CONNECTICUT DEPARTMENT OF TRANSPORTATION

AEC Applications – Division of Facilities & Transit

CTDOT

InRoads SS2 Survey for Designers Workshop

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Survey for Designers Workshop

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Preface

Overview

The goals of the CTDOT InRoads V8i Survey for Designers Workshop are:

To give the designer a working understanding of how survey information is gathered in the field including shot placement, breakline and survey limits.

To improve communication between the Survey and Design units when placing a survey request.

To understand the InRoads workflow, as it relates to how points taken in the field become a DTM and how the MicroStation survey file is created.

To gain a better understanding of the existing DTM including viewing triangles and contours.

The CTDOT InRoads V8i Survey for Designers Guide will identify standard resource files, configurations, and CAD functions used in the creation survey data.

The material covered in this guide does not replace the need for other references and training regarding InRoads software. Additional publications and training may be needed for further clarification of CAD procedures and functions. The intent of this guide is not to prevent or limit individual initiatives and engineering judgment. Rather, it is meant to document standard digital design procedures currently in practice at CTDOT.

The information provided in this guide is subject to change as technology and experience warrant. Therefore, this guide will be updated as major revisions in design software and CTDOT DDE policies occur.

Distribution

This manual, in its entirety, may be freely copied and distributed for the purpose of providing a consistent guide to InRoads Design requirements of the Connecticut Department of Transportation. This manual is available on the web.

Trademarks

"*MicroStation*" and "*InRoads*", are registered trademarks of Bentley Systems, Incorporated. Other trade names, computer protocols, and file formats mentioned in this manual are the trademarks of their respective owners. In no event will the appearance of any graphic, description of a graphic, picture, screen display, or any other method of conveying meaning, be considered to impair the rights of the respective owners.

Prerequisites:

The required prerequisites for installing and using InRoads V8i are listed below.

MicroStation V8i SS 2 Version 08.11.07.492 or higher,

MicroStation V8i SS 3 Version 08.11.09.397 or higher,

InRoads V8i SS2 Version 08.11.07.428 or higher,

This is <u>not</u> configured to work with OpenRoads (InRoads V8i SS 3)

Online Application Help

As mentioned earlier, this manual is not intended to be a sole source of information for the InRoads user. InRoads software has extensive online help available through Help on the InRoads Menu Bar. Additionally, when using the different InRoads dialog boxes, each box has a Help button. These buttons link directly to information specific to the InRoads process being performed. It is generally expected that new or even seasoned InRoads users will need to reference the online help regularly. The best solution to a problem usually requires testing and selecting from multiple options.   Practice and experience using InRoads is the key to becoming a proficient InRoads user. Also, InRoads Help contains a media library with video presentations and examples of standard workflows.

In addition, there is other outside InRoads learning resources for CTDOT users. CTDOT employees can access the internet for help and training on the Bentley Learning Web site:

 http://www.bentley.com/en-US/Training/, or call Bentley directly at *1-800-778-4277* only for SELECTservices or all others call 1-800-BENTLEY.   To access these learning resources from Bentley Systems, Inc., CTDOT employees should contact AEC Applications to have a Bentley SELECT-ID issued to them. However, Consultant Engineering firms need to purchase their own training subscriptions directly through Bentley.

CTDOT AEC Applications has setup InRoads preferences and standardized CTDOT InRoads practices in an effort make using InRoads as productive as possible. If you have questions regarding this manual or the CTDOT InRoads preference files, please contact:

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Section 1   Orientation to InRoads Survey

InRoads Survey provides a vehicle for data transfer and reduction from total stations, GPS, and other raw data sources. It includes a complete set of tools for adjustments, data analysis and editing of raw input data. Also included are tools for coordinate geometry and DTM display. InRoads Survey allows you to save data in geometry and DTM file types for further usage by other applications within the InRoads product group. InRoads Survey has resource files that have been configured with CTDOT standards.

