Data Acquisition

10.1 General Concepts

The **Data Acquisition** toolset provides user-friendly functions that compile disparate data sources employed in the civil design process. The primary goal of the Data Acquisitions toolset is the creation of an existing surface DTM. The tools are available for users of the following civil products: MX, InRoads, GEOPAK, PowerSurvey, and PowerCivil for North America.

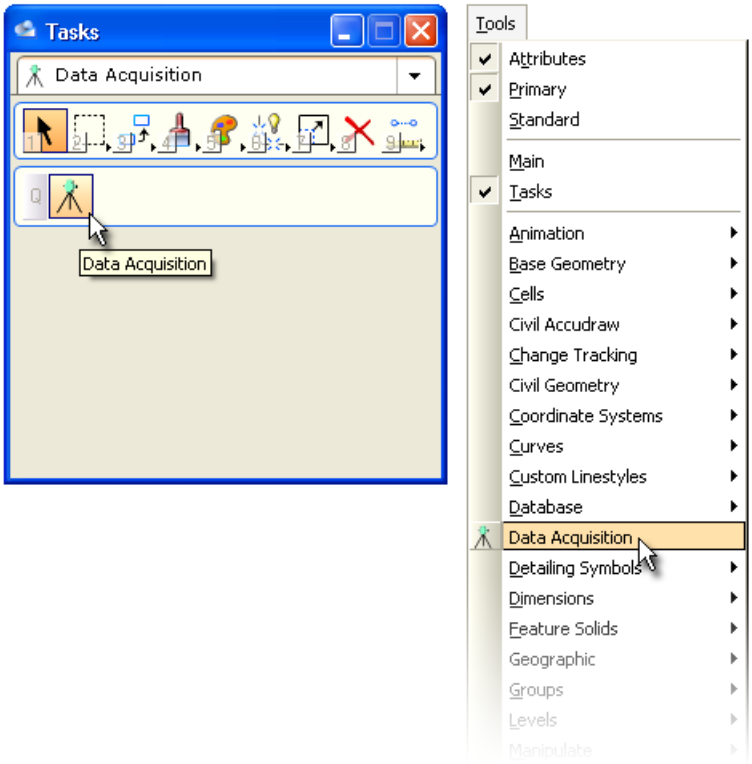
All Data Acquisition data is stored in the active DGN Model and can be exported to various file formats as required.

Recommendations for Usage:

1. It is strongly recommended that all Data Acquisition usage occur in a 3D DGN Model. Some tools require the 3D Model to operate as expected.
2. Also, it is strongly recommended that all MicroStation DGN levels specified in your Style Library are already created prior to importing data via the Data Acquisition tools.

10.1.1 Interface

Data Acquisition tools are invoked from the Tasks navigation pane or from the Tools menu.



The interface opens to a Data Tree and a Details Panel.

Note: The panels can be docked, docked and pinned, or remain floating per your preference.

Data Tree

The Data Tree organizes information into logical groupings for ease of selection and superior visibility.

- Right-click on tree elements (*branches*) to access related commands.

Details Panel

The Details Panel presents information associated with whichever item is currently selected in the Data Tree.

Drag and Drop Functionality

Files (of the formats listed above) can be imported by dragging from Windows Explorer and dropping into the Data Tree.

10.2 Create a New Field Book

To create a new field book, right-click on the **Field Books** branch of the Data Tree then click **New** on the menu.

Note: To change the name of a field book, select the field book in the Data Tree then open the Element List tab of the Details Panel. Select the field book name in the Name cell of the Details Panel, delete the existing text, enter the new name, and strike the Enter key. The new name will appear in both the Data Tree and the Name cell of the Details Panel Element List.

10.2.1 Add Survey REC file

If you wish to add survey REC file, simply right-click on the **Field Book** branch in the Data Tree.

a. Select **Load** on the menu and choose **File** from the submenu.
b. Navigate to the desired file then double-click it.

Note: If you load a file with an ambiguous file extension, you will be prompted to identify that file's format. Choose from the available options on the **Data Format** dialog and click Accept.

In the process of loading raw data, the system performs the following actions:

- Point and Linear Features, Setup, and Observation data are stored in the DGN. **Please Note:** Setups, Observations, and Control Points will be drawn to specific levels in the DGN file.

- Linking Codes are processed to create line work (Linear Features).

- Points and Linear Features are symbolized according to the Feature Style table.

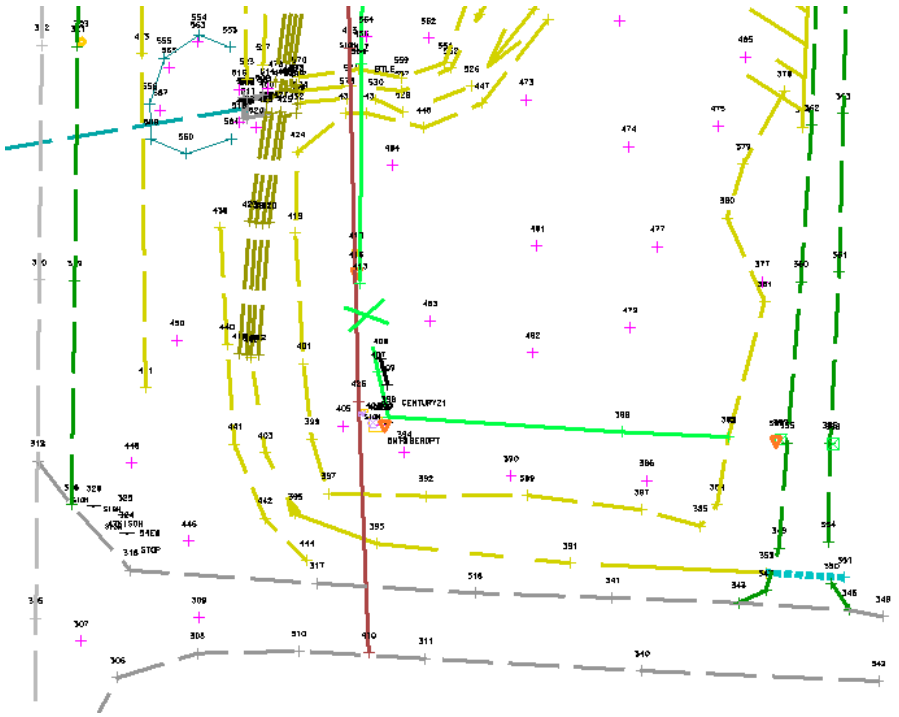
Data Acquisition uses three (3) types of Linear Feature: Dynamic Link, Point List, and Graphic. These linear feature types are hierarchical. A Dynamic Link type can be converted to a Point List or a Graphic type. A Point List type can be converted to a Graphic type.

Linear Features, automatically generated through the use of one of the Linking Methods (Field Code, Consecutive, or Non-Consecutive), are created as "Dynamic Link" linear features and have a property type of GeneratedByLinking. These linear features are constructed based on the combination of linking and/or field codes and the order in which field points are collected. If a linear feature is started, it will link all subsequent points with same field code until it encounters another start or an end depending on the Linking Method used.

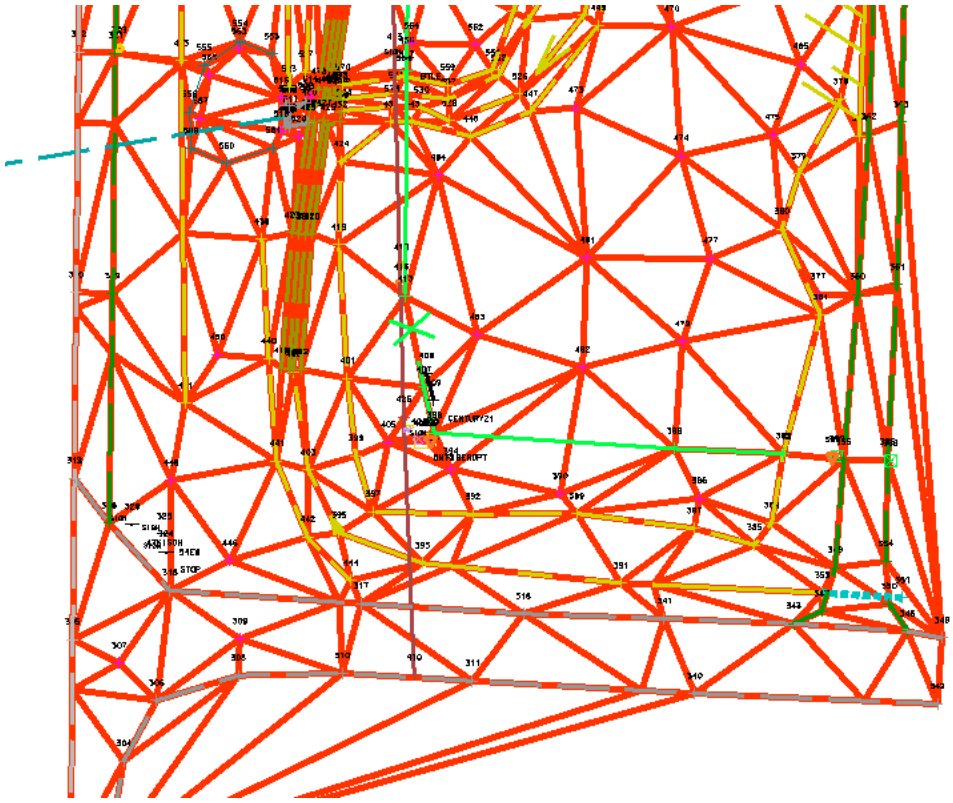
Dynamic Link: Creation is described above. All points within these linear features are of the same field code and the linking of these points is in the order they were collected in the field. Starting, stopping, and changing of geometry of these linear features is controlled by a combination of linking and/or field codes. Editing consists of modifying linking and/or field codes or moving the location of the survey point features.

Point List: These linear features are generated by a list of points that can be of any field code. These have a property type of GeneratedByPointList. The order of the points in the linear feature is not dependent on the order they were collected in the field, but is solely dependent on the order they appear in the list. The Geometry of this type is still controlled by the link codes but not where the linear feature starts and ends. This is controlled by the point list. Editing consists of modifying linking and/or field codes or moving the location of the survey point features in addition to modifying or managing the order of the points in the list.

Graphic: A graphic linear feature can be any MicroStation graphical element and is not tied to any survey point features. These have a property type of Graphic. Editing consists of using any MicroStation edit tool. The symbolization of these linear features can be controlled by the assigned feature, but assigning a specific feature is an option – not a requirement.



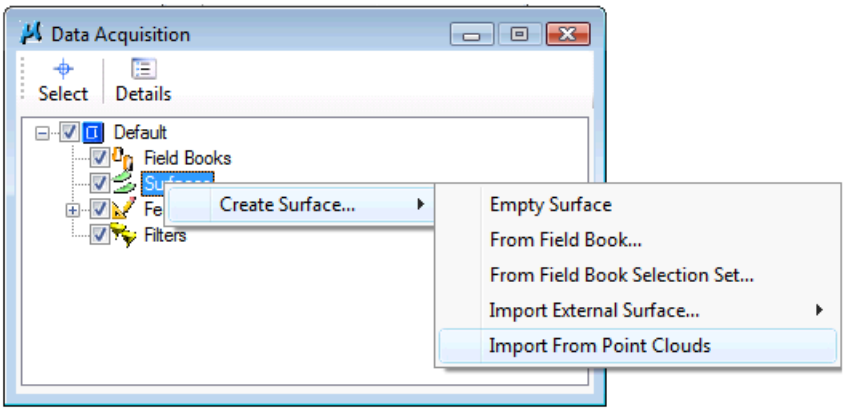
Points and Linear Features created from a REC file



Surface triangles created from the REC files – The surface is generated automatically based on the surface settings of the imported point features and linear features.

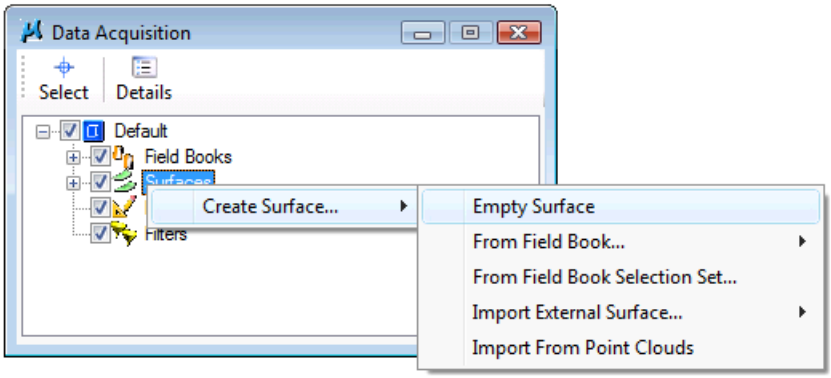
10.3 Creating Surfaces

· Right-click the Surfaces branch then choose Create Surface from the available menu options.

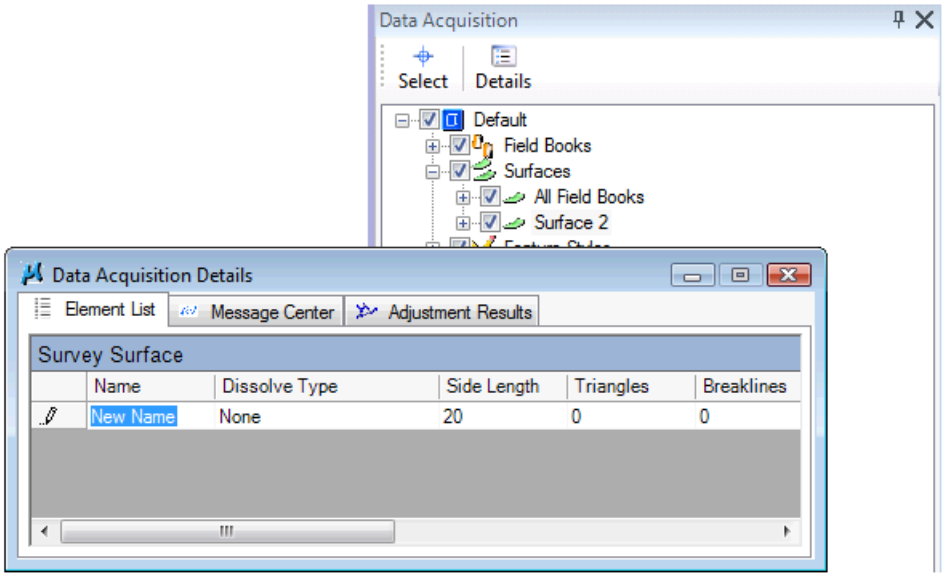


10.3.1 Create an Empty Surface

To create an empty surface, right-click on the Surfaces branch of the Data Tree, select Create Surface from the menu, and choose Empty Surface from the submenu. This creates an empty surface with a default name.



Note: To change the name of an empty surface, select the surface in the Data Tree then open the Element List tab of the Details Panel. Click in the Name cell of the surface, delete the existing text, enter the new name, and strike the Enter key. The new name will appear in both the Data Tree and the Name cell of the Element List.



10.3.2 Create New Surface from Field Book

To create a surface from field book data (survey data):

1. Right-click on the Surfaces branch.
2. Select Create Surface on the menu.
3. Choose From Field Book on the submenu.
4. Select the desired field book.

Note: The available field books are those listed under the Field Books branch in the Data Tree.

A surface named "All Field Books" is automatically created from the survey data. This function is useful to recreate the "All Field Books" surface due to accidental deletion or to create a surface for additional field books.

Example: Were you to create separate field books for special uses, perhaps a special field book for a particular bridge deck, you would then be able to create a surface for the bridge deck while preserving the integrity of the main surface.

10.3.3 Create New Surface Based on Field Book Selection Set

The Create New Surface from Field Book Selection Set function builds a separate surface from a selection set of Field Book data.

Note: This option is not a method to extract 3D graphic data to a surface. See Extracting Graphics section for this method.

To create new surface from field book selection:

1. Create a Selection Set of the desired point and linear feature elements in the DGN Model.
2. In the Data Tree, right-click on the Surfaces branch.
3. Select Create New Surface from the menu.
4. Choose the From Field Book Selection Set item from the submenu.

To rename the created surface, select it in the Data Tree then open the Element List tab of the Details panel. Click in the Name cell of the surface, delete the existing text, enter the new name, and strike the Enter key. The new name will appear in both the Data Tree and the Name cell of the Details Panel Element List.

10.3.4 Create a New Surface by Import External File

To create a new surface by importing data from an external file:

1. Right-click on Surface branch in the Data Tree.
2. Select Create New Surface from the menu
3. Choose the Import External Surface item from the submenu.
4. Choose the type of file that you wish to import from the list of available options.
5. Navigate to the file you wish to import and double-click on it.

The name of the surface is set to match the selected file name. To rename the created surface, select it in the Data Tree then open the Element List tab of the Details Panel. Click in the Name cell of the surface, delete the existing text, enter the new name, and strike the Enter key. The new name will appear in both the Data Tree and the Name cell of the Element List.

10.3.5 Create a New Surface by Import from Point Cloud

The MicroStation Point Cloud data can be used to create a Data Acquisition surface. This option is available with the V8i SELECTseries 2 products.

Note: Extraction of Point Cloud data is always from the View 1 window.

The loaded Point Cloud data must then be visualized to display only the data to be used in the surface.

For example, a typical scenario would be: In the View Window 1, view the Point Cloud data by "classification" then enable ONLY the "ground" classified points. Optionally, place a Fence around the portion of the Point Cloud data from which you wish to build a surface.

Extraction of the Point Cloud data supports two (2) selection methods.

- Method 1) By entire View 1 window.
- Method 2) By Fence (inside) (from View 1 window)

If a Fence is enabled, it will be used. If a Fence is not enabled, the entire View 1 window area will be used as the extraction area.

