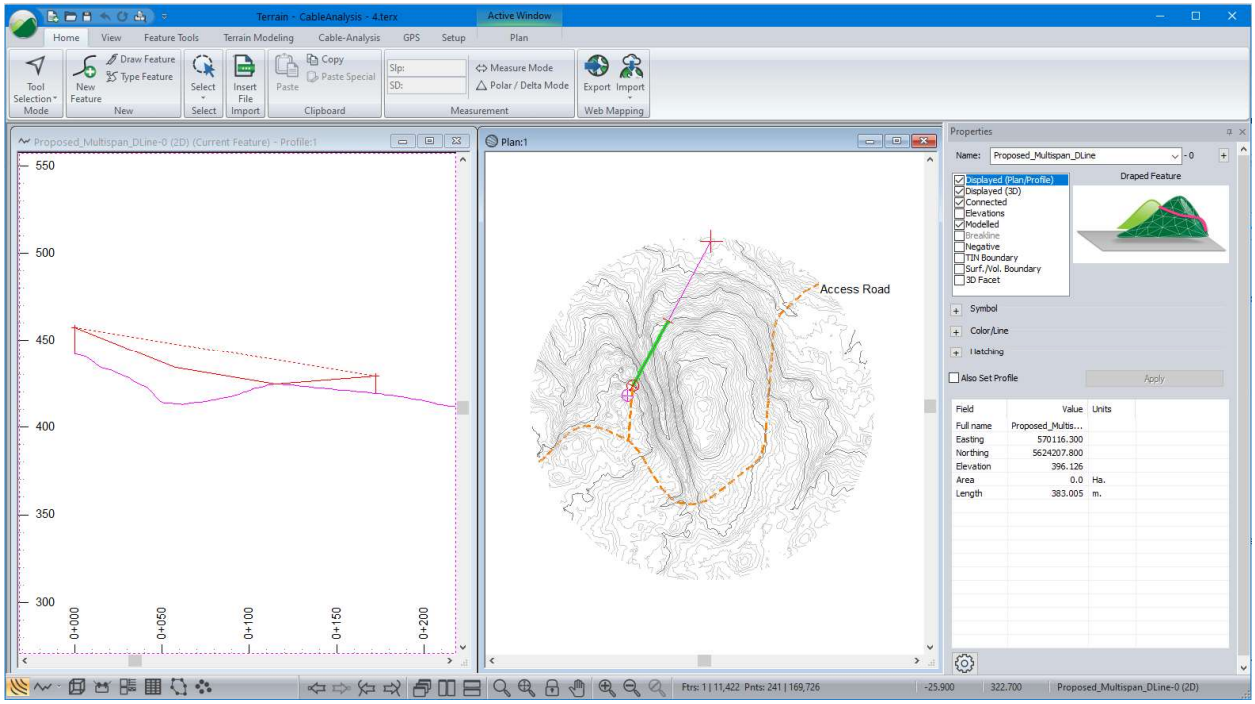

Figure 6-1: Terrain document containing proposed multi-span deflection line road.

This file already contains a proposed cable road named Proposed_Multispan_DLine-0. The Profile window shows this feature with a simple third-point deflection analysis using 8% sag and a backspar height of 10m.

2. Add a new piece of *Equipment* to represent the intermediate support for the multi-span setup:

- Press the Equipment icon in the *Cable-Analysis* ribbon to open the *Equipment* dialogue box.
- Press *Add* to open the *Equipment Edit* dialogue.
- Change the *Name* to **10m Intermediate support** and the *Spar Ht.* to **32.8** ft (10m).

Note: The software will not account for the effect the interim support will have on forces in the proposed cable logging system, for that reason it is recommended that only simple third-point deflection is used in this approximation. If simple 3-point deflection is used, the only equipment variable that effects the analysis is the spar height.

- Press *OK* twice to return to the main screen.

3. Create a new *Logging System* to represent the intermediate support:
   - Press the *Logging System* button in the *Cable-Analysis* ribbon to open the *Logging Systems* dialogue box.
   - Select the *LC550 w T-MAR 86" Grapple* system then press the *Add* button to open the *Edit Logging System* dialogue box with a copy of the selected system.
   - Change the *System name* to **10m Intermediate support syst.**
   - Change the *Equipment* to the recently added *10m intermediate support*.
   - Press *OK* twice to return to the main screen.
4. Lock the feature name for the existing Profile fence (as in the Multiple Deflection Lines on a Single Output Sheet example):
   - Right click in the Profile *window* and choose menu *Active Window (Profile) Options*.
   - Clear the *Auto* check box to set the *Main Fence Feature* to **Proposed_Multispan_DLine-0**
   - Press *OK* to go back to the main screen.