MicroStation is the platform application which allows InRoads data to be displayed. MicroStation and InRoads applications both work together to provide users with CAD functions. For example, InRoads uses MicroStation files to display CAD graphics for a DTM. This guide will outline the InRoads commands that are available to view, display and present InRoads design data in CAD files.

1.1   InRoads File Types

The InRoads road design process uses several different file types. All InRoads data is stored in external files. The CAD file is used to view a graphical representation of the design data, but the graphics files do not store the InRoads Data. For example, if the graphics that represent the horizontal alignment are deleted, the InRoads geometry file is not modified.

The following InRoads resource files have been configured for the V8i Environment:

Preference File (*.xin) - This file contains the control settings of all the dialog boxes within InRoads. The settings for surface, geometry and survey tools have all been confined to one .xin file, replacing the previous two .ini files, .fxp and .fwf files. This is the main source of standardization where all InRoads design and graphical output are configured to meet CTDOT standards.

Template Library (*.itl) – This file contains a storage area for typical sections. A template is comprised of a series of points and components that represent breakline features. These are processed later using the Roadway Designer command. Roadway features that have been processed are then saved to the design surface. CTDOT has two standard .itl files; one for roadway use and the other for airport taxiway and runway uses.

Style Sheet (*.xsl) - All style sheets have been provided by Bentley and are located on the local hard drive, in the Inroads directory under Civil/XML Data. The View XML Reports command allows users to select an .xsl style sheet, which specifies the exact information to pull from the .xml file and how to format it. To further clarify, the .xml file contains raw or computed data; the .xsl file specifies how to format the data into a report.

Drafting Notes (*.dft) - This file is used to enhance the production of final drawings. Use the commands across the design session to place intelligent annotation notes on features and geometry, in the plan, profile, and cross section views, as well as at the intersection of two alignments.

Pay Items (*.mdb) - This file is used with Quantity Manager. Quantity formulas and CTDOT pay items are stored in this Microsoft Access database.

Drainage Structures (*.dat) - This file is used with InRoads Storm and Sanitary. This file has been configured with CTDOT standard drainage structure information, including sizes, shapes, materials, and many other parameters.

Rainfall Table (*.idf) - This file is used with InRoads Storm and Sanitary. This file contains a table of Rainfall/Time of Concentration data that conforms to CTDOT drainage standards.

The following InRoads files need to be created for the project design:

Projects (*.rwk) - This file contains directory and file information for loading and saving InRoads data files. Once the project file is open, all of the specific project files are also opened.

Surfaces (*.dtm) - A Digital Terrain Model (DTM) file is a surface where existing ground and design terrain surface models are stored.

Geometry Projects (*.alg) – This file contains coordinate geometry and alignment information for a specific geometric project.

Survey Data (*.fwd) – This InRoads Survey Fieldbook data file is created by importing survey data from a field data collector.

XML Data (*.xml) - The XML Reports command, available as an application add-in under Tools on the pull down menu, generates XML data files. The XML files are not reports, but contain data that can be formatted into reports by using the View XML Reports command. XML data files are ASCII files that are not formatted as a report for direct viewing. A report is the output generated when users display data from an XML file using the View XML Reports command.

1.2   Resource File Storage Location

The latest versions of all V8i resource files will be kept in the workspace under InRoads_V8i _RSC. The newest V8 level structure resource files will be found in the folder V8_Environment.

1.3   Project Defaults

An organized work environment along with a standardized file management system provides a consistent way to maintain digital design data. These measures decrease the chance that users will create and/or work with incorrect InRoads files. File management also eliminates the creation of multiple copies of the same file. Therefore, a standardized file management system greatly increases productivity by ensuring the availability of correct InRoads files and eliminating duplicate files.

By setting up the project defaults and creating a project file, users can quickly load all files needed for project design. Additionally, the project file helps coworkers load and analyze current design data. The Project Defaults command is used to open resource files including the preferences file (.xin) and drafting

file. This command is also used to set up default directories for all file types that can be accessed through the File/Open and File/Save As dialog boxes. These include Project (.rwk), Surface (.dtm), Geometry (.alg) and Survey Data (.fwd). All other files, which are opened or saved throughout the InRoads program, use the Project Default Directory setting. The project default file directories are stored in the computer's registry on the local hard drive.