To create a new surface by importing data from MicroStation Point Cloud elements:

1. Set the View 1 window to display desired points for surface creation.
2. Right-click on Surface branch in the Data Tree.
3. Select Create New Surface from the menu.
4. Choose the Import from Point Cloud External Surface item from the submenu.
5. Choose the type of file that you wish to import from the list of available options.
6. Navigate to the file you wish to import and double-click on it.

The name of the surface will be “Point Cloud Surface_1”. To rename the created surface, select it in the Data Tree then open the Element List tab of the Details Panel. Click in the Name cell of the surface, delete the existing text, enter the new name, and strike the Enter key. The new name will appear in both the Data Tree and the Name cell of the Element List.

See LIDAR and Raster topics for more information on additional inputs required for those formats.

10.3.6 Surface Operations

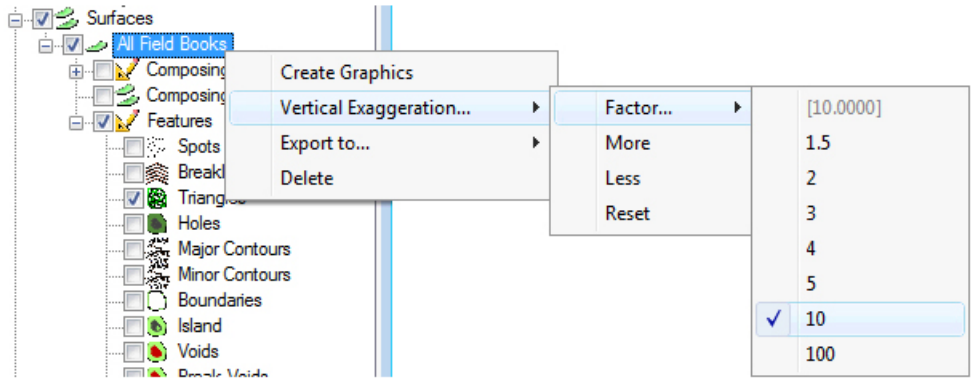
When you right-click on a surface's branch in the Data Tree, a variety of operations may be performed on that surface.

10.3.6.1 CREATE GRAPHICS

The surface features (triangles, contours, etc.) currently displayed are permanently written to the DGN.

Note: The Surface Feature display toggles visualize the features as transient graphics. Closing Data Acquisition will cancel the visualization of these features.

10.3.6.2 VERTICAL EXAGGERATION



Vertical Exaggeration allows the User to distort the surface features. This option allows the user to visually find any vertical abnormalities in the surface more clearly.

- Factor – available scaling factors. Select a factor and click More or Less to exaggerate the selected surface features. Note: The grey value at the top of the list indicates the current scale value applied to the selected surface

- More – increases the vertical exaggeration of the currently displayed surface features by the selected factor value.

- Less – reduces the vertical exaggeration of the currently displayed surface features by the selected factor value.

- Reset – returns the surface feature display to a true vertical representation.

Note: The exaggeration is reset to true values when Data Acquisition is closed.

10.3.6.3 CLIP BY POLYGON

The ***Clip by Polygon*** function trims a portion of the surface. Options are Internal and External:

- ***Clip Internal*** removes everything within the shape.

- ***Clip External*** removes elements outside of the shape.

The *Draw a Shape* function outlines the area to be clipped.

10.3.6.4 APPEND/MERGE EXTERNAL SURFACE

Appends or merges an external surface into the currently selected surface without the need to first import this external file into a separate surface.

See the Append/Merge help for additional information on how appending and merging works.

The external surface can be any of the supported surface types. See Creating Surfaces help page for a list. The external surface is read directly into the existing surface as either appended or merged as specified.

10.3.6.5 EXPORT TO

Allows export of the selected surface data to one of four formats, allowing design processes to continue in native design applications.

- GEOPAK TIN – creates a TIN file, which is the standard GEOPAK terrain model format

- InRoads DTM – creates a DTM file, which is the standard InRoads terrain model format

- MX FIL – creates a surface in a MX model file

- LandXML – creates a surface in a LandXML file (Version 1.2 of the LandXML specification is used.)

10.3.6.6 DELETE

Click Delete to remove the surface from the project.

10.3.7 Importing LIDAR files

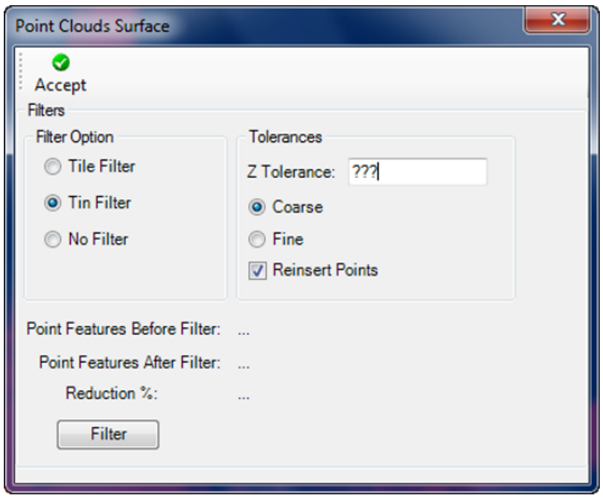
10.3.7.1 CREATING SURFACES FROM LIDAR

Surfaces can be created from both LIDAR XYZ and LAS files through separate, though similar, processes.

- LIDAR XYZ – LIDAR data that has been processed from the raw binary files into a points file containing only a single surface, usually the existing ground surface
- LIDAR LAS – the binary file that usually contains point data with multiple classifications

10.3.7.2 CREATE A NEW SURFACE FROM LIDAR XYZ

1. In the Data Tree, right-click on the **Surfaces** branch then select **Create Surface** from the menu
2. Choose **Import External Surface** from the menu and **Import Lidar XYZ** from the submenu.
3. Navigate to the desired file then double-click it.
4. Set the desired filtering options and appropriate filtering tolerances then click Accept.



Filter Options:

- Tile Filter – The tiling algorithm is a recursive divide and conquer algorithm that divides the LIDAR data set into tiles. A best fit plane is calculated for each tile, and LIDAR points are removed if they fall within the user set Z tolerance to the plane.

- **TIN Filter (Recommended)** – The TIN algorithm filters LIDAR points if they fall within the user set Z tolerance of the triangle planes. The TIN algorithm first tiles the LIDAR points into tiles with a maximum of 2 million points and then repetitively triangulates each tile filtering out points. Tin Filter option is much slower than the Tile option, but gives 90% + reduction rates while maintaining TIN accuracy within desired values. With "Reinsert Points" checked on (again recommended) the following process happens: After all the points are filtered out, a 'final' TIN is built from the remaining points. At this point in the process, all of the discarded points are draped on this 'final' TIN … any discarded points that fall outside of the vertical tolerance are added back in and the TIN is rebuilt. This is a safety measure, allowing the re-inserting of points that may have been mistakenly removed. When using the Tin Filter also always use the "**Coarse"** option. The "**Coarse"** option is much more efficient at thinning down the data..

- No Filter – No filtering is applied

Filter button – generates a report showing the amount of reduction in the number of point features before data is imported as a surface

10.3.7.3 CREATE A NEW SURFACE FROM LIDAR LAS FILE

1. In the Data Tree, right-click on the **Surfaces** branch then select **Create Surface** on the menu.
2. Choose **Import External Surface** from the menu and **Import Lidar LAS** from the submenu.
3. Navigate to the desired file then double-click it.
4. As there may be multiple classifications in the file, choose the classifications you wish to import in the Selected Features section of the Lidar LAS dialog.
5. Set the desired filtering options and appropriate filtering tolerances then click Accept.

    - Click the Filter button to generate a report showing the amount of reduction in the number of point features before data is imported as a surface.

6. Click the Accept bar to import the selected surface according to the specified parameters.

10.3.8 Creating Raster Surfaces

Data Acquisition can import surfaces from the following raster file types.

- DTED
- ERDAS IMG
- Spot Dimap
- USGS DEM
- USGS STDS
- GeoTiff

Note: As the source files may have been compiled in a different coordinate system than the one used in your project, the import process must transform the data. It may be useful to set the coordinate system for your DGN file prior to beginning the import process.

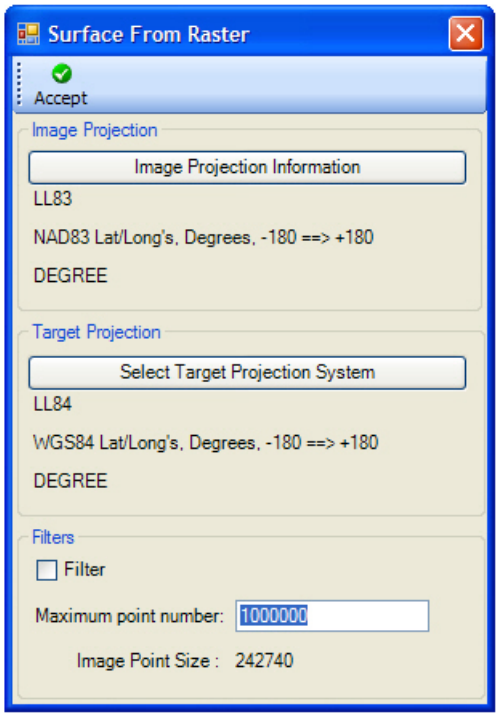
1. In the MicroStation window, open the Tools menu, choose Geographic, and Select Geographic Coordinate System from the submenu.
2. On the Geographic Coordinate System dialog, use the tools available to identify and apply the desired system.

Note: For more information, see the Geographic Coordinate System Dialog topic in the MicroStation Help.

10.3.8.1 CREATE A SURFACE FROM RASTER FILE

1. In the Data Tree, right-click on the Surfaces branch then click Create Surface on the pop-up.
2. Choose Import External Surface from the menu and Import Raster from the submenu.
3. Navigate to the desired file then double-click it.
4. On the Surface from Raster dialog, review the default import settings and make adjustments as necessary.

    - The Image Projection area displays the coordinate system of the raster file; this information cannot be edited.



5. The Target Projection area displays the coordinate system of the DGN. Click the Select Target Projection System to choose a coordinate system other than that currently assigned to the DGN.

   · When the raster is imported, the data is transformed from the source file's coordinate system to the system designated as the Target Projection.

5. To reduce the number of data points imported to the Data Acquisition surface, check the Filter box and enter the Maximum Point Number value in the field provided.
6. Click Accept to import the selected raster surface data according to the specified parameters.

10.3.9 Merging or Appending Surfaces

Both the Merge and Append functions combine two surfaces into a single surface; the difference is that Merge is a destructive operation while Append is not.

Example: You might combine an aerial survey with field survey data or a LIDAR surface with field survey data.
Example: Merge Surface 1 into Surface 2
When Surface 1 is merged, all the data in Surface 2 underneath the boundary of surface 1 is destroyed and then Surface 1 is used to fill the destructed area.
Example: Append Surface 1 into Surface 2.

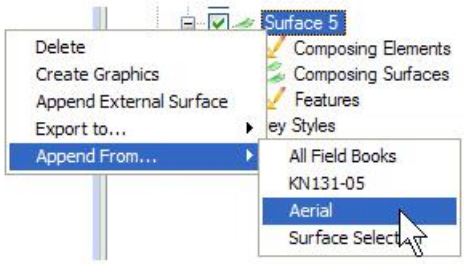
When Surface 1 is appended, Surface 2 remains 100% intact. The data contained in surface 1 is intermingled with the information contained in Surface 2.

10.3.9.1 TWO METHODS TO CREATE A MERGED/APPENDED SURFACE:

1. Merge/Append surfaces already contained in the DGN file
2. Merge/Append external surfaces

10.3.9.2 MERGE/APPEND INTERNAL SURFACES

1. Create a new, empty surface to contain the merged/appended data:
2. Right-click on the Surfaces branch of the Data Tree and select Create Surface from the menu then choose Empty Surface from the submenu. This creates an empty surface with a default name.
3. Right-click on the new surface and choose Append From.
4. Select the base surface. This is usually the largest surface or the one that acts as lowest level of information to be superseded or augmented by more detailed information.



5. Right-click again to merge or append additional surfaces.

10.3.9.3 MERGE/APPEND EXTERNAL SURFACES

The process is identical to the internal surface process except that, instead of using surfaces already stored in the DGN, you must select external files with formats supported by Data Acquisition. The external surface can be any of the supported surface type. The external surface is either appended to or merged with the existing surface.

10.3.9.4 ONE INTERNAL SURFACE\ONE EXTERNAL SURFACE

1. Right-click on the surface to which you wish to add surface data.
2. Choose Append External Surface or Merge External Surface from the menu.
3. Navigate to the desired file and double-click it.

10.3.9.5 IMPORT TWO EXTERNAL SURFACES, APPEND, THEN MERGE

1. Import the surfaces you wish to merge (see Importing Surfaces).
2. Create an empty surface (see Creating an Empty Surface).
3. Right-click on the newly created empty surface then choose Append From and select the first of the imported surfaces.

4. Right-click on the newly created empty surface then choose Merge From and select the second of the imported surfaces.
5. Right-click again on the previously empty surface then choose Merge From and select the second of the imported surfaces.

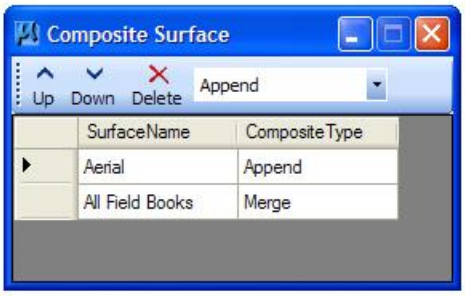
10.3.9.6 MERGE TWO EXTERNAL SURFACES

1. Import the first surface you wish to merge (see Importing Surfaces).
2. Right-click on the newly imported surface and choose Merge External Surface from the menu.
3. Navigate to the desired surface file then double-click it.

10.3.9.7 CHANGING MERGE/APPEND ORDER

Surfaces are processed from the top of the surface list to the bottom. Each surface in the surface list is merged/appended to the result of the merge/append operations performed on the items above, thus there may be occasions where the order of surface merging needs to be adjusted. To do so:

1. Right-click on the surface name in the Data Tree and choose Rearrange Surfaces from the menu.
2. On the Composite Surface dialog:

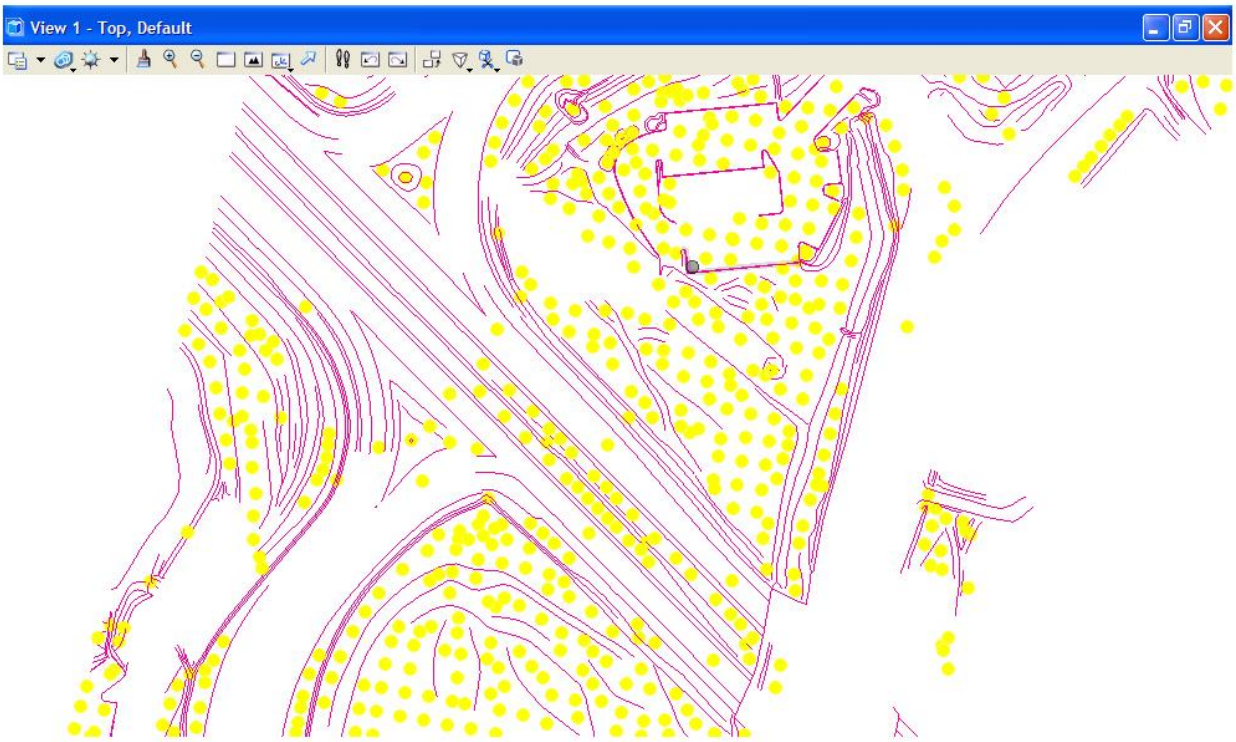


   a. Select a surface and click the Up arrow to raise the selected surface's position in the surface list.
   b. Select a surface and click the Down arrow to lower that surface's position in the surface list.
   c. Select a surface and click Delete to eliminate the surface.
   d. Expand the drop-down and choose whether you wish the surfaces to be Appended or Merged.