Only one D-Line analysis can be attached to a feature. For that reason, a duplicate of the feature must be created to show multiple analysis scenarios on the same profile. In this example the second scenario will represent the second span in our multi-span analysis.

5. Make a copy of the D-Line feature:
   - Make *sure* that feature *Proposed_Multispan_DLine-0* is the only feature selected.
   - In the plan view, right click and *Copy* this feature.
   - Right click *Paste*.

All the new feature attributes will be copied from the original, but the feature name will change to *Proposed_Multispan_DLine-**1***. Now we need a new Profile window to display this feature.

6. Create a new Profile window and check the display options:

- Choose View ribbon, *New Window* and select *Profile*.
- Right click in the new Profile *window* and choose menu *Active Window (Profile) Options*.

Note: When you create a new Profile window it copies the options as the previous Profile window, but it displays the *current* feature (in this case *Proposed_Multispan_DLine-1*)

- Confirm that the *Profile Window Options* match those in the figure below.
- Press *OK* to close and return to the main screen.

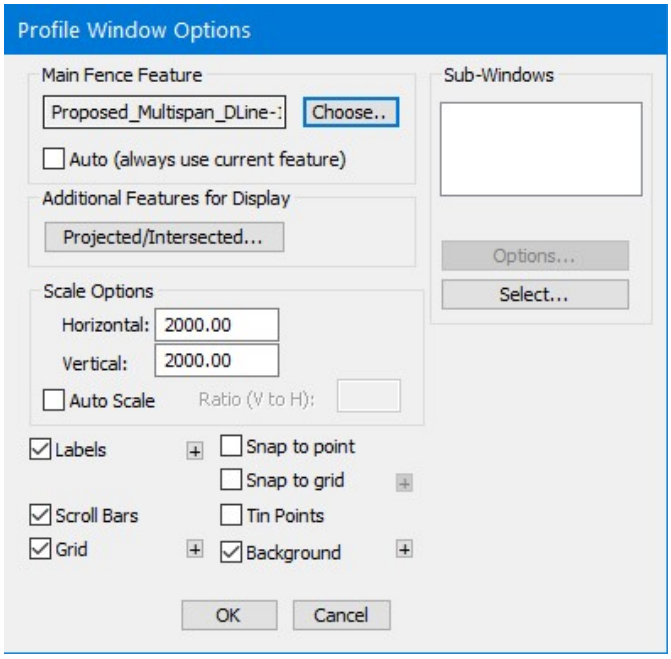

Figure 6-2: *Profile Window Options* for the second Profile window.