The following two methods, automated method and conventional method, can be used for setting up project defaults:

- The **automated method** based on variables, only has one configuration name. Files are opened and paths are driven by the project user's selection when opening MicroStation.   Users can set a windows system environment variable to define a project working directory. Use Project Defaults to set the variable name using the syntax, $(variable) or %variable%.

- The **conventional method** allows each project to have its own Configuration Name based on hard-coded paths. When a particular configuration is saved and users exit the dialog, that configuration is remembered as the "Current" configuration. The next time InRoads is accessed all the directory paths are set according to the last configuration used. If the project has been changed, users will need to select the corresponding project configurations. This means a configuration name will be needed for every project that the user is working on.

1.4   Start Up - *Lab 1*

A. **Open** *Windows Explorer* and **Browse** to your projects folder, example: **X:\999_Student_HIS##.**
   Within your project folder create the folder **SURVEY** under the 'Highways' setting <u>for this</u>
   <u>workflow only.</u>

CTDOT_Projects (SH3DGS18) (X:) ▸ 999_Student_HIS01 ▸ Highways ▸ Survey

B. Again in *Windows Explorer* and **Browse** to the *CTDOT V8i workspace*, **copy** the following files to
   the SURVEY folder just created, example: **X:\999_Student_HIS##\Highways\SURVEY\.**

   W:\Workspace\InRoads_V8i_RSC\V8_Environment

   ➔ **CT_civil.XIN & CT_notes.dft**
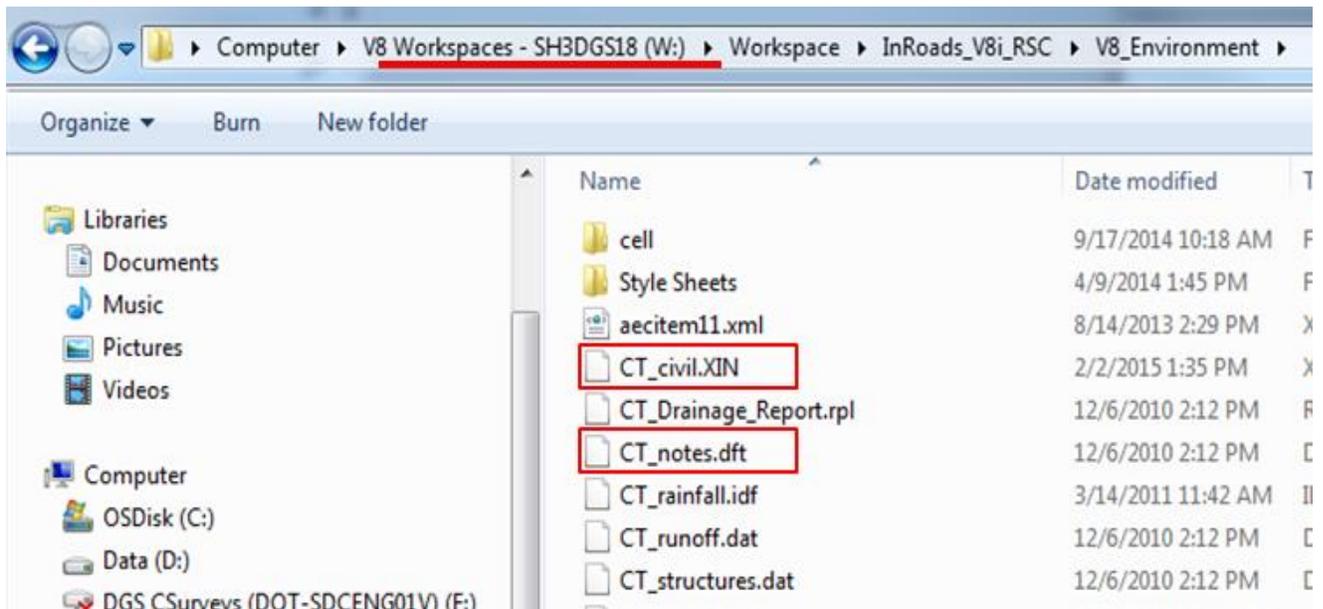
C. Double-Click on the **Accounting** icon located on your desktop.