10.3.10 Extract Graphics

10.3.10.1 CREATE SURFACES BY EXTRACT GRAPHICS

3D graphic data may be supplied as a result of various processes. This image is an example of typical data resulting from a photogrammetric process.



To create a surface from 3D graphic elements:

1. Create an empty surface by right-clicking the Surface branch in the Data Tree then choosing **Create Surface** from the menu and **Empty Surface** from the submenu.
2. Expand the newly created surface's branch in the Data Tree.
3. Use MicroStation's **Element Selection** functionality to select every instance of a particular graphic feature (spot or breakline or void etc.).
4. In the Data Tree, expand the Features branch and right-click on the Surface Feature corresponding to the selected DGN 3D graphical data. For example, if you selected breaklines in the workspace, you would then right-click on Breaklines in the Data Tree. In the image above, the selected items were breaklines, so the right-click and import were performed on the Breaklines branch.
5. On the pop-up, click Import Selection.
6. Repeat the select and import process for all other Surface feature types you wish to import from the graphical data: Spots, Triangles, Holes, Boundaries, etc. Each type of feature must be imported separately.

Note: If you wish to employ graphic information stored in a DGN file other than the DGN file that contains your Data Acquisition project, then you must attach the source file of your graphics as a reference (File > Reference > Attach References). There is no provision in this version to extract 2D graphics with text indicators of the elevation.

- Features – provides access to symbology settings for each kind of surface feature – Each branch is accompanied by a checkbox that controls the visibility of the branch and sub-branches; set the symbology for each type in the Details Panel.

- Spots – random surface points
- Break lines – break line elements
- Triangles
- Holes – a void in the surface whereby underlying surfaces can control the triangulation
- Major Contours
- Minor Contours
- Boundaries – the external boundary of the surface
- Island – a triangulated area inside of a hole
- Void – an area defined by a closed shape that demarcates a region of missing data or obscure areas – No point or break data located within the void area is utilized and no triangles are created inside the void areas. The Void coordinates are included in the triangulation and void lines between successive void coordinates are inserted as drape lines on the surface. Therefore, they do not change the slope or elevations of the surface.
- Break Void – A Break Void utilizes the vertex elevations of the graphical element, while the void lines between successive void coordinates are inserted as break lines; therefore, break voids change the slope and elevations of the TIN surface.
- Drape Void – Drape Void elements are treated as strictly 2-dimensional and are inserted post-triangulation. The area within the Drape Void is an aperture through the surface over which the void is draped. The graphical element elevations (if they exist) are not included in the triangulation. The void vertices and lines are draped onto the surface. The addition of a Drape Void should not change the surface grading external to that void.
- Drape Boundary – an exterior surface boundary that determines its elevations by draping on the underlying surface

10.3.11 Exporting a Surface

When you have finished surface creation and editing, you may wish to export the Surface to one of Bentley's native surface formats OR to LandXML.

The Surfaces can be exported to:

- MX (FIL)
- InRoads (DTM)
- GEOPAK (TIN)
- LandXML version 1.2

10.3.11.1 EXPORT A DATA ACQUISITION SURFACE

In the Data Tree, right-click on the desired surface, choose Export To from the menu and select the desired output format from the submenu.

10.4 Exporting to COGO

When you have finished processing data, you may wish to export the point and linear features to a coordinate geometry database and continue the design process with the native product's design tools.

The points and lines can be exported to:

- MX model file (FIL)
- InRoads cogo file (ALG)
- GEOPAK cogo file (GPK)
- LandXML version 1.2

10.4.1 Export to COGO

In the Data Tree, right-click on the desired field book, choose *Export To* from the menu and select the desired output format from the submenu.

10.5 Exporting a Surface

When you have finished surface creation and editing, you may wish to export the Surface to one of Bentley's native surface formats OR to LandXML.

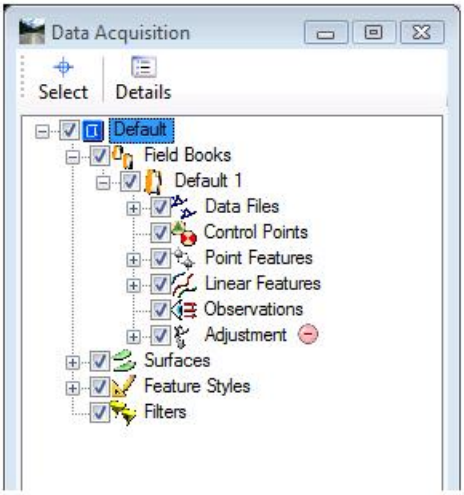
The Surfaces can be exported to:

- MX (FIL)
- InRoads (DTM)
- GEOPAK (TIN)
- LandXML version 1.2

10.5.1 Export a Data Acquisition Surface

In the Data Tree, right-click on the desired surface, choose Export To from the menu and select the desired output format from the submenu.

10.6 Data Tree



Top Row Buttons

- Select – Used to graphically select Data Acquisition point and linear features; selected feature properties are provided in the Details Panel.
- Details – Opens the Details Panel.

10.6.1 Default Branch

Default – At the top of the tree is the name of the active DGN model. All data imported is stored in this model.

10.6.2 Survey Data Branches in the Data Tree

When populated with data, the Data Tree contains one or more branches. Each branch is accompanied by a checkbox that enables/disables the visualization of the branch and sub-branches.

- **Field Books** – expands to show all of the field survey data loaded into the project – To create a new field book, right-click on the Field Books branch.
- **Field Book** – Created as a subfolder under "Field Books" when survey data is imported to your project.
  - **Load** – provides options to import Survey data from different sources
    - **File**… – Allows the User to select a supported survey file for import

- **Trimble Link** – Launches the Trimble Link software for importing of Trimble data formats

- **Leica DBX** – Launches Leica DBX import software for importing of that DBX data format

- **Features from Current Graphics** – Examines all graphical data in the current DGN model and compares the symbolgy against the currently loaded style file. Where the graphical data symbology matches a style file feature, the graphical data is converted to Data Acquisition Point and Linear features.

- **Delete** – allows the User to delete the currently selected Field Book
- **Export** – Allows the currently selected Field Book to be exported to GEOPAK, InRoads, MX and LandXML formats.

- **Data Files** – expands to show all of the raw survey data files currently loaded into the project – Each data file expands to show setups and observations. See the Survey Raw Data section of the Workflow help topic for more information.

- **Control Points** – lists the control points that exist in the project

- **Point Features** – lists points loaded from survey raw data files – The Point Features branch expands to show a list of individual feature names.

- **Linear Features** – lists linear features loaded from survey raw data files – The Linear Features branch expands to show a list of individual feature names.

- **Observations** – shows all observations contained in the project

- **Adjustment** – When activated, a Least Squares Adjustment. is applied to the Field Book. To activate the adjustment, right click on "Adjustment" and select Turn On. The circular symbol to the right of the Adjustment branch will become green when the adjustment option has been enabled. The check box toggles the graphical display of the error ellipses resulting from the adjustment. When active, the least squares adjustment properties are shown in the Detail Panel. Caution: Once enabled, the adjusted data cannot be "unadjusted".

10.6.3 Point and Linear Features Expansion

By expanding the Point Features or Linear Features branch, you can view data by individual feature style definition. The Point Features branch displays different feature types that have been assigned to points in the Field Book. When you select one of these sub-branches, the Details Panel presents only points that have been assigned to the selected feature definition.

The Linear Features branch can be similarly expanded and operates in much the same way.

10.6.4 Surfaces Branch

Expand the Surfaces branch to see all of the surfaces stored in the active DGN Model. The surfaces may come from a variety of sources.

The All Field Books branch, by default, is the surface built by triangulating all the data from all of the field books contained in the active DGN Model. It is created automatically anytime there is raw survey data contained in the Data Tree.

Expand any surface in the tree to access more detailed information about the active DGN Model.

- Composing Elements
- Point Features – lists the DA Field Book points that contribute to the surface
- Linear Features – lists the DA Field Book linear features that contribute to the surface

- Composing Surfaces – (ωαριεσ βασεδ ον μετηοδ οφ συρφαχε χρεατιον) If this surface was created by merging/appending other surfaces, then this branch lists the surfaces that were used in the merge; if not, the branch lists no data.
- Features – provides access to symbology settings (by selecting the feature and editing the setting in the details panel) for each surface feature – Each branch is accompanied by a checkbox that controls the visibility of the branch and sub-branches; set the symbology for each type in the Details Panel.
- Spots – random surface points
- Break lines – break line elements
- Triangles
- Holes – a void in the surface whereby underlying surfaces can control the triangulation
- Major Contours
- Minor Contours
- Boundaries – the external boundary of the surface
- Island – a triangulated area inside of a hole
- Void – an area defined by a closed shape that demarcates a region of missing data or obscure areas – No point or break data located within the void area is utilized, and no triangles are created inside the void areas. The Void coordinates are included in the triangulation and void lines between successive void coordinates are inserted as drape lines on the surface. Therefore, they do not change the slope or elevations of the surface.
- Break Void – A Break Void utilizes the vertex elevations of the graphical element, while the void lines between successive void coordinates are inserted as break lines; therefore, break voids change the slope and elevations of the TIN surface.
- Drape Void – Drape Void elements are treated as strictly 2-dimensional and are inserted post-triangulation. The area within the Drape Void is an aperture through the surface over which the void is draped. The graphical element elevations (if they exist) are not included in the triangulation. The void vertices and lines are draped onto the surface. The addition of a Drape Void should not change the surface grading external to that void.
- Drape Boundary – an exterior surface boundary that determines its elevations by draping on the underlying surface

10.6.5 Feature Styles Branch

The Feature Styles branch, when expanded, is a read-only view of the currently accessed style file.

The style file is set within the Design File Settings (or, optionally, via a configuration variable) and can be either a GEOPAK SMD file (which must be first saved as a XML file), an InRoads XIN file (the survey features from within the XIN are used), or a MX PSS file.

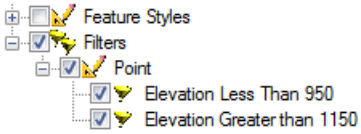
Each feature corresponds to a survey field code. Drill down each feature style to see the currently used visualization settings for each code.

> ***Note:*** Styles that display in RED text are styles that were used in the survey data but were not found in the specified SMD/XIN/PSS file. Add the missing features to the native style database and reattach the style file to your Data Acquisition seed file.

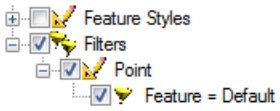
10.6.6 Filters Branch

The Filters branch allows you to create customized data filters for quick viewing of data sub-sets. These filters can be pre-created and stored with the Data Acquisition seed file for use with all projects generated from that seed.

An example filter may highlight any points whose elevation is above or below the expected range within a Clients geographic area.

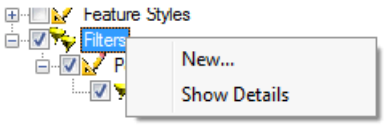


Another example may be to highlight all “default” coded points to provide visual feedback of field coded points that did not match the available feature styles.

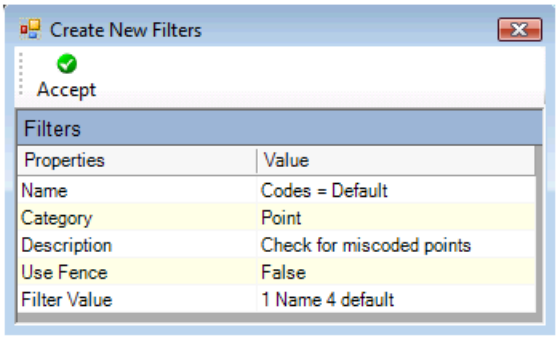


10.6.6.1 FILTER CREATION

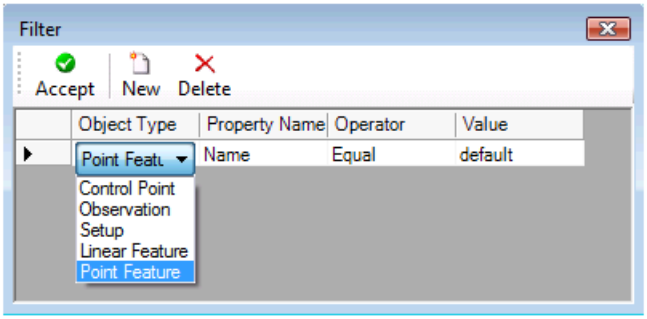
To create a new filter, right-click on the word “Filter” in the data tree. Click New.



The Create New Filter dialog will activate.



Name: Supply a logical name for the filter.
Category: A custom category that will be used in the Data Tree as a branch for housekeeping purposes (ε.γ., you have the option to group "like" filters together logically by using Category)
Description: Enter a brief description of the Filter.
Use Fence: True/False toggle
Filter Value: Click the browse button in the Filter Value field to launch the Filter dialog shown below.



Filter Dialog: Multiple rows can be added to a single filter using combinations of Object Type, Property Name, Operator, and custom values to build up the required filter. Once the filter rows are completed, Accept the Filter and Accept the New Filter. The filter will appear in the Data Tree under "Filter <category> <name>".

Please note that between each row is an inferred "and". For data to pass a filter, it must fulfill the attributes of filter line 1 AND the attributes of each subsequent filter line.

10.6.6.2 FILTER ACTIVATION

To activate one or more filters:

1. Disable the display of the data type you are filtering (point features and/or linear features) within the Field Book area of the Data Tree.

2. Drill down the Filters branch to the specific filter/filters you wish to activate.
3. Enable the desired filters.

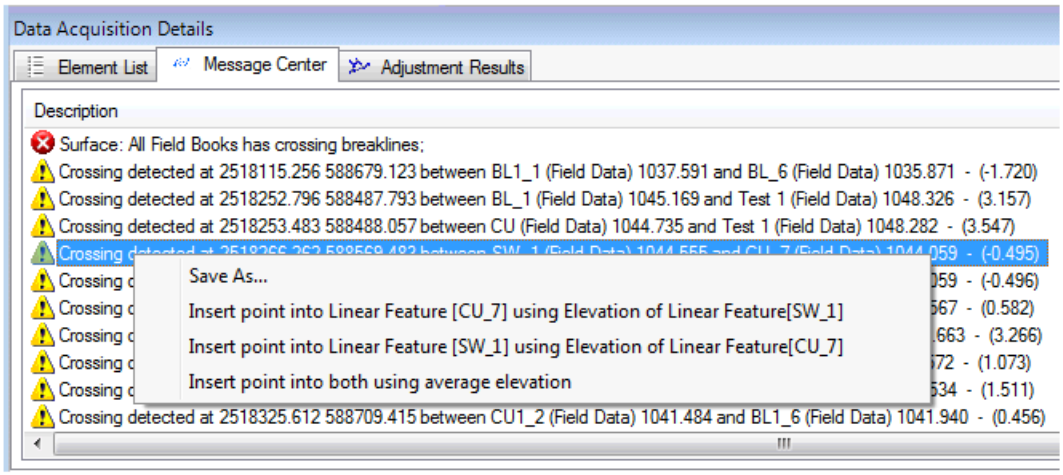
The data passing the enabled filters will display on your screen.

To display the results of the filter in the Details panel, right-click on the filter and select Show Details. This will populate the Details panel with the data that has passed the filter.

10.7 Linear Crossings

Linear Crossings, when enabled, provides a Linear Feature crossings detection engine that continuously runs to provide feedback of crossing linear features. The feedback is provided in the Message Center of the Data Acquisition Details panel.

Message Center Details



Detected crossing features are displayed in the message center as shown above. Selecting any of the detected crossings in the list will center the current view to that crossing and place a circle around the intersection.

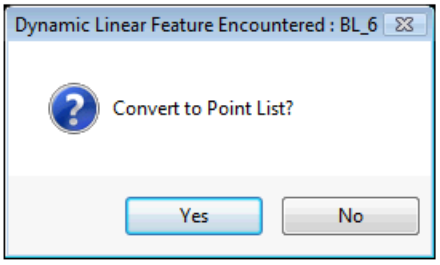
Right-click on the selected crossing to access the options you see above.

- **Save As**: Saves the details to a text file

- **Insert point into Linear Feature < A > using Elevation of Linear feature < B >**: Both of these "insert" options will create a new point and add that point into the first linear feature at an elevation that corresponds with the crossing linear feature.

- **Insert point into both using average elevation**: This option averages the elevations at the crossing and inserts a new point that is added to both linear features.

All of the “insert” options require that the new point be inserted into a Point List type linear feature. If a Dynamic Link linear feature is selected, a pop-up message, similar to that shown below, will appear.



- Click “Yes”: The Dynamic Link linear feature will be converted to a Point List linear feature, and the new point will be inserted.

- Click “No”: The operation will be aborted.

Please Note: The option to insert points into linear features is only one of many ways to resolve crossing linear features. Editing or breaking the linear feature, moving or re-coding points or even changing the linear feature DTM type are all valid methods to resolve this situation without the need to convert the linear feature type. Sound, practical

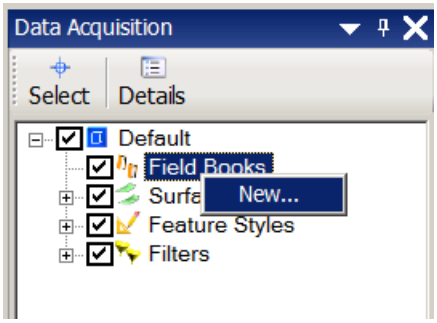
10.8 Individual Exercise:

1) Open **pw:\\District CADD\Survey\BENTON\J2P0223\data\Data_Acquisition.dgn**

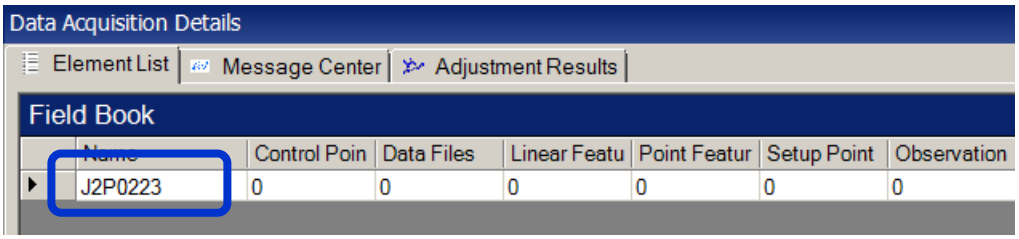
2) Activate the Data Acquisition tool by selecting **Tools > Data Acquisition**

3) Dock the Data Acquisition **Details Pane** to the bottom and **Main Dialog** to the right.