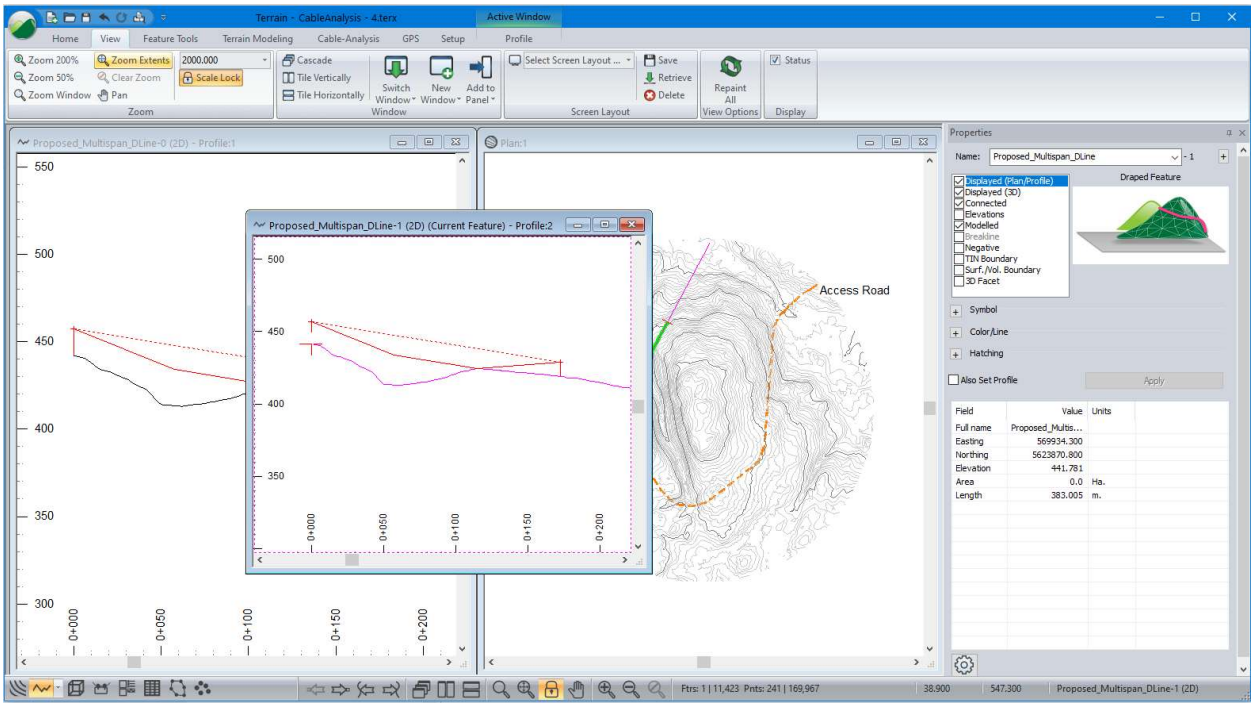

Figure 6-3: The original and duplicate D-Line features shown in two separate Profile windows.

You now have another Profile window showing the duplicate feature. Let's modify it to represent the second half of the multi-span system.

7. Change the Cable Analysis properties for the new feature:
    - With *Proposed_Multispan_DLine-1* selected
    - Press *Edit* in the *Cable-Analysis* tab of the ribbon bar to open the dialogue box below.
    - Change the *Logging System* to *10m Intermediate support*,
    - Copy the *Haulback Block* Station into the *Head Spar (Landing)* station,
    - Change the *Haulback Block Height* to **4.0** m.
    - Press *Auto-calc Tail Station* to update the *Haulback Block Station*.

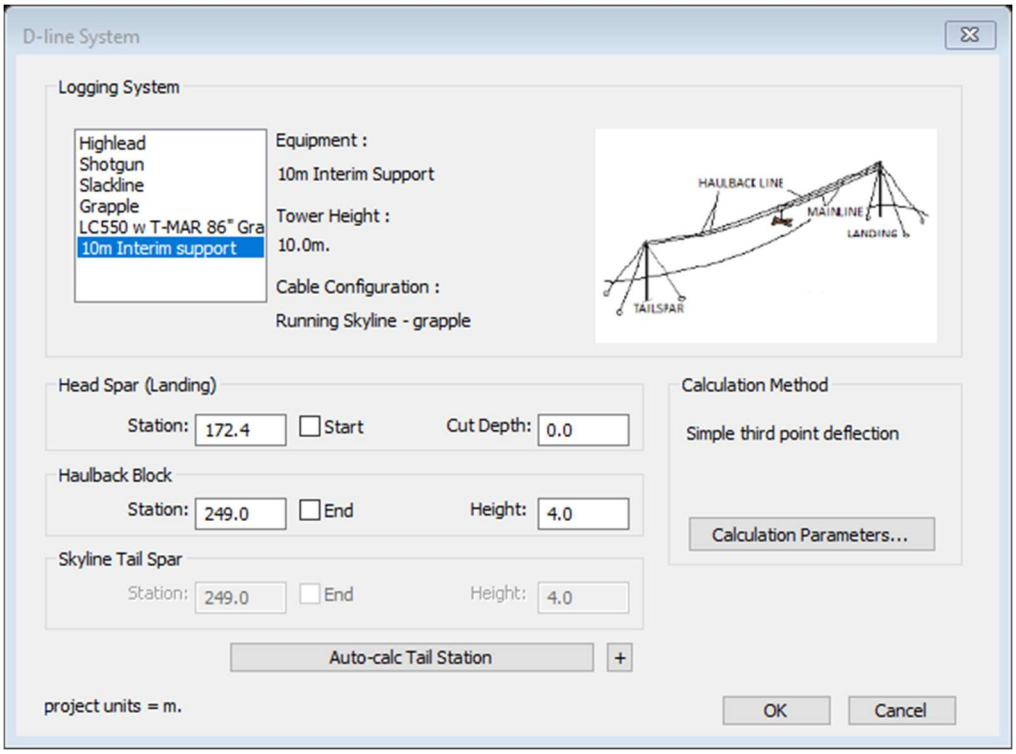

Figure 6-4: The *D-line System* dialogue box after the setting are changed as described above.

The settings in should now appear identical to the settings shown in Figure 6-4 above.