D. Select the "MicroStation" program under Run Program to open MicroStation. From Available Accounts pick **OVERHEAD**, for this class only. No Resource Type: needs to be picked. Click **Start**.
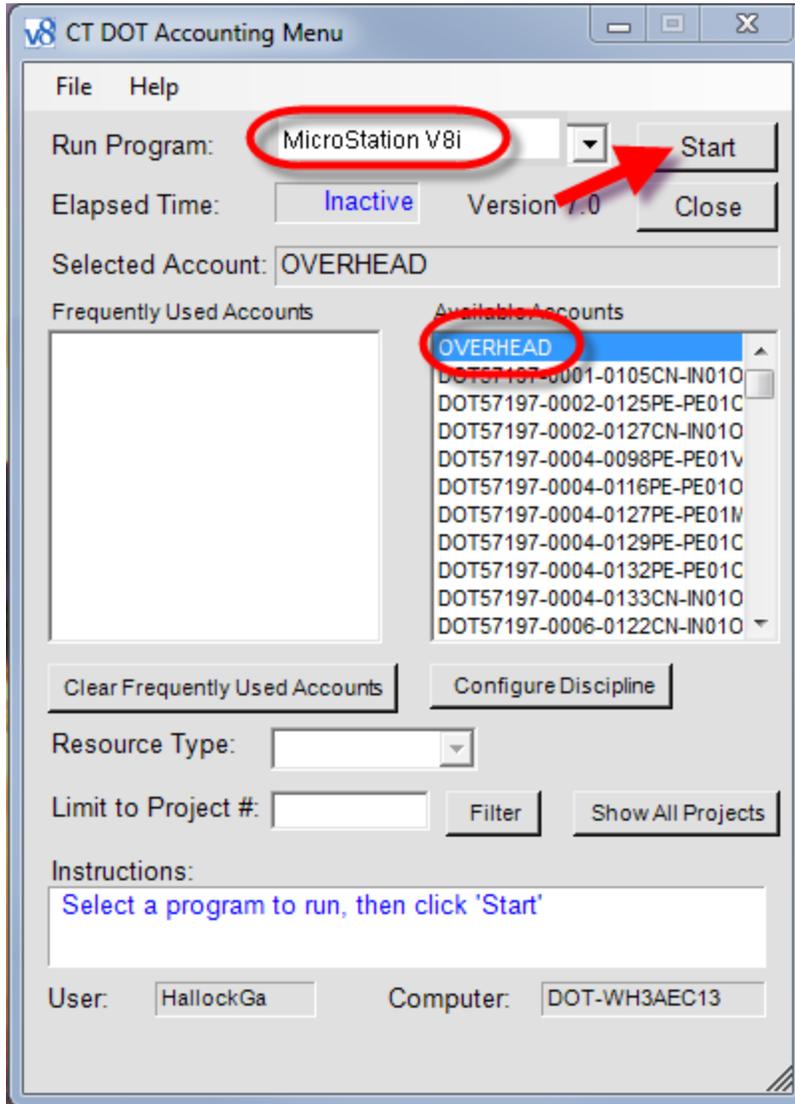
E. In the File Open box, pick your interface and user preferences, then pick your project folder, all training folders start with: **999_Student_HIS** and a two digit number. The instructor will assign you your project.
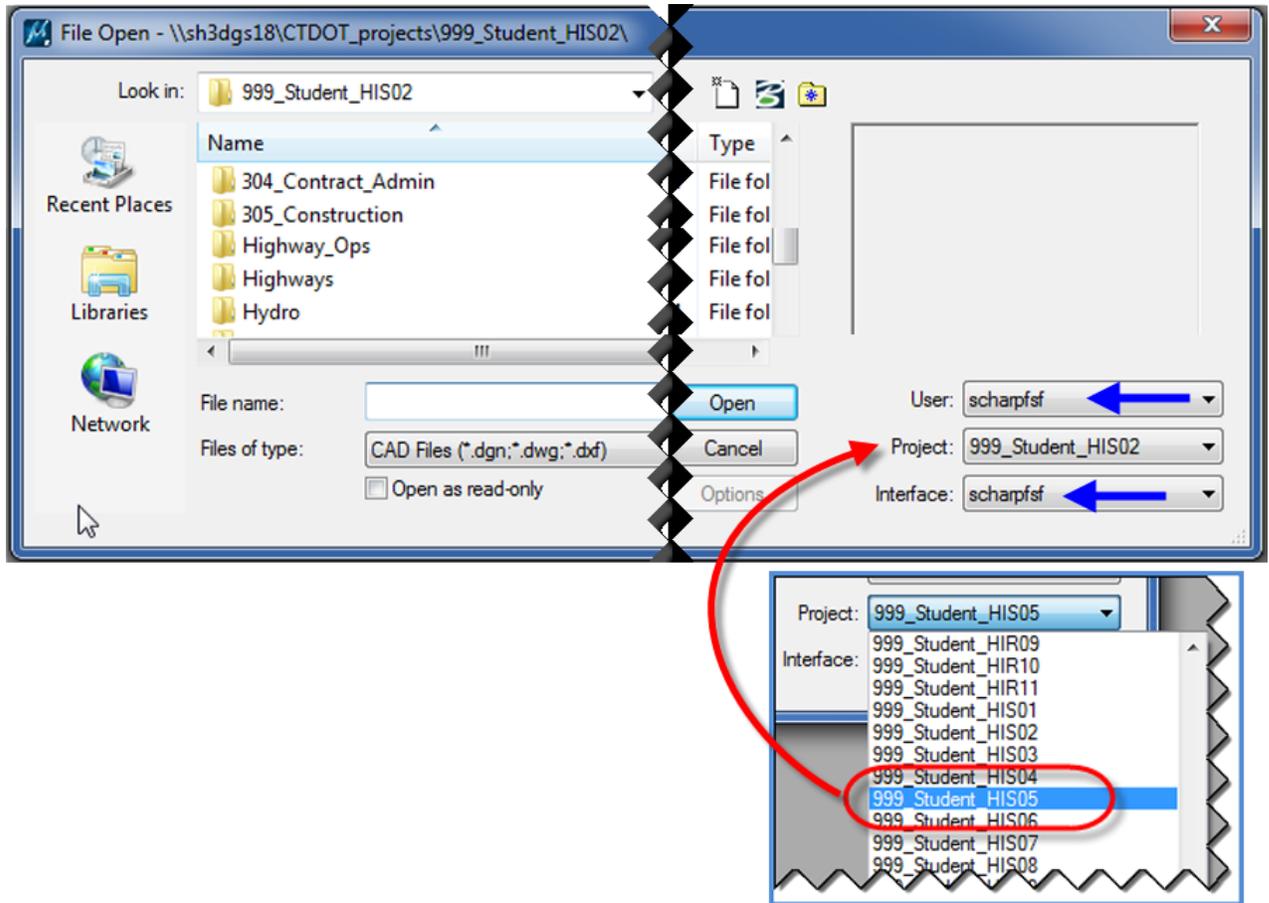