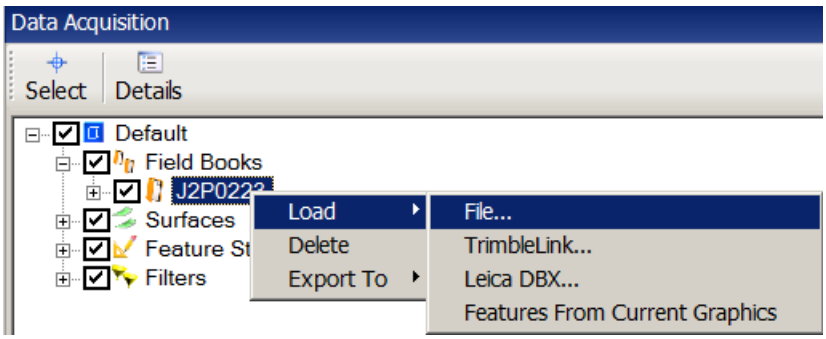
4) In the Data Acquisition **Main Dialog** right-click on Field Books and create a new Field Book.



5) **Rename** the Field Book in the **Details Pane** to **J2P0223**.



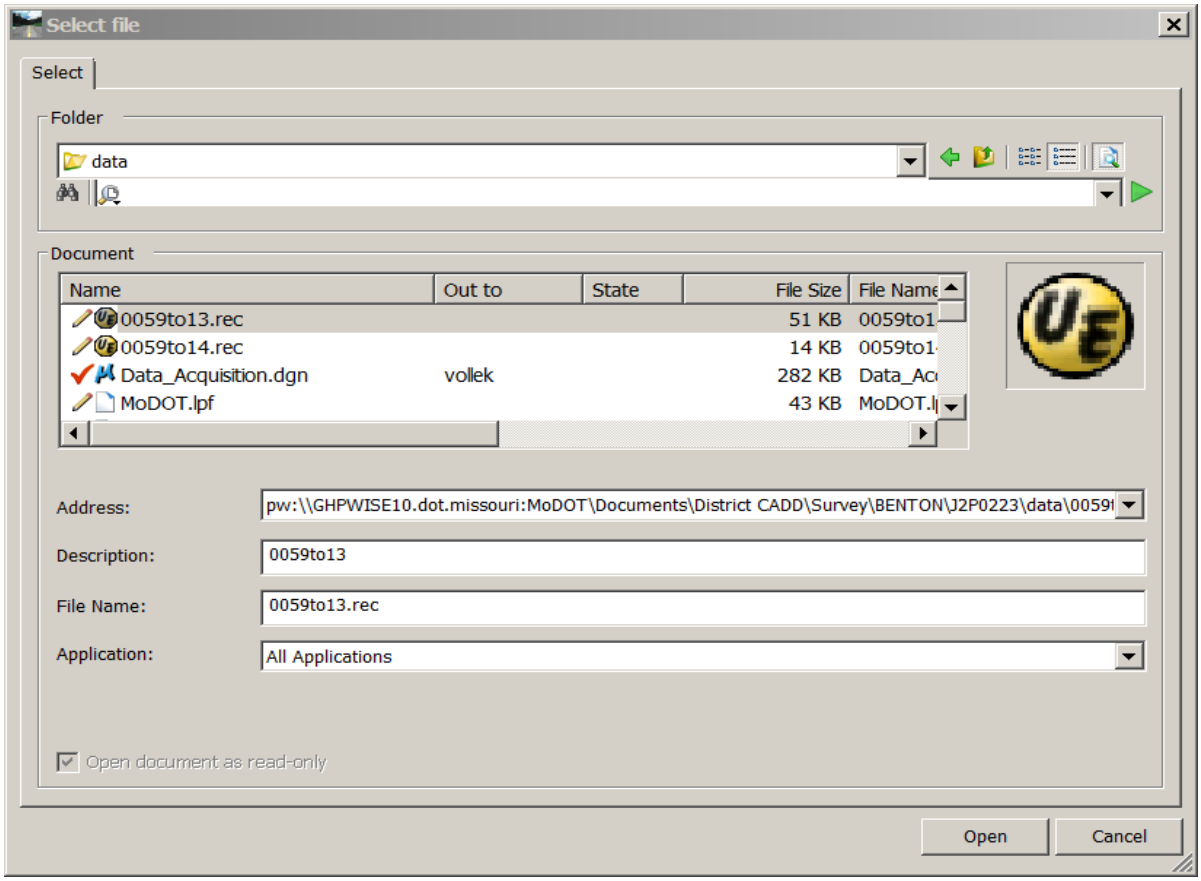
6) In the Data Acquisition **Main Dialog** right-click on the **J2P0223** Field Book and select **Load > File**



7) Select the **0059to13.REC** file.

The Folder should be set to the following location:

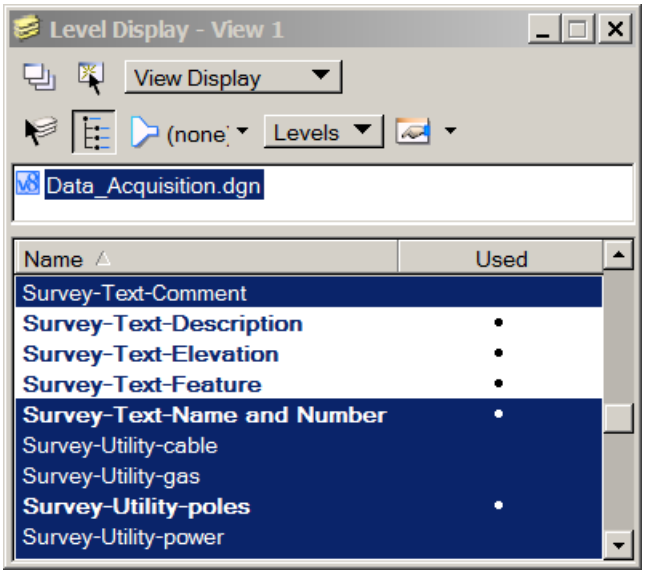
pw:\\District CADD\Survey\BENTON\J2P0223\data\0059to13.rec



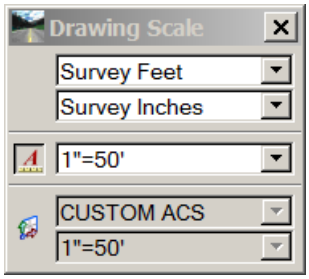
8) Review Survey Data visualized in DGN.

9) Turn **OFF** the following three levels:

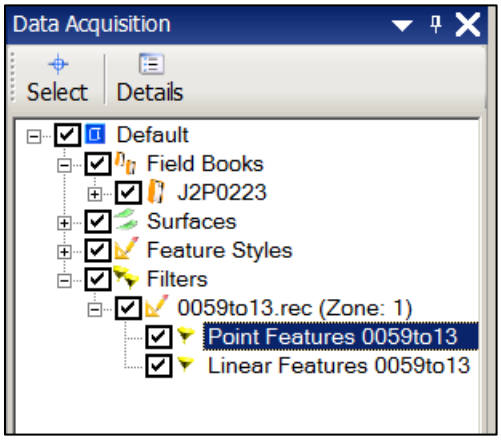
Survey-Text-Description
Survey-Text-Elevation
Survey-Text-Feature



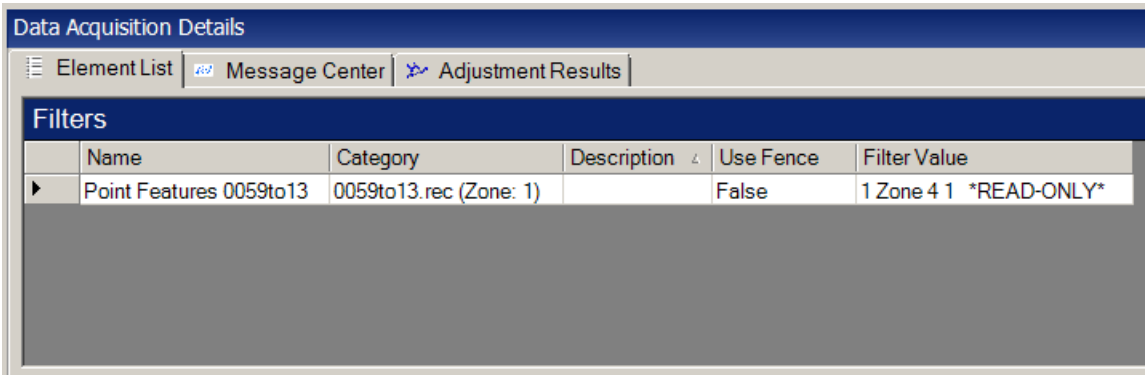
10) Change the Drawing (Annotation) Scale to 1"=50' by selecting "**Settings > Drawing Scale".**



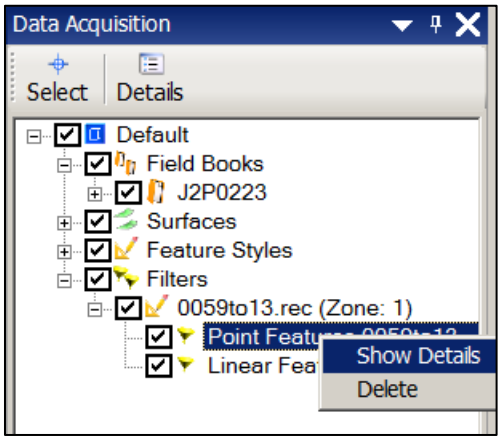
11) In the Data Acquisition Pane, expand the Filters branch until you see **Point Features 0059to13**



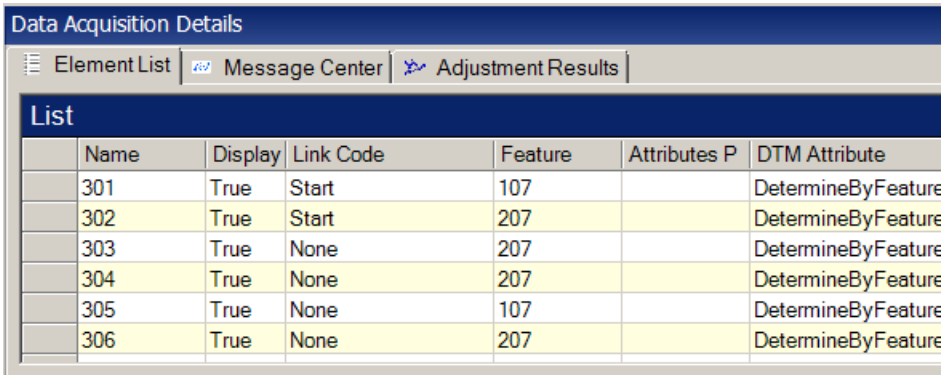
Notice in the Data Acquisition Details Pane that **Point Features 0059to13** is listed



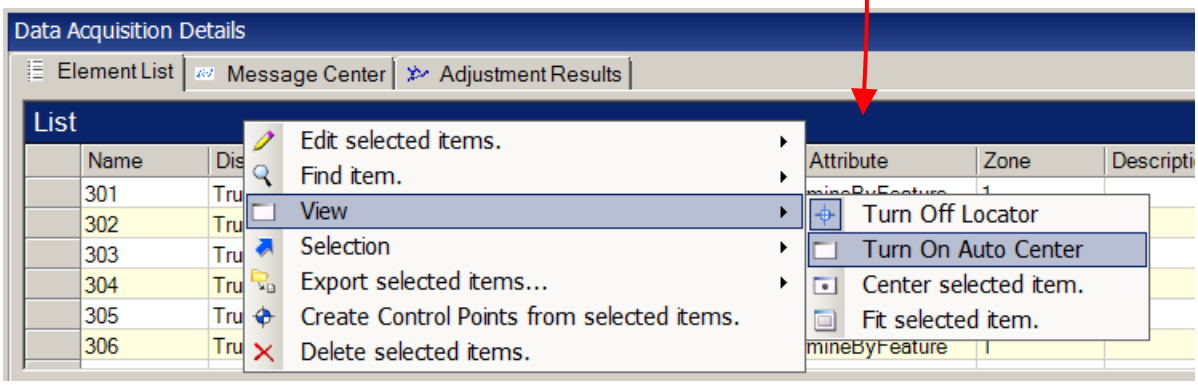
12) In the Data Acquisition Pane, under Filters Right Click on **Point Features 0059to13** and select **"Show Details".**



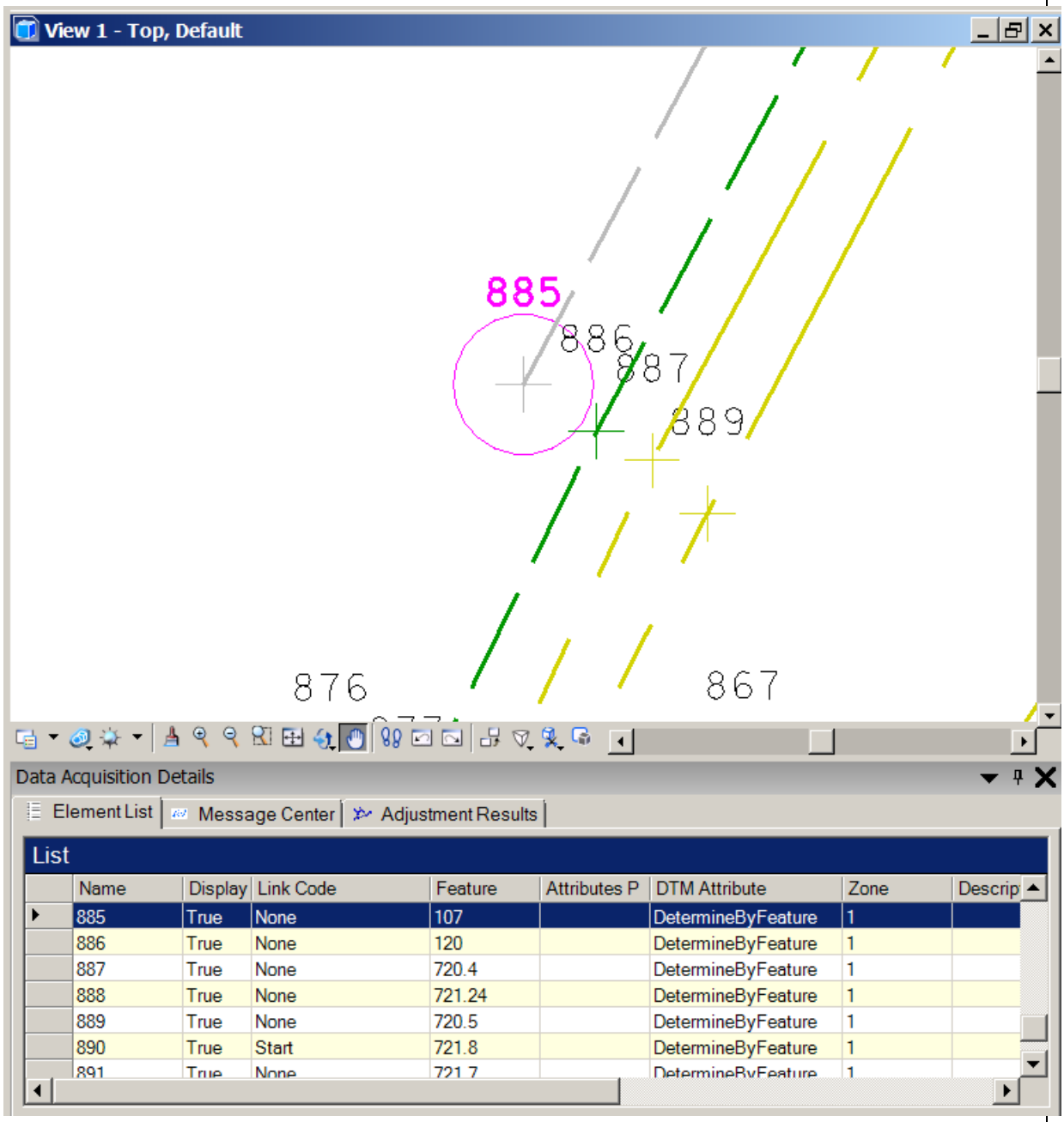
13) The Data Acquisition Details Pane will now list all the points that are included in the **0059to13** REC (Survey) file.



14) In the Data Acquisition Details Pane **Right Click** on the **List Banner** and select **View > Turn On Auto Center**.