8. Press OK to return to the main screen.

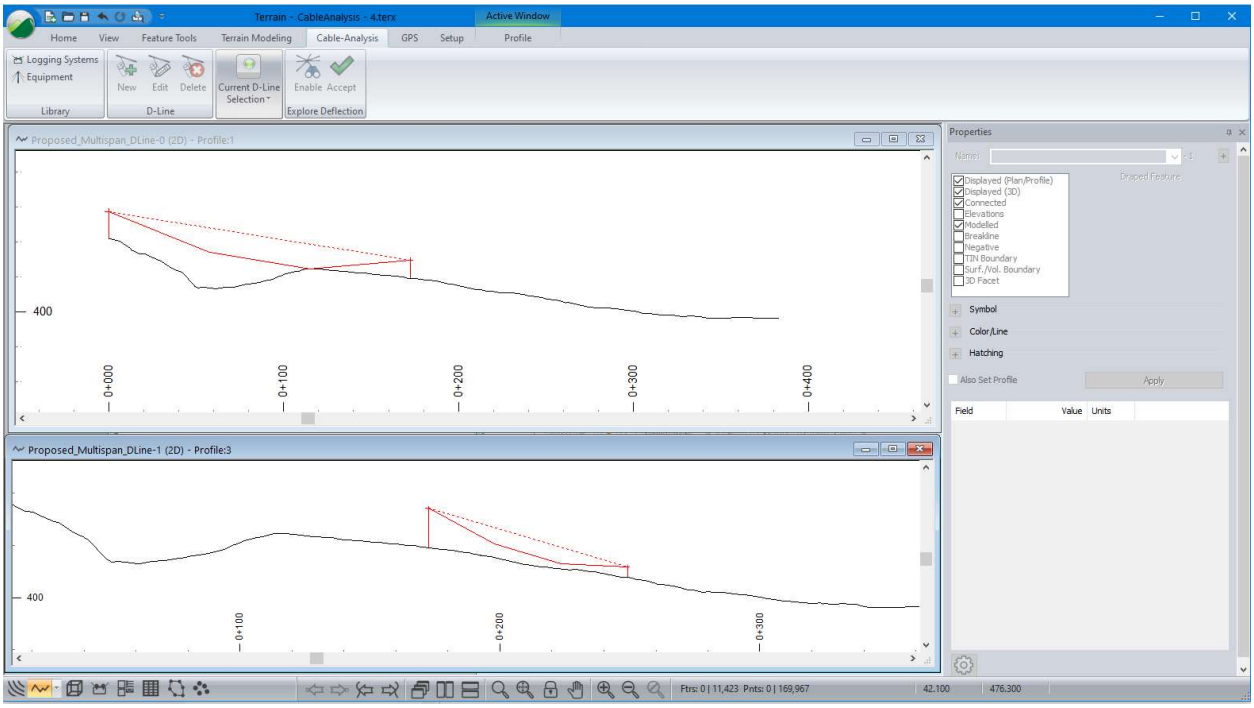

Figure 6-5: Profile windows arranged to show the two parts of the multi-span system.

Now we will use the Multi-Plot window to overlay the two profiles.

9. Press the multi-plot icon in the bottom left of the main screen (or use *View* ribbon, *New Window*). A blank multi-plot window will appear.

10. If you want to change the page size or orientation, choose *File | Print Setup* to open *Printer Properties.* Screen captures below use a *Letter* (or *A4*) sized page in *Portrait* mode.

11. Turn on snap to grid in Multi-plot. This will allow us to align the two Profile windows.

    - In the multi-plot window, right click and choose *Multi-plot Options*.
    - Check *Snap to grid* and *Show grid*. Set the *Spacing* to **10** mm.
    - Press *OK* to return to the main screen.

12. In the *Multi-plot* ribbon, press the *New Sub-view* button and add *Profile 1*.

13. Move and size it to the top of the page as shown in Figure 6-6 below (click and drag in the interior to move ✣, on the handles to size ↔ ↕)

14. Set the Scroll Position to be explicit:

    - Double click *the* profile sub-view and the *Profile 1* dialogue box will appear.
    - Clear *Auto* and set the *Station* to **-50** and the *Elevation* to **420** as shown below.
    - Press *OK* to return to the main screen.