F. Go to the **Survey** folder and select the **"New File"** icon to create a new MicroStation file.
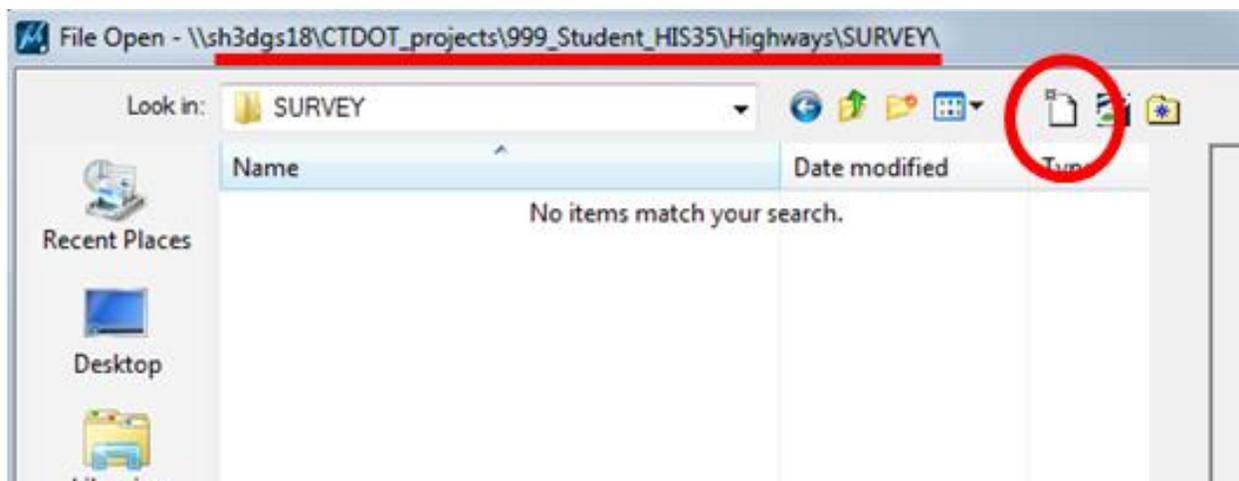
G. In the New dialog box select '**Browse**' button and go to:
    W:\CTDOT_Standards\Workspace\Standards\seed\SV_Design_Civil_3D_V8i.dgn and click
    Open.   Back in the 'New' dialog box **type in** a file name (**SVY_HWY_DEMO_2015**.dgn) and
    select the **Save** button.
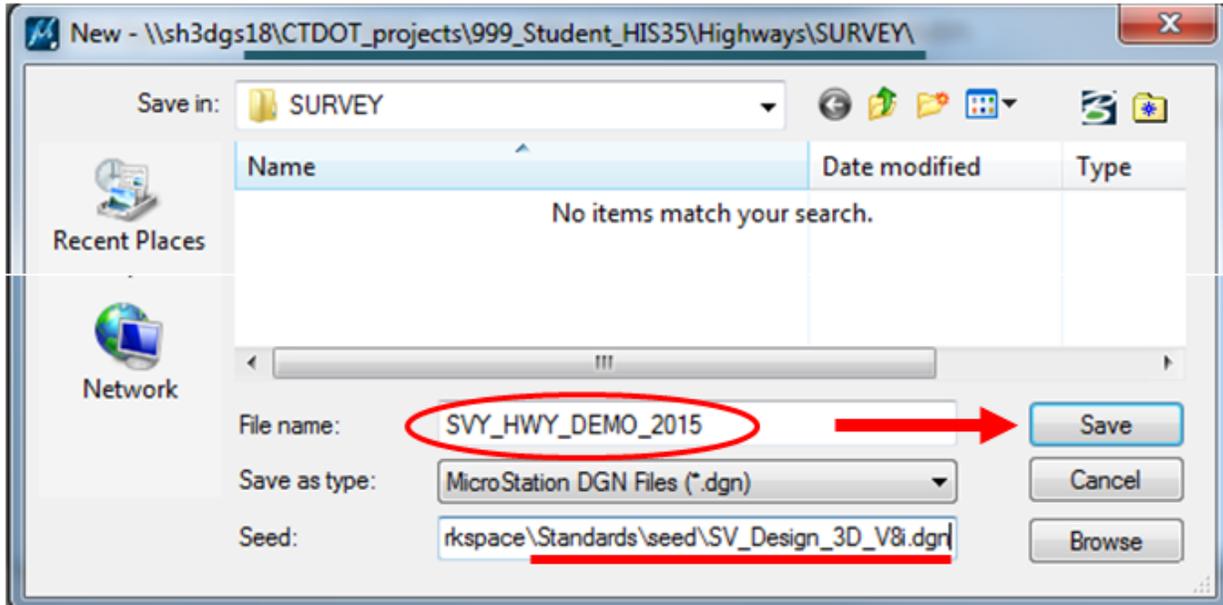
H. In the 'File Open' dialog box select the file that was just created (**SVY_HWY_DEMO_2015.dgn**)