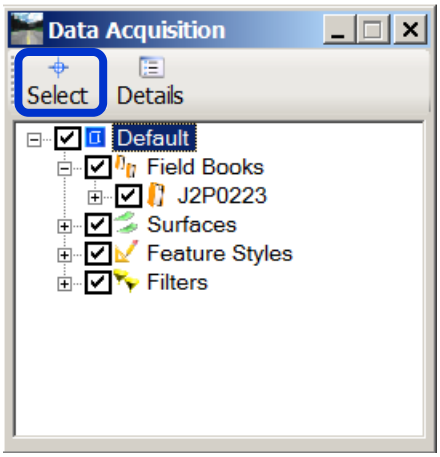


15) In the Data Acquisition Details Pane locate **Point 885** and highlight the row. Once the row is highlighted the point should be centered in the screen



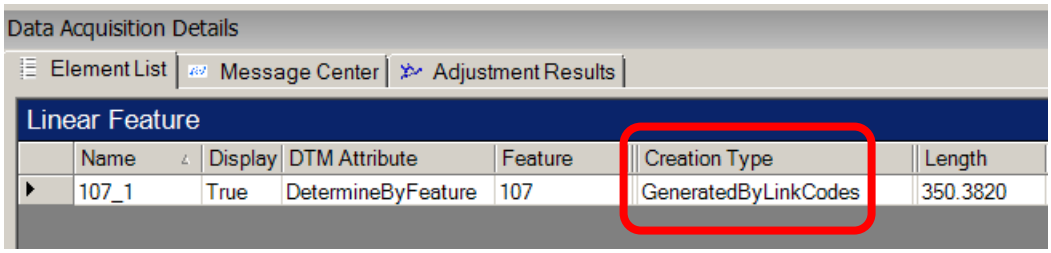
	Name	Display	Link Code	Feature	Attributes P	DTM Attribute	Zone	Descrip
▶	885	True	None	107		DetermineByFeature	1	
	886	True	None	120		DetermineByFeature	1	
	887	True	None	720.4		DetermineByFeature	1	
	888	True	None	721.24		DetermineByFeature	1	
	889	True	None	720.5		DetermineByFeature	1	
	890	True	Start	721.8		DetermineByFeature	1	
	891	True	None	721.7		DetermineByFeature	1	

16) In the Data Acquisition Pane use the **"Select"** button to identify the Survey Chain that starts with point **885**.



17) In the Data Acquisition Details Pane the Survey Chain named **107_1** should now be listed.

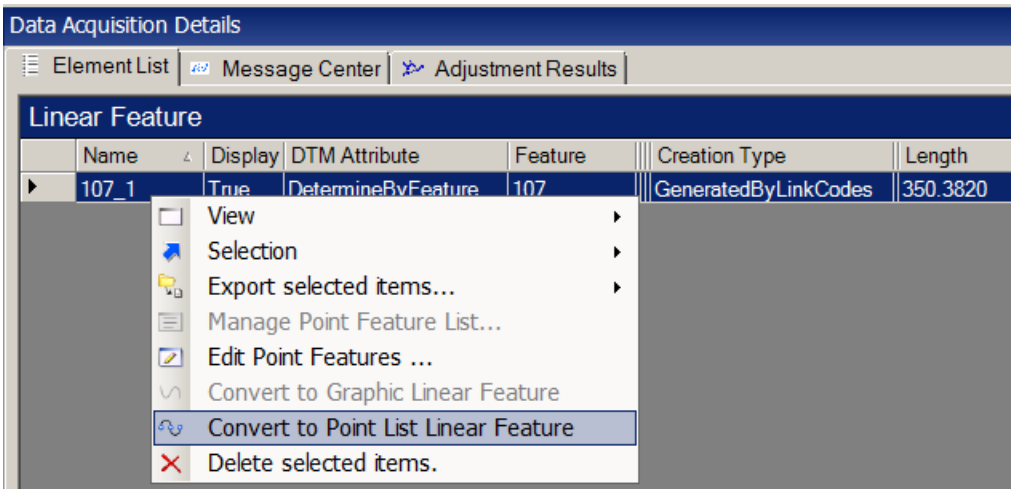
Since the **Survey Chain 107**_1 was created using linking codes it is considered a Dynamic Link Linear Feature.



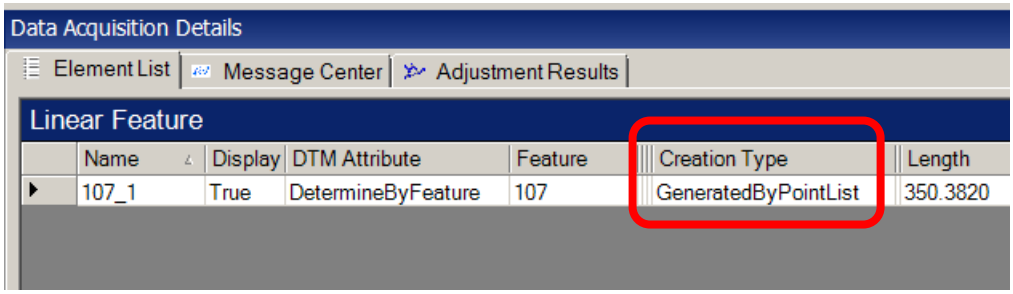
18) What we are going to attempt to do is join **Survey Chain 107_1** to the Survey Chain directly to the Southwest (Chain 107).

Before the two chains can be joined together they both need to be drop from a **Dynamic Link Linear Feature** to a **Point List Linear Feature.**

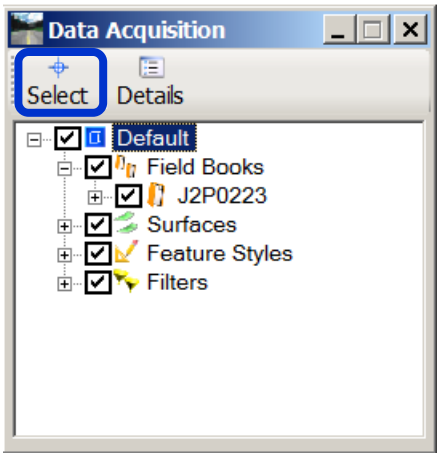
To drop the **107_1** chain, highlight the row in the Details Pane and Right Click and select "**Convert to Point List Linear Feature**"



19) Once the 107_1 Survey Chain is converted to a **Point List Linear Feature** in the Details Pane the Creation Type should be listed as **GeneratedByPointList**.

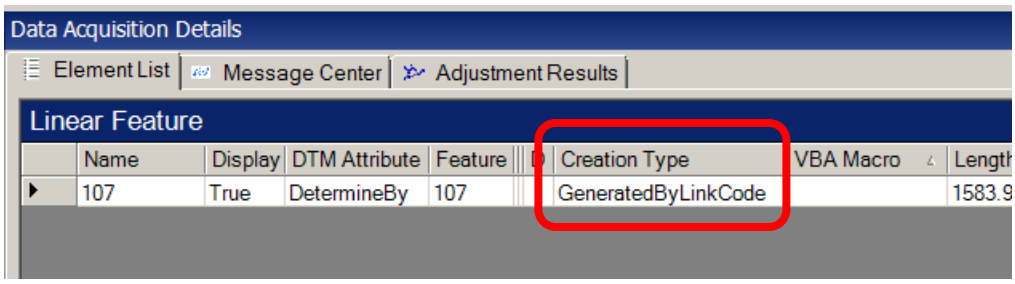


20) In the Data Acquisition Pane use the **"Select"** button to identify the Survey Chain that is just southwest of the 107_1 chain and ends with a point **876**.



21) In the Data Acquisition Details Pane the Survey Chain named **107** should now be listed.

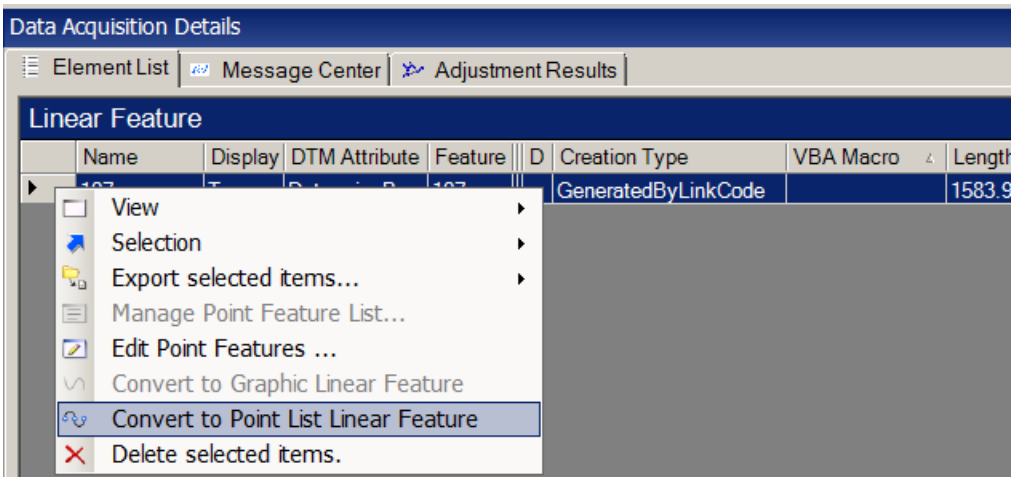
Since the **Survey Chain 107** was created using linking codes it is considered a Dynamic Link Linear Feature.



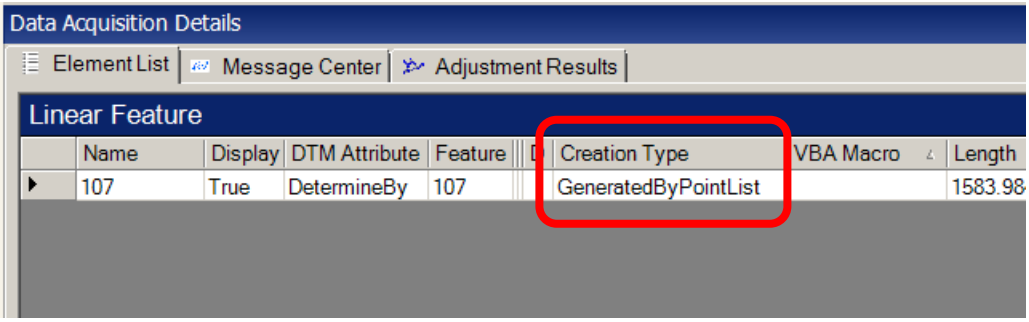
22) Again what we are attempting to do is joining **Chain 107_1** to the Chain **107**.

Before the two chains can be joined together the **107** Chain needs to be drop from a **Dynamic Link Linear Feature** to a **Point List Linear Feature.**

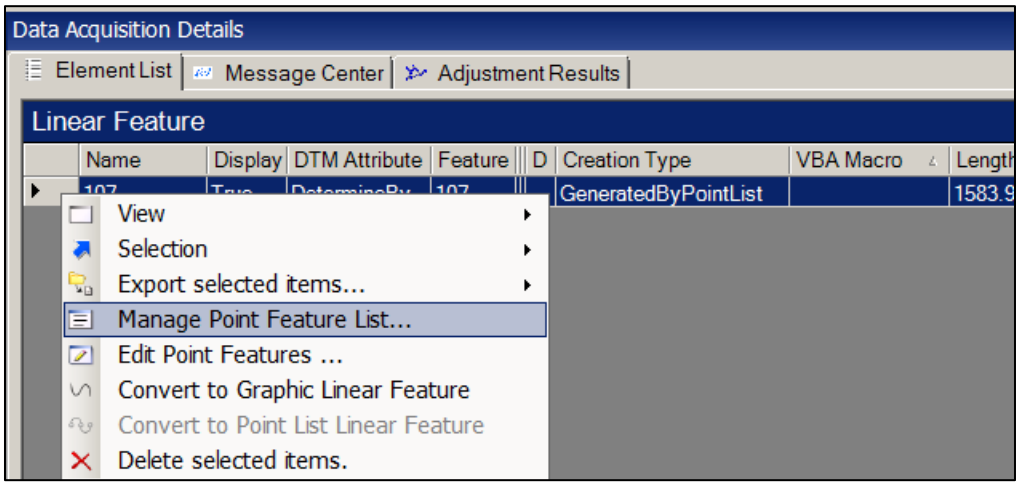
To drop the **107** chain, highlight the row in the Details Pane and Right Click and select "**Convert to Point List Linear Feature**"



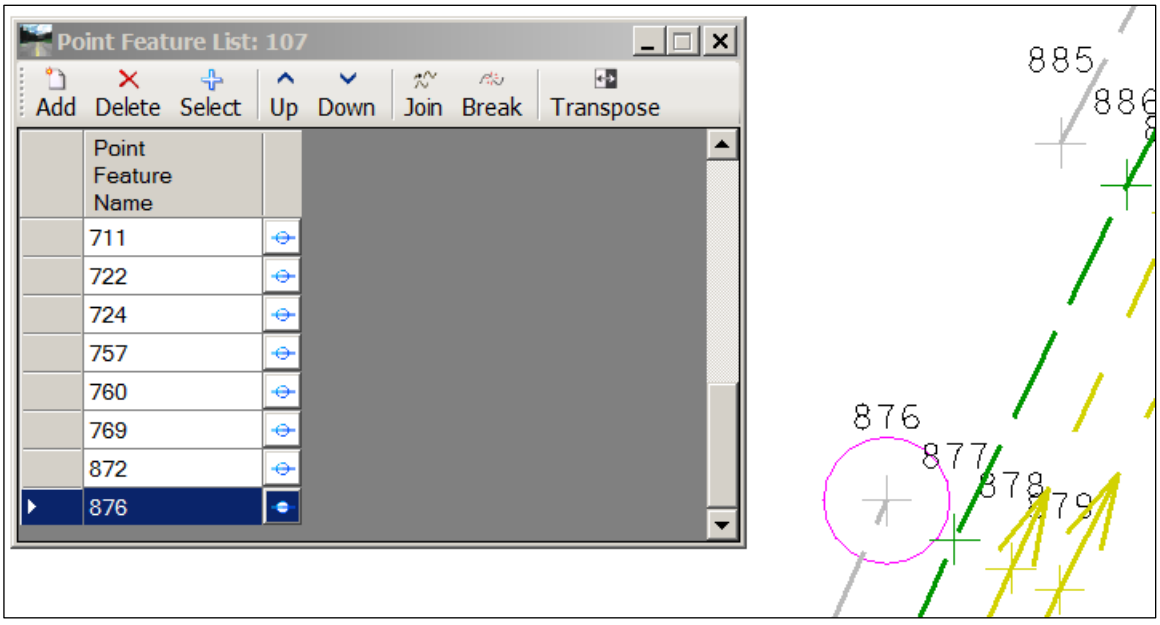
23) Once the **107** Chain is converted to a **Point List Linear Feature** in the Details Pane the Creation Type should be listed as **GeneratedByPointList**.



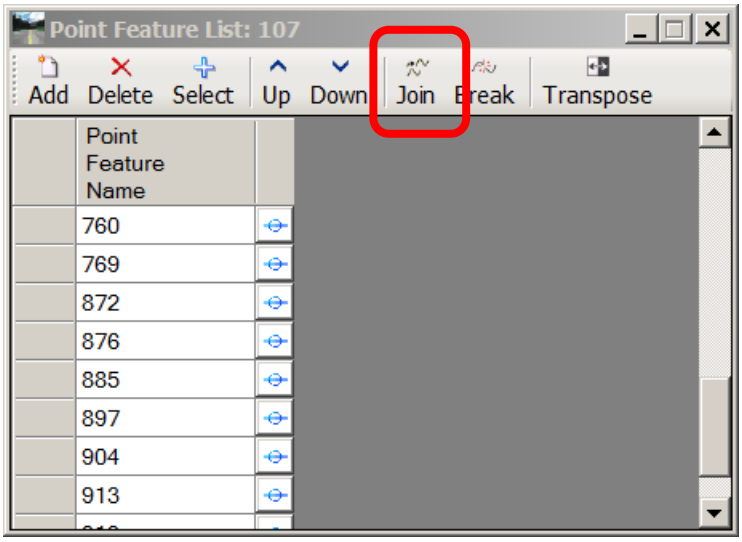
24) Next in the Details Pane highlight the row that contains the 107 Survey Chain and Right Click and select "**Manage Point Feature List**".



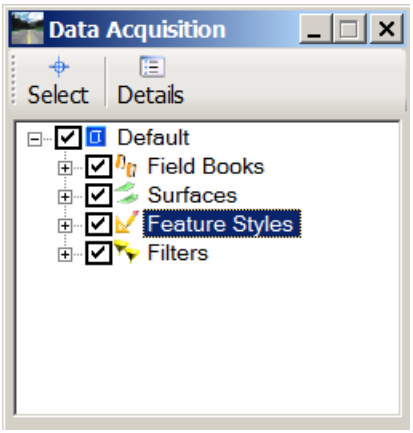
25) In the **Point List Features Dialog** Select/Highlight the row for **Point 876**. After selecting the 876 row a round locator ball should now appear around the point in the plan view.



26) In the **Point List Features** dialog select the **Join** button and select the **107_1** chain. After joining the chains look in the **Point Feature List** dialog and the points from the **107_1** chain (points 885-926) should have been added to **107** chain.



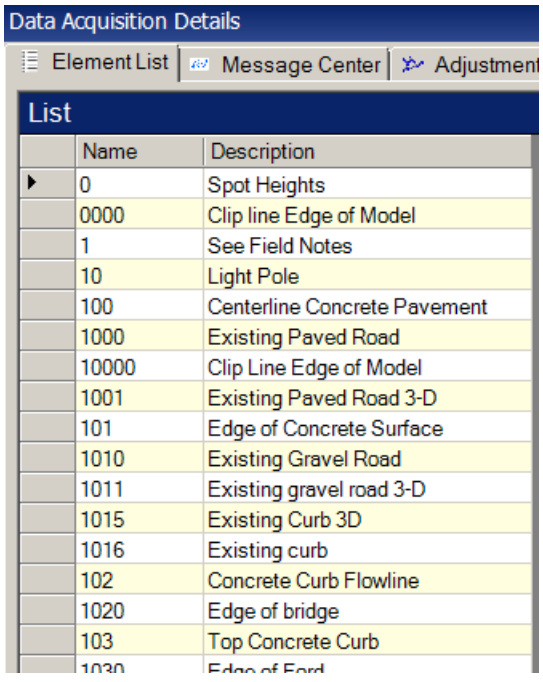
27) In the Data Acquisition Pane select Feature Styles.