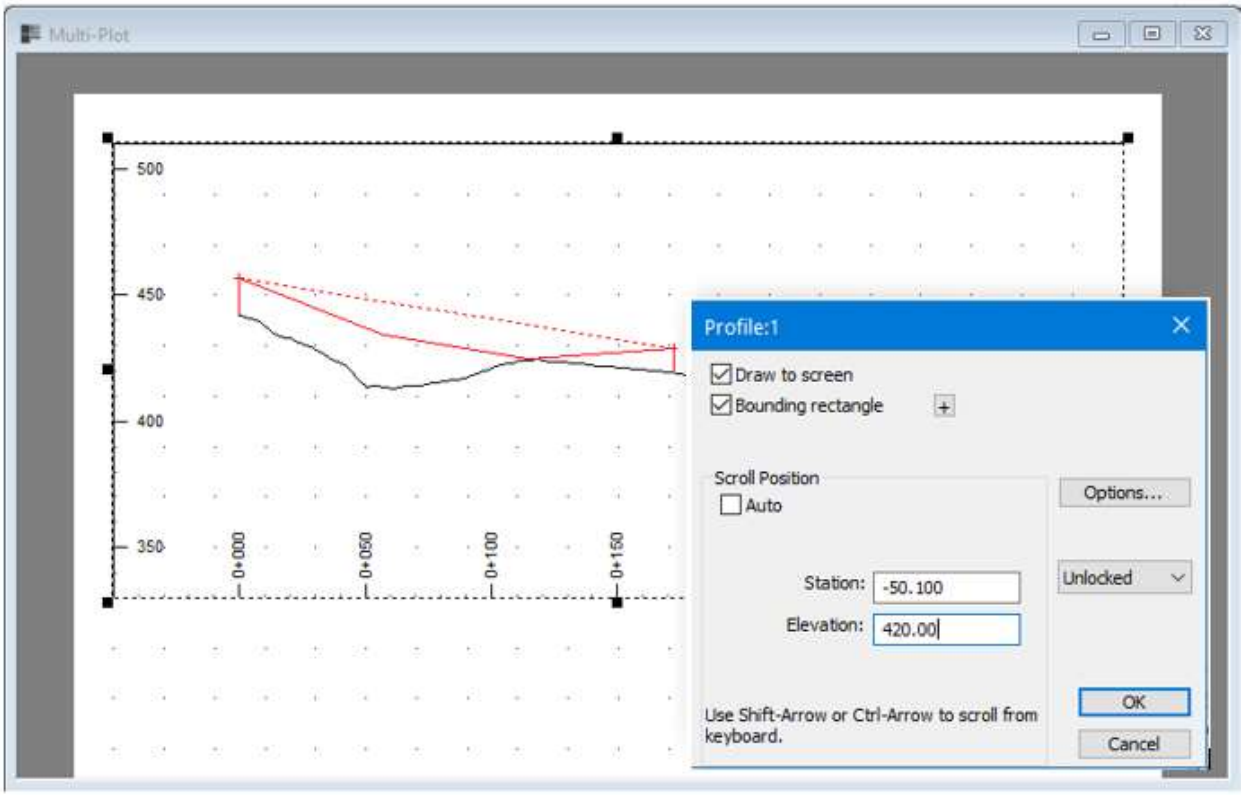

Figure 6-6: The *Profile:1 Sub-view Options* with explicit *Scroll Position*.

15. Repeat steps above (starting at 12) to add Profile 2 Sub-view, overlap it with Profile 1 and configure the *Scroll Position*.

Note: If you have overlapping sub-views you will need to use the *Shuffle Front to Back* to access the window underneath. You can access this function from the right click context menu.

If you were successful at overlapping the two profile sub-windows, your multiplot screen should look like the figure below.

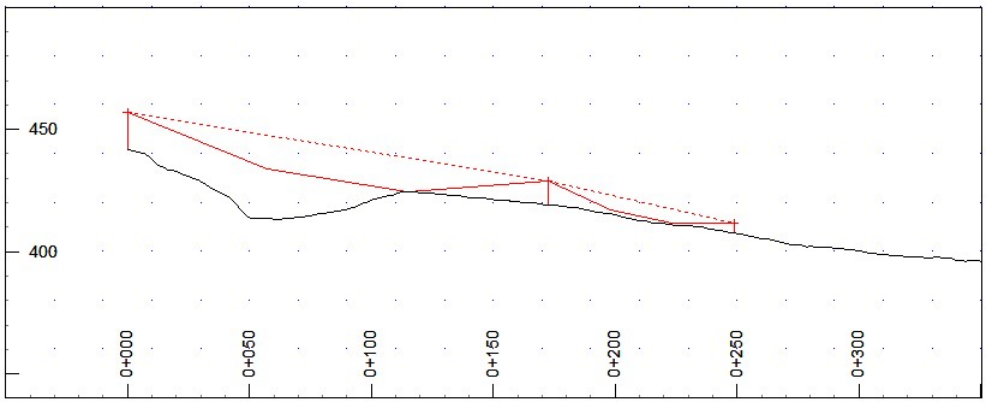

Figure 6-7: Overlapped multi-plot sub-views to illustrate a multi-span D-Line.

16. Choose menu *File* | *New*, do not save changes

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