    and select the **Open** button. MicroStation will open.
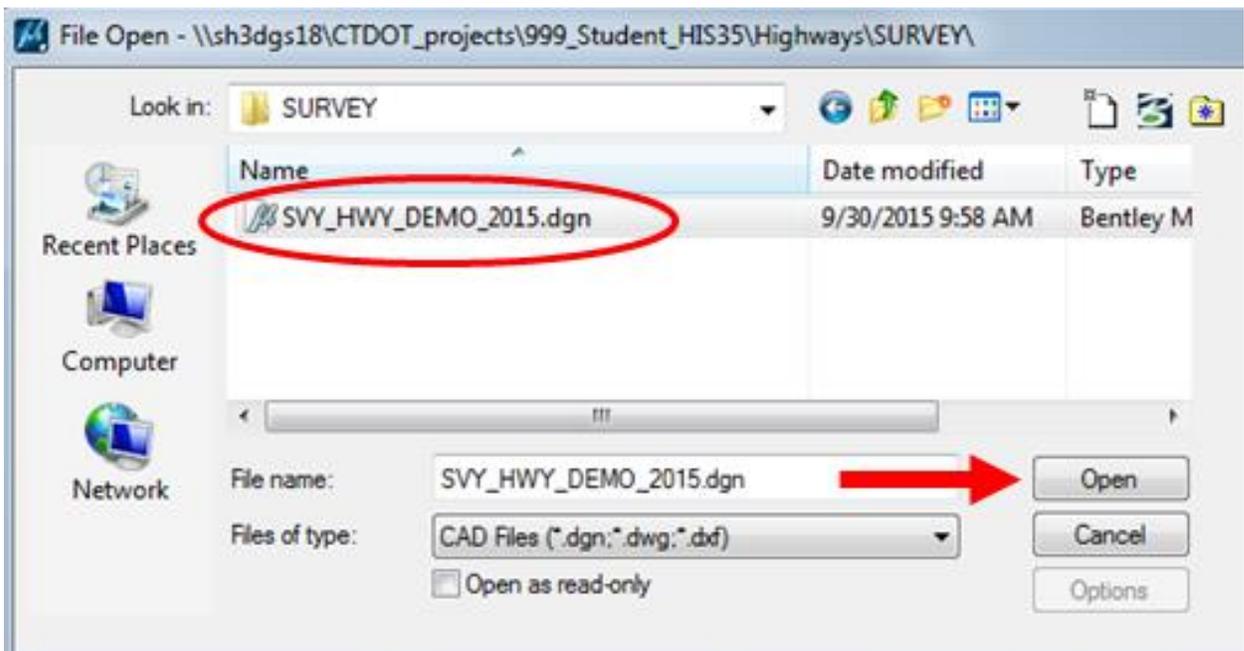
I.   From the MicroStation main menu select **Element > Cells.**
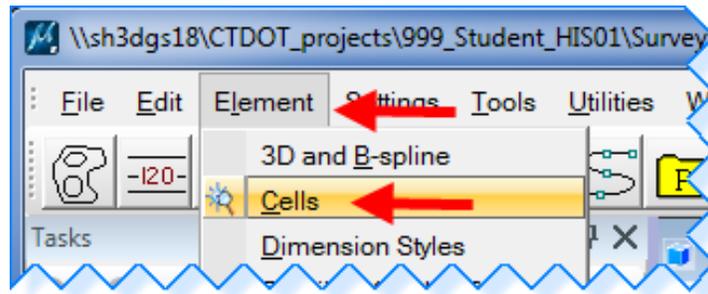
J.   On the Cell Library Dialog box select **File > Attach File… > Attach Cell Library**. Browse to **W:\Workspace\InRoads_V8i_RSC\V8_Environment\cell** and select **SV_V8_LEVELS_40e.cel**, double-click or click Open. **Close** the cell library box. In MicroStation click on **File > Save Settings**.