A list of all available Feature Styles (Codes) will be displayed in the Details Pane.

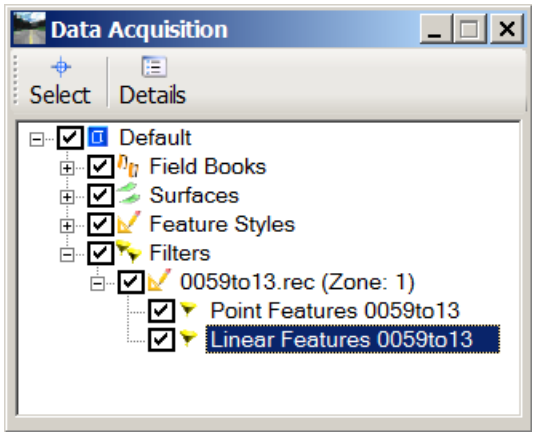
Typically Point Codes are as follows:

Survey Codes	1-999
Photometric Codes	1000-6999
Archeological Codes	7000-7999

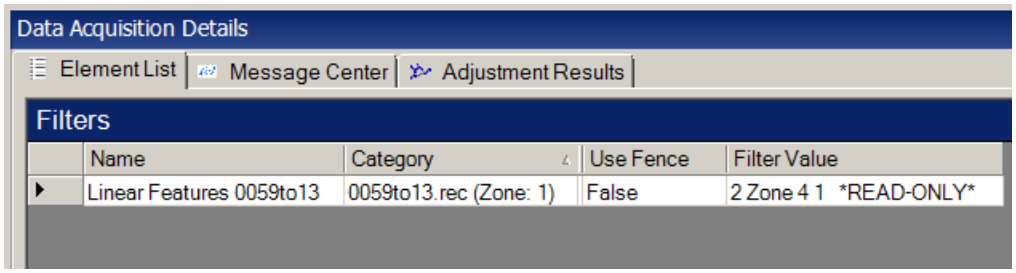


Name	Description
0	Spot Heights
0000	Clip line Edge of Model
1	See Field Notes
10	Light Pole
100	Centerline Concrete Pavement
1000	Existing Paved Road
10000	Clip Line Edge of Model
1001	Existing Paved Road 3-D
101	Edge of Concrete Surface
1010	Existing Gravel Road
1011	Existing gravel road 3-D
1015	Existing Curb 3D
1016	Existing curb
102	Concrete Curb Flowline
1020	Edge of bridge
103	Top Concrete Curb
1030	Edge of Ford

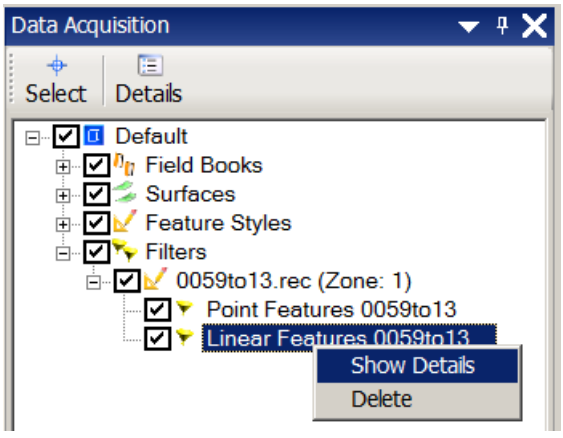
28) In the Data Acquisition Pane, expand the Filters branch until you see **Linear Features 0059to13**



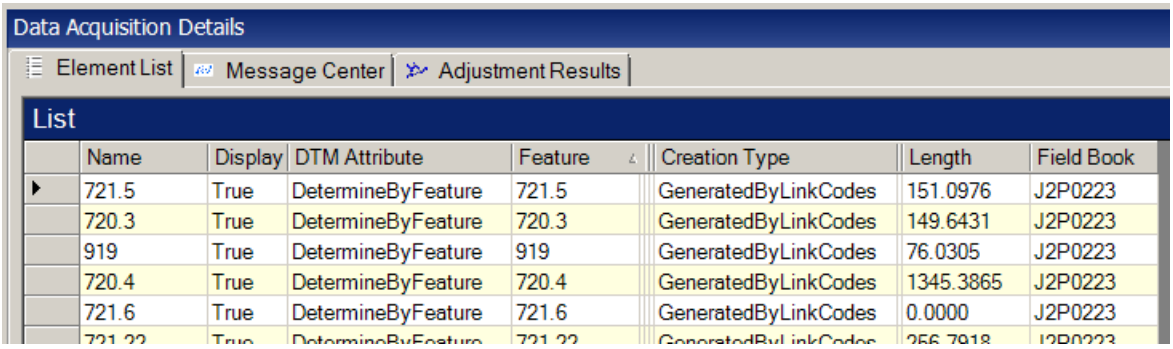
Notice in the Data Acquisition Details Pane that **Linear Features 0059to13** is listed



29) In the Data Acquisition Pane, under Filters Right Click on **Linear Features 0059to13** and select **"Show Details".**

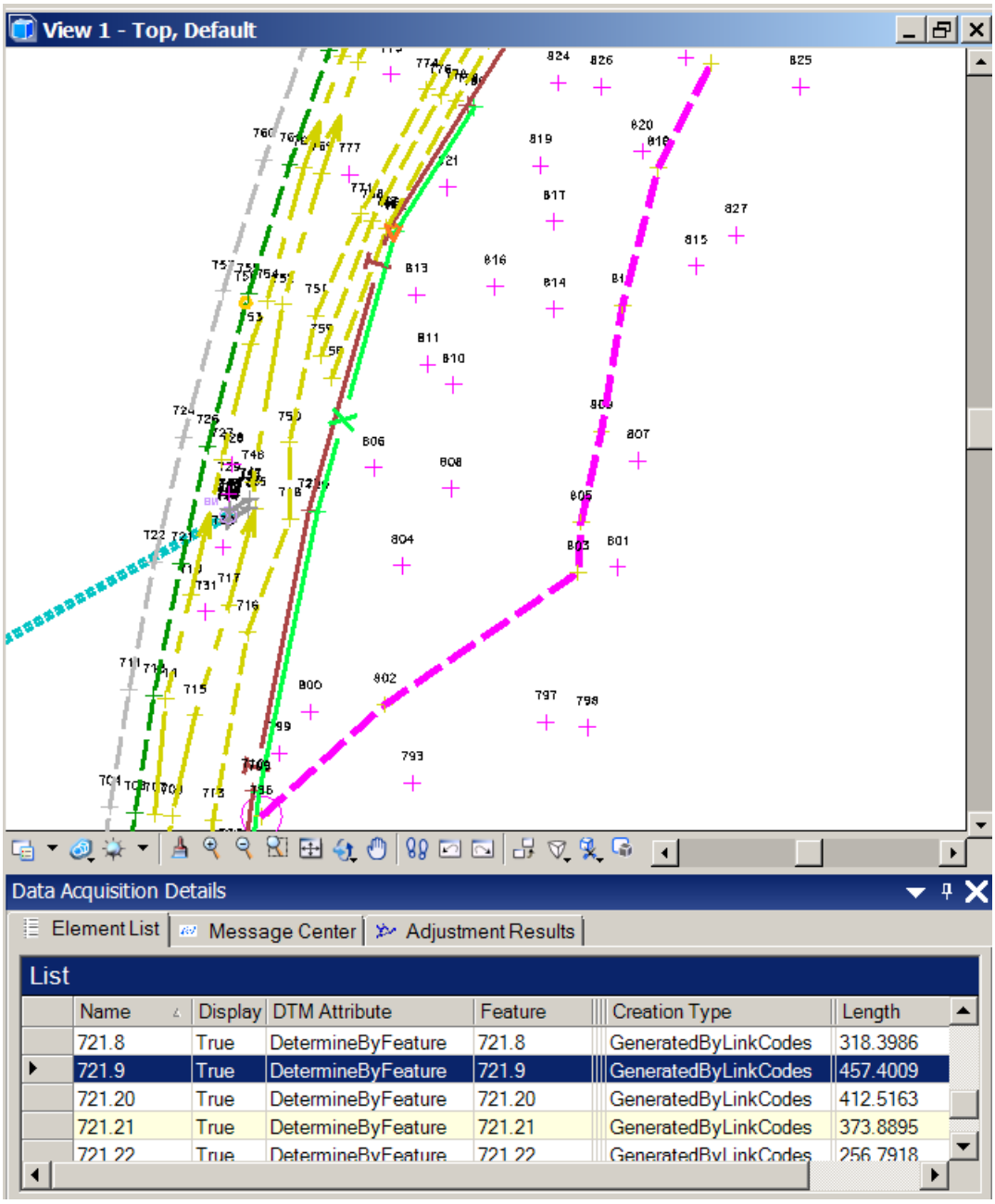


30) The Data Acquisition Details Pane will now list all the Linear Features (Survey Chains) that are included in the **0059to13** REC (Survey) file.

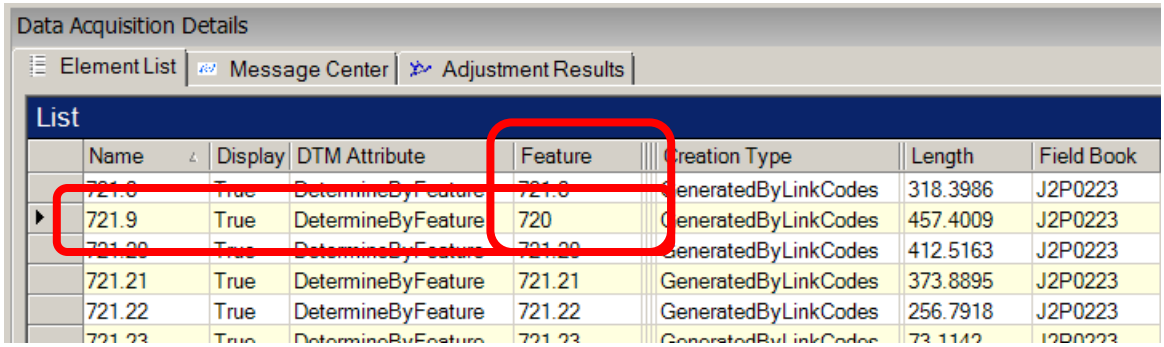


	Name	Display	DTM Attribute	Feature	Creation Type	Length	Field Book
▶	721.5	True	DetermineByFeature	721.5	GeneratedByLinkCodes	151.0976	J2P0223
	720.3	True	DetermineByFeature	720.3	GeneratedByLinkCodes	149.6431	J2P0223
	919	True	DetermineByFeature	919	GeneratedByLinkCodes	76.0305	J2P0223
	720.4	True	DetermineByFeature	720.4	GeneratedByLinkCodes	1345.3865	J2P0223
	721.6	True	DetermineByFeature	721.6	GeneratedByLinkCodes	0.0000	J2P0223
	721.22	True	DetermineByFeature	721.22	GeneratedByLinkCodes	256.7918	J2P0223

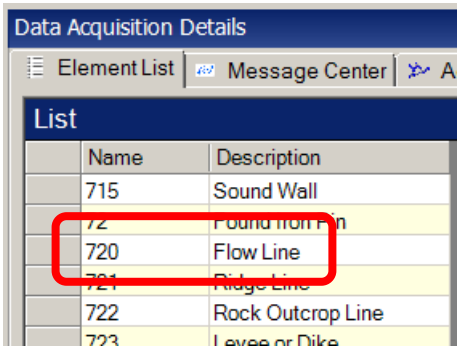
31) In the Data Acquisition Details Pane locate the **Linear Feature** (Survey Chain) **721.9** and highlight the row. Once the row is highlighted the Linear Feature should be centered in the screen



32) In the Data Acquisition Details Pane change the Feature of the **721.9** Linear Feature (Survey Chain) to "**720**"



From the Feature Styles explained in Step 27 a 720 feature is a "**Flow Line**".

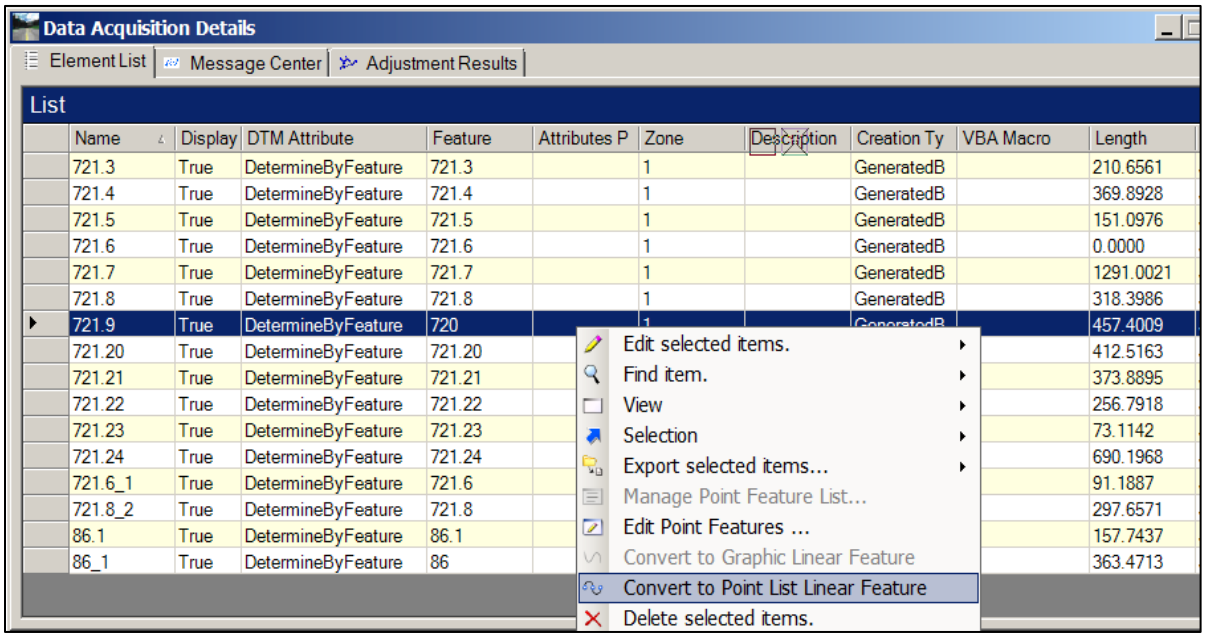


Note: All columns in the Details Pane can be sorted by selecting Column Header.

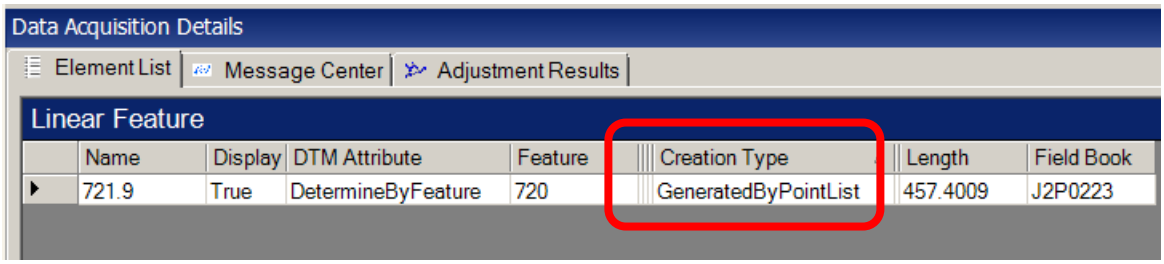
33) Next we are going to attempt to reverse the direction of the **Chain 721.9** so that the flow line goes in a southerly direction.

Before the chain can be transposed the 721.9 Chain needs to be drop from a **Dynamic Link Linear Feature** to a **Point List Linear Feature.**

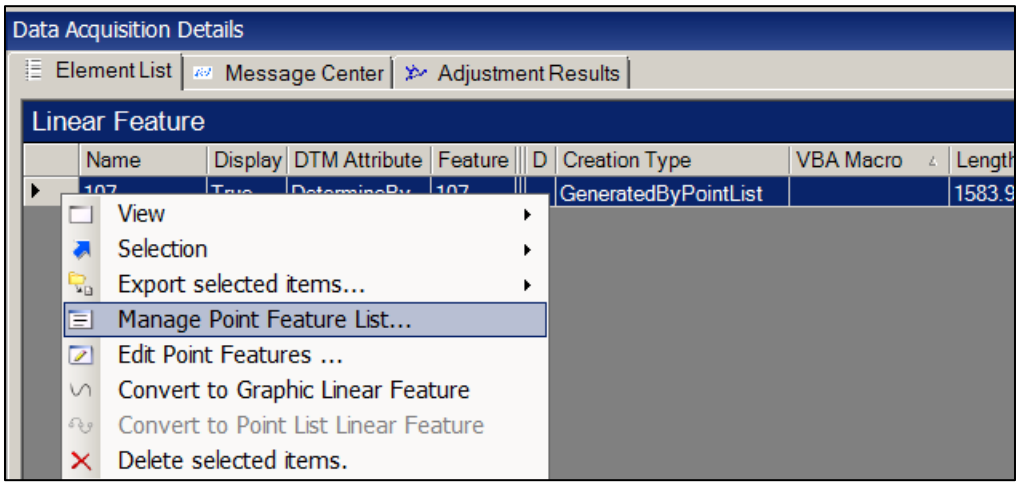
To drop the **721.9** chain, Select/Highlight the row in the Details Pane and Right Click and select "**Convert to Point List Linear Feature**"



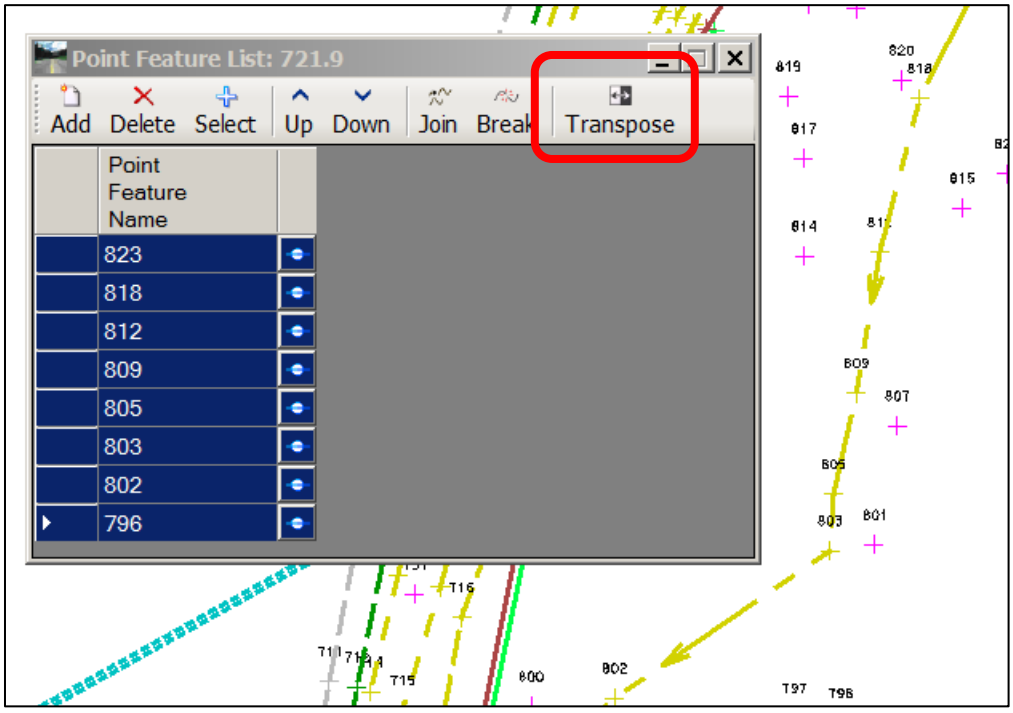
34) Once the **721.9** Chain is converted to a **Point List Linear Feature** in the Details Pane the Creation Type should be listed as **GeneratedByPointList**.



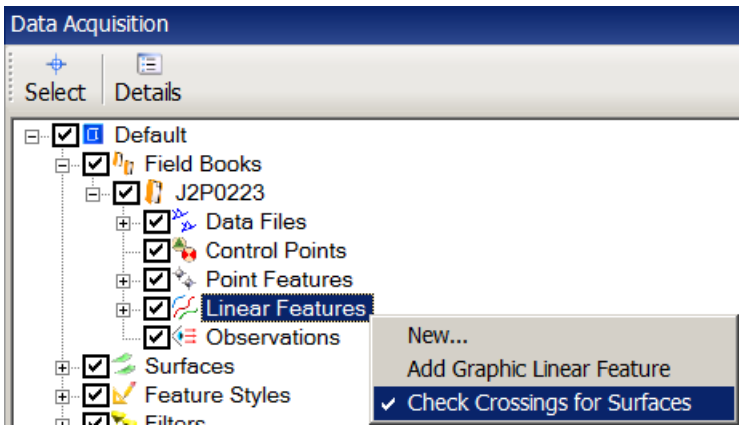
35) Next in the Details Pane Select/Highlight the row that contains the **721.9** Survey Chain and Right Click and select "**Manage Point Feature List**".



36) In the Point List Features Dialog select/highlight all the rows. After selecting all the rows left click on the **Transpose** icon and you should see the flow arrow switch to the south.



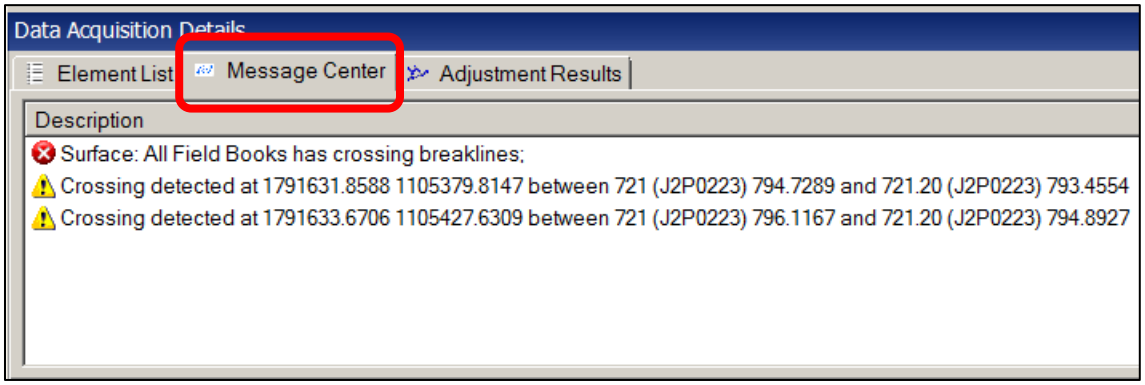
37) Next we are going to check for crossing breaklines. First in the Data Acquisition Pane go to **Field Books > J2P0223 > Linear Features** and make sure **Check Crossings for Surfaces** is checked on.



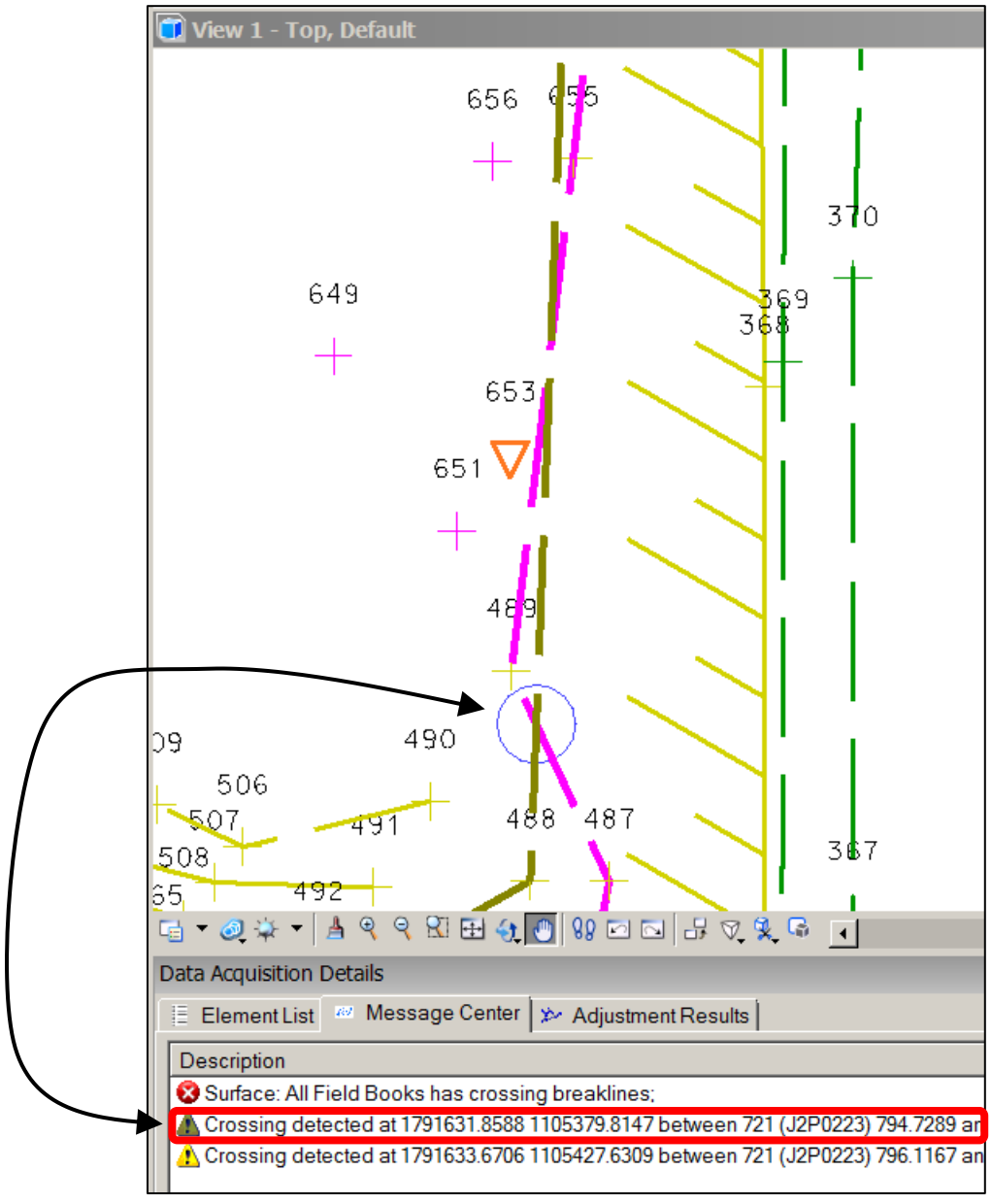
Then go to the Details Pane and select **Message Center** tab.

If there is a crossing it will be listed here with the following warning icon. 

Select either of the two warning icons.

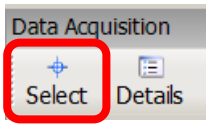


38) After selecting the first Crossing Breakline in the message box, Data Acquisition will center the window and place a locator ball at the point of crossing. .



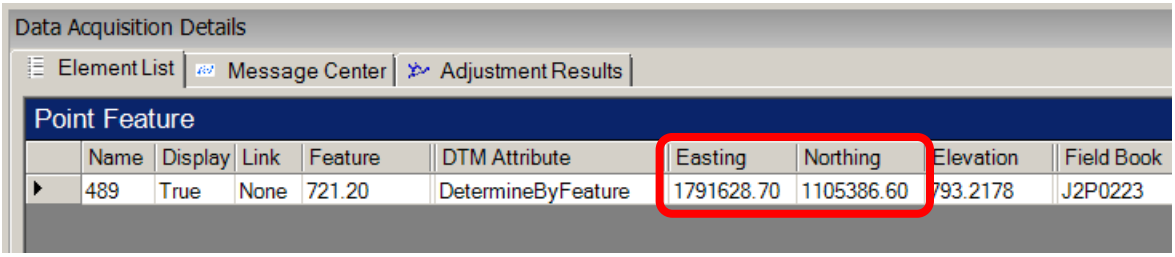
After looking at both crossings, it becomes clear that Point 489 is the cause of the crossings.

39) To remove the crossings you could do one of the following:



Solution 1) Select the **Point 489** using the Data Acquisition Select Element.

Once selected in the Details Pane adjust the Northing, Easting coordinates until the crossing is resolved.

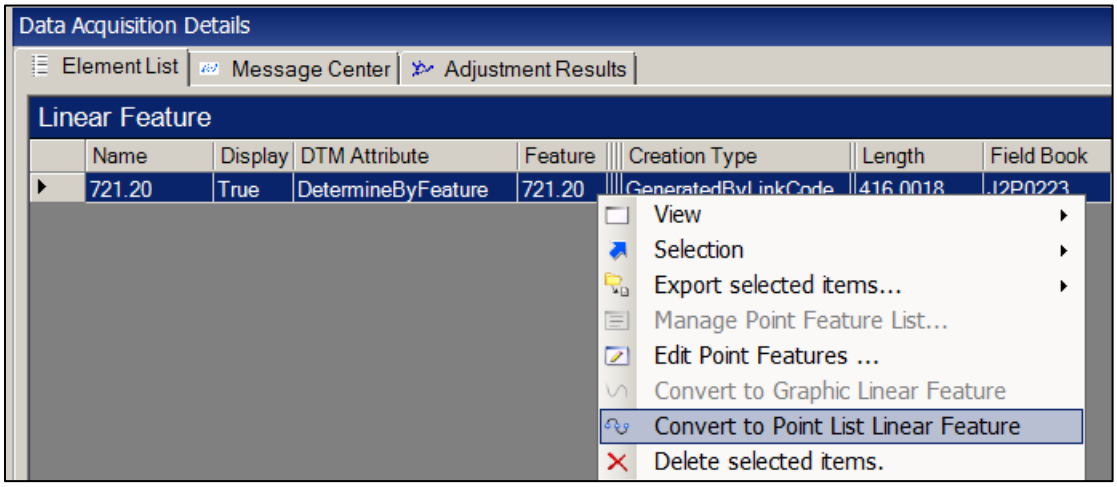


Solution 2) Delete the Point using a MicroStation Delete.

Solution 3) Remove Point **489** from the **721.20** Survey Chain.

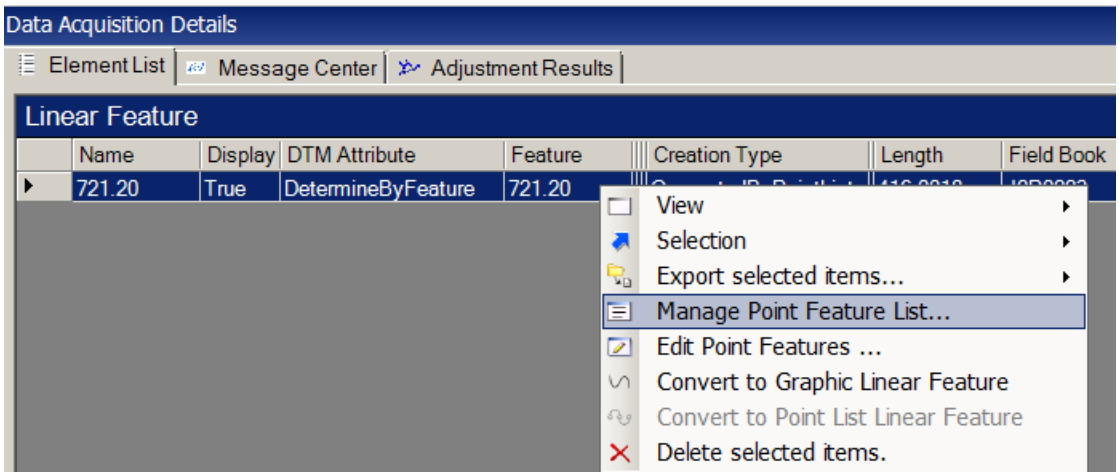
First you have to drop the **721.20** Chain down to a **Point List Linear Feature**.

Select/Highlight the row containing the chain **721.20** and right click and select "**Convert to Point List Linear Feature**".

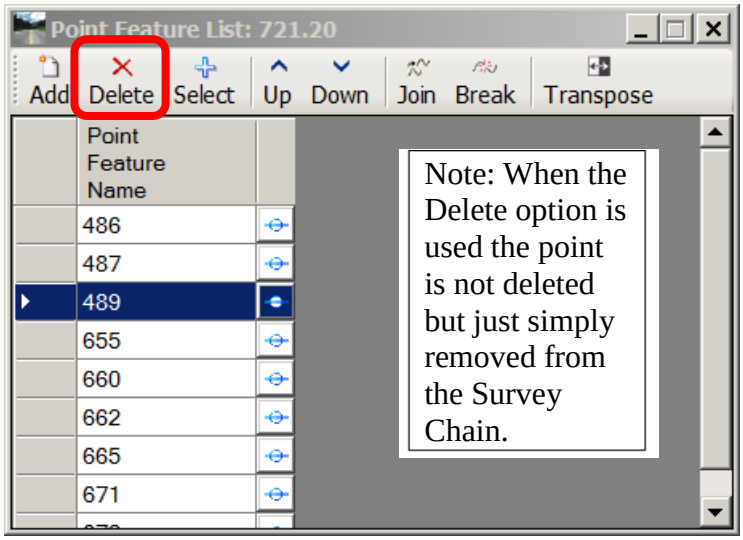


Solution 3 continued:

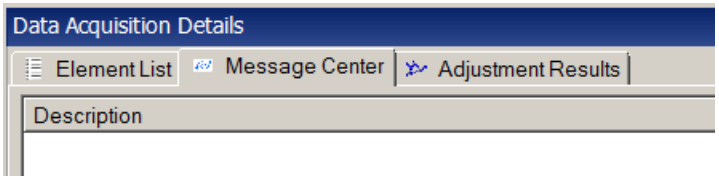
Select/Highlight the row containing the chain **721.20** and right click and select "**Manage Point Feature List**".



Select/Highlight the row containing the 489 point and then select the Delete icon.



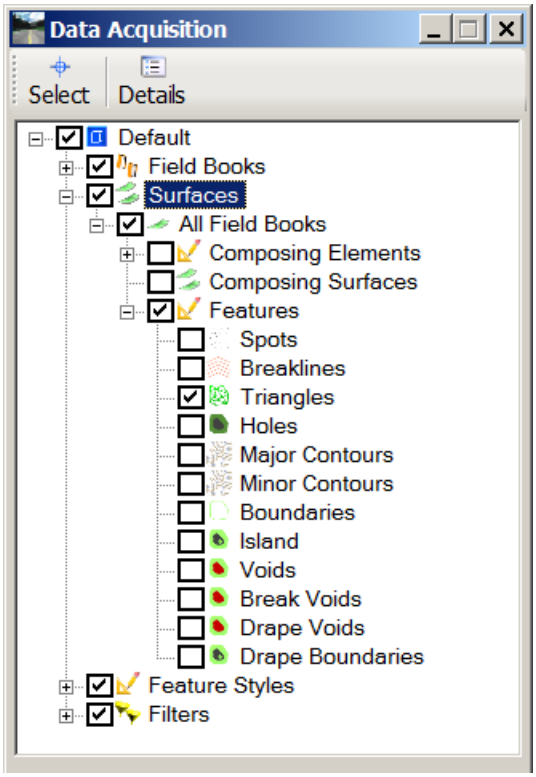
Once the Crossings are resolved the Message Center will no longer display the warnings.



40) Next we are going to visualize the Surface and export the Surface out to a TIN file.

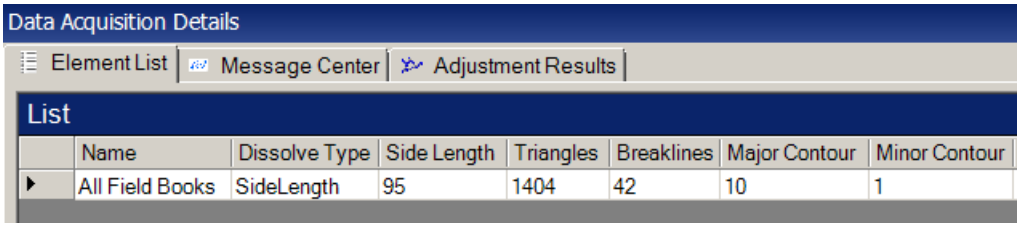
In the Data Acquisition Pane select the **Surfaces** folder, and then expand the **All Field Books** and **Features** folders.

Once you see all the items listed under the Features folder toggle on **Triangles, Major** and **Minor Contours.**



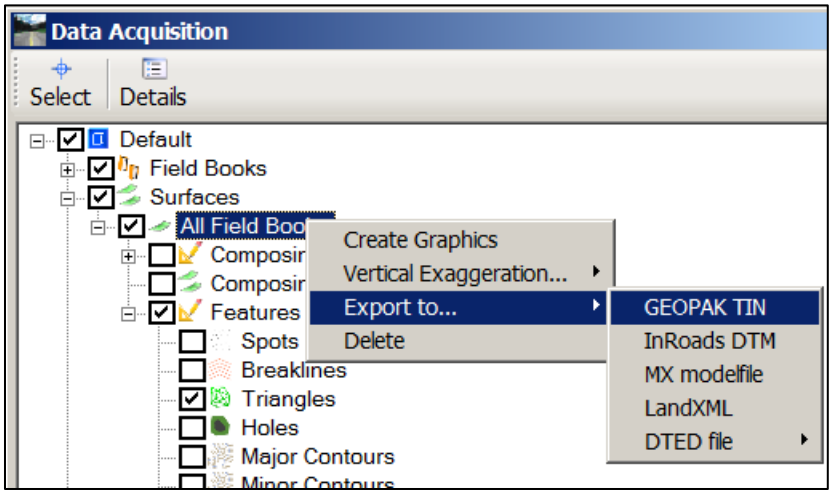
In the Details Pane change (if needed) the following settings:

Dissolve Option:	SideLength
Side Length:	95
Major Contour	10
Minor Contour	1

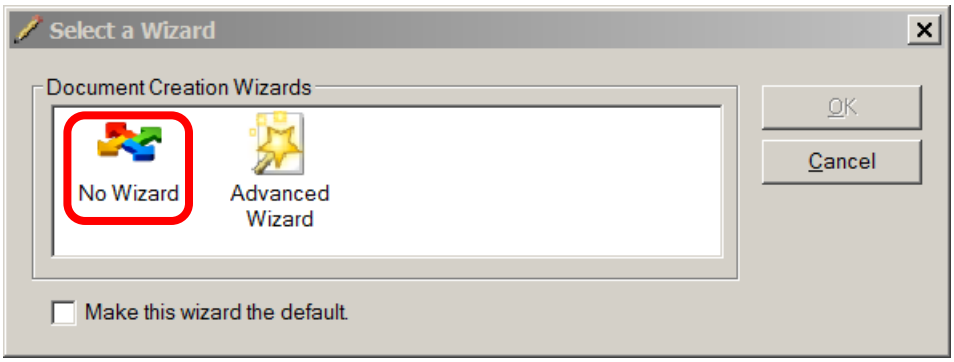


	Name	Dissolve Type	Side Length	Triangles	Breaklines	Major Contour	Minor Contour
▶	All Field Books	SideLength	95	1404	42	10	1

41) To export out a Tin file select **All Field Books > Export to… > GeoPak Tin**.



Select No Wizard



Step 41 continued on next page:

41 Continued)

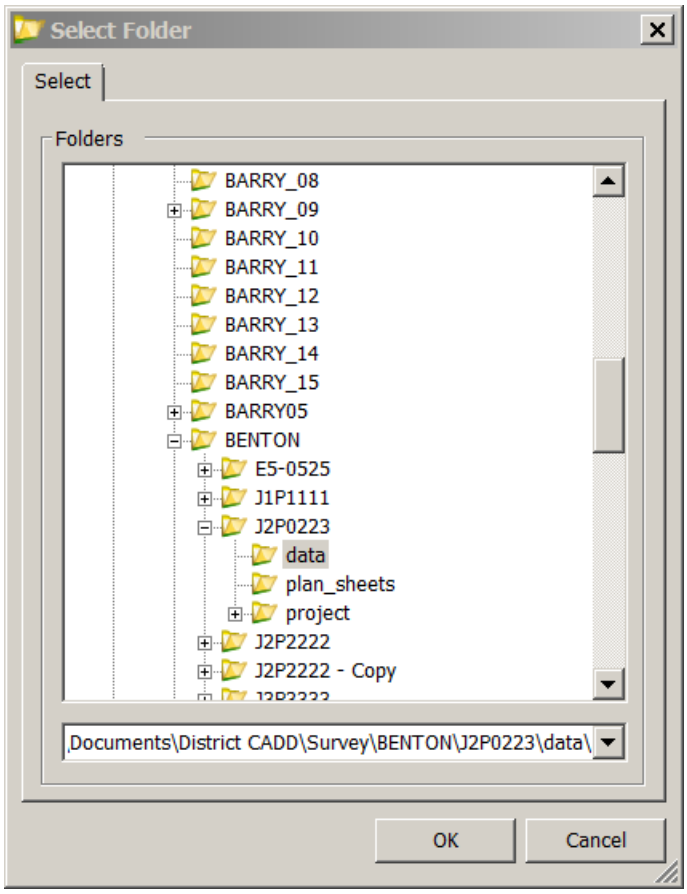
In ProjectWise select the following folder:

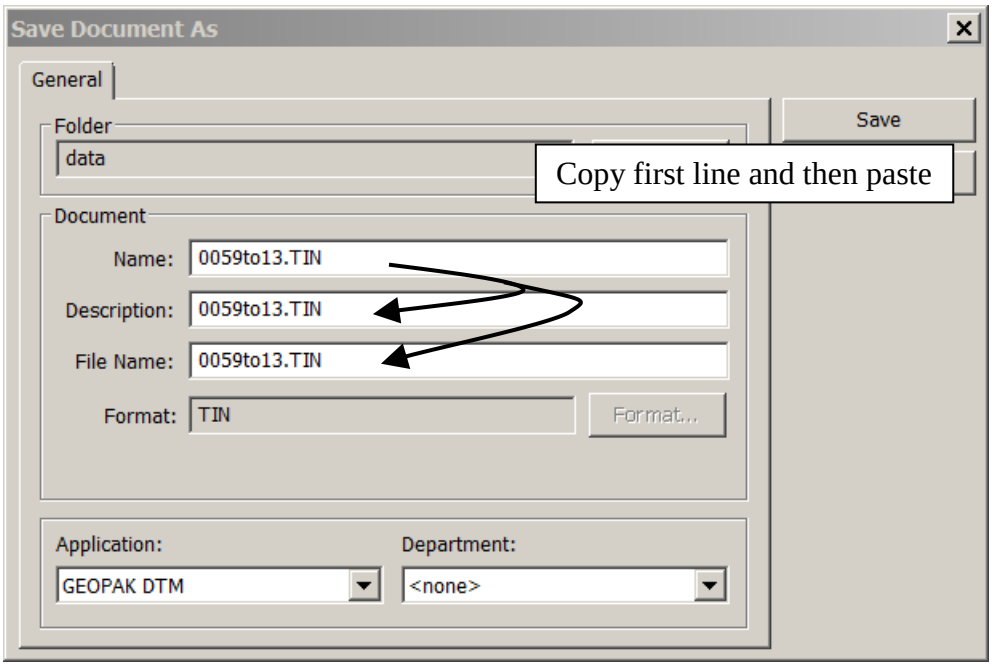
pw:\\
District CADD\
Survey\
BENTON\
J2P0223\
data\

Click OK

Below fill use the following name:

0059to13.tin

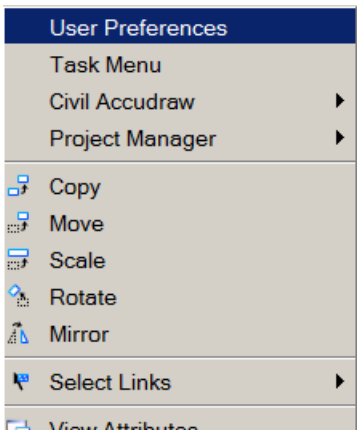




.

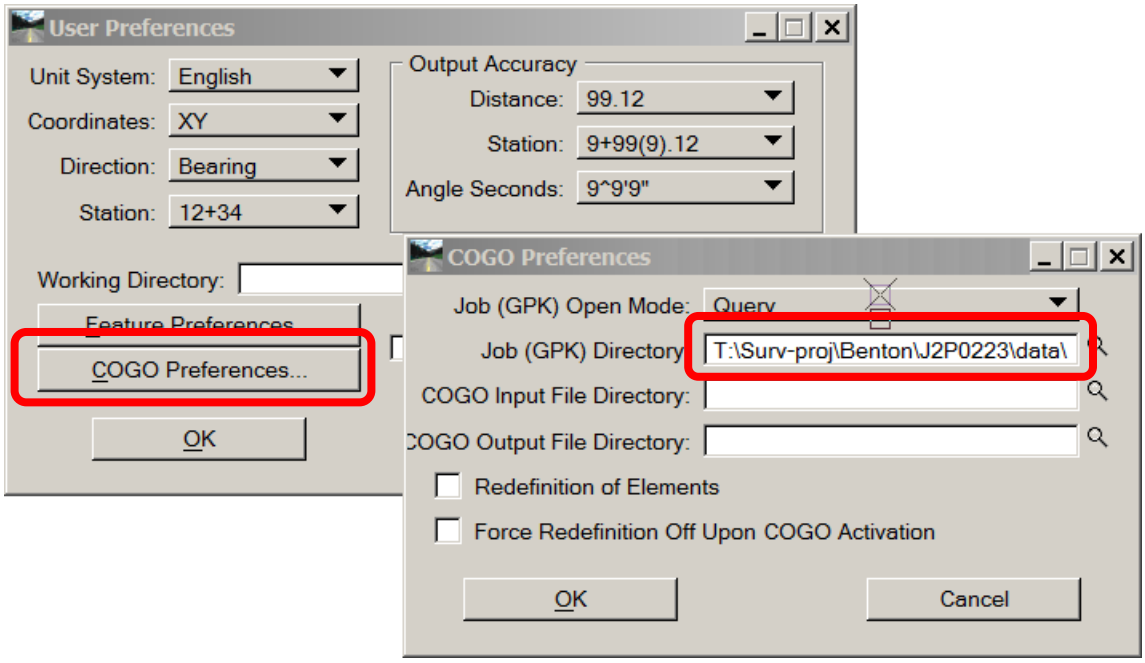
42) Lastly we are going to export the geometry out to a GPK file.

First check the settings in the User Preferences of the DGN file. **Right Click** and hold on any blank area of the DGN window. Then select **User Preferences**.



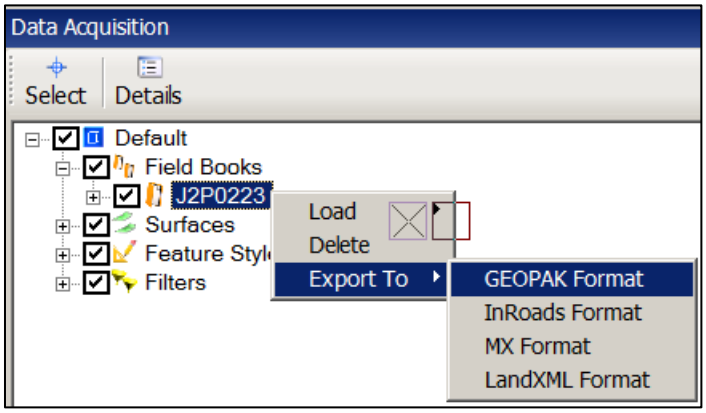
Select COGO Preferences and then define the Job (GPK) Directory as follows:

T:\Surv-proj\Benton\J2P0223\data



Then select "**OK**" to close both dialog boxes.

43) Next select the Field Book **J2P0223** and **Right Click** and select **Export To > GeoPak Format.**

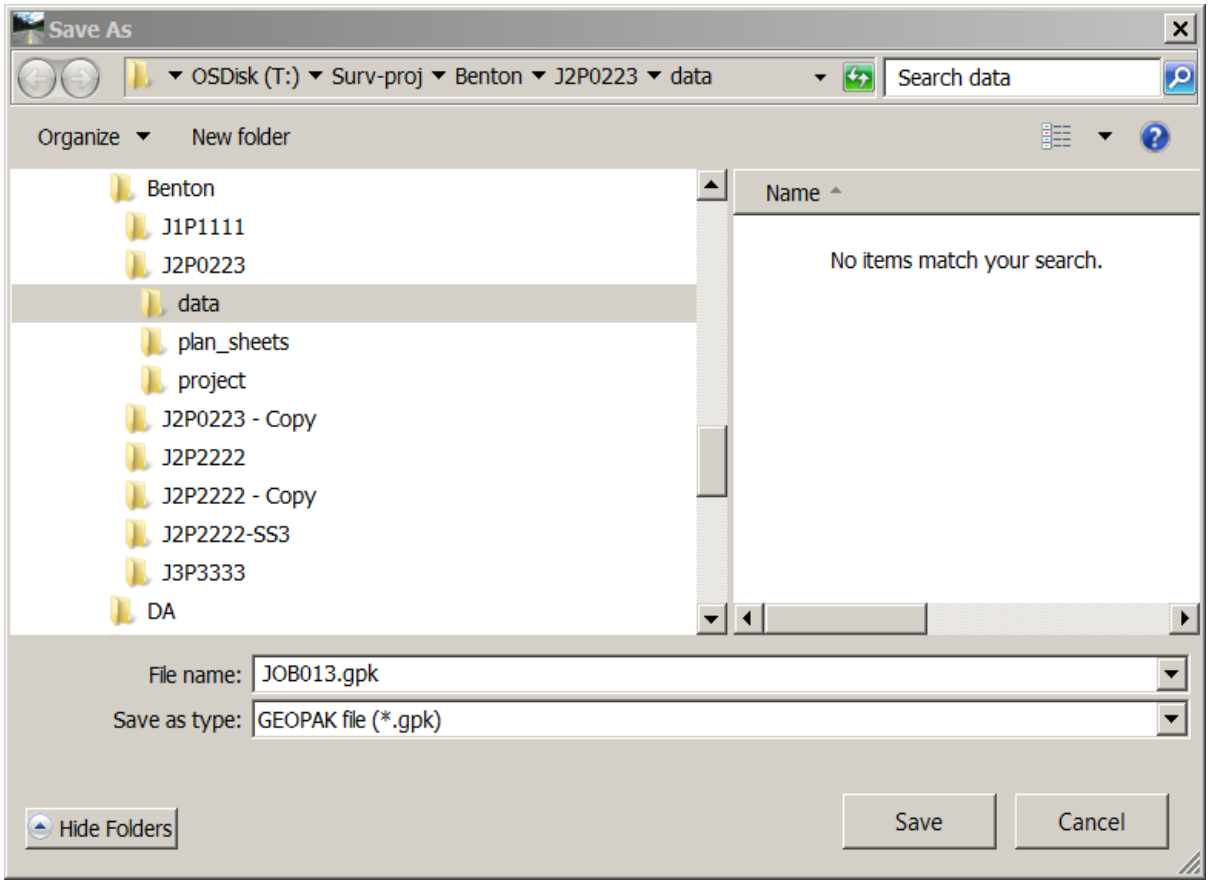


The **Save As** Dialog should be pointing to your COGO (job) directory. Type in the following file name:

JOBxxx.GPK

Where xxx = a numeric value

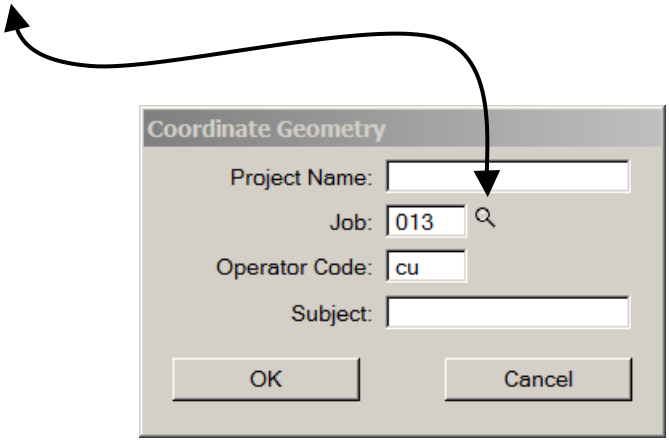
JOB013.GPK



44) Review exported COGO data using GeoPak Coordinate Geometry.

Select **GeoPak > Road > Geometry > Coordinate Geometry**

Use the **Magnify Glass** to the right of the Job field to browse for you newly created GPK.



In Coordinate Geometry use **COGO Navigator** to view you Points and Survey Chains.