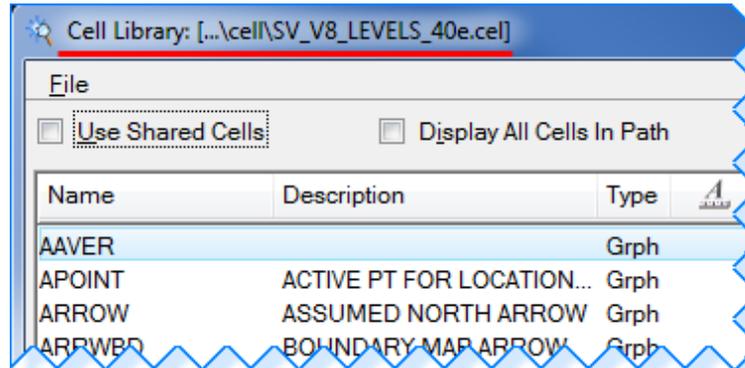
K.   From the MicroStation main menu select **Applications > InRoads Group > Activate InRoads Suite** and InRoads will open. Make sure **'Survey'** is on the InRoads main menu.
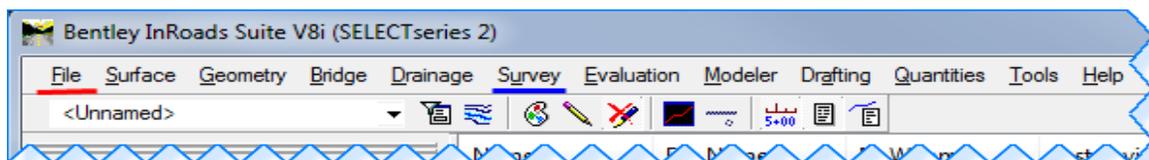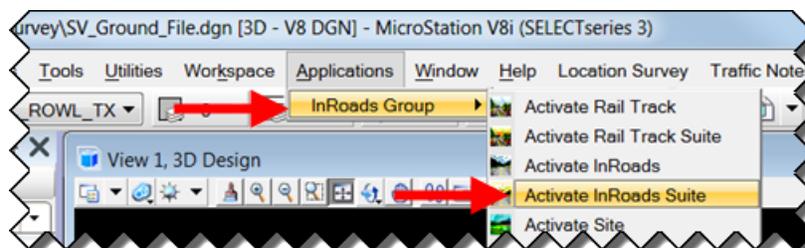
L. To set-up the project defaults we will be using the conventional method. From the InRoads main menu select **File > Project Defaults**. The **'Set Project Defaults'** dialog box will appear. Click **New…** In the 'New Configuration' box type in: **SVY_HWY_Demo_2015.** Click **OK**.
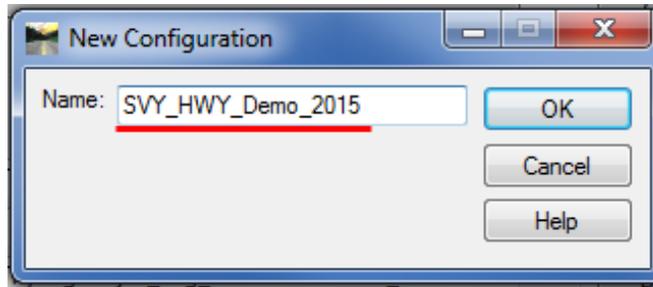
M. Back in the Set Project Defaults box, under the 'Default Preferences' **Click** within the **Preferences (*XIN)** field and Click on **Browse,** go to:

> **X:\999_Student_HIS##\Highway\SURVEY\CT_civil.XIN and click Open.**

N. Now click within the Drafting Notes (*dft) field and click on Browse, go to:

> **X:\999_Student_HIS##\Highway\SURVEY\CT_notes.dft** and click Open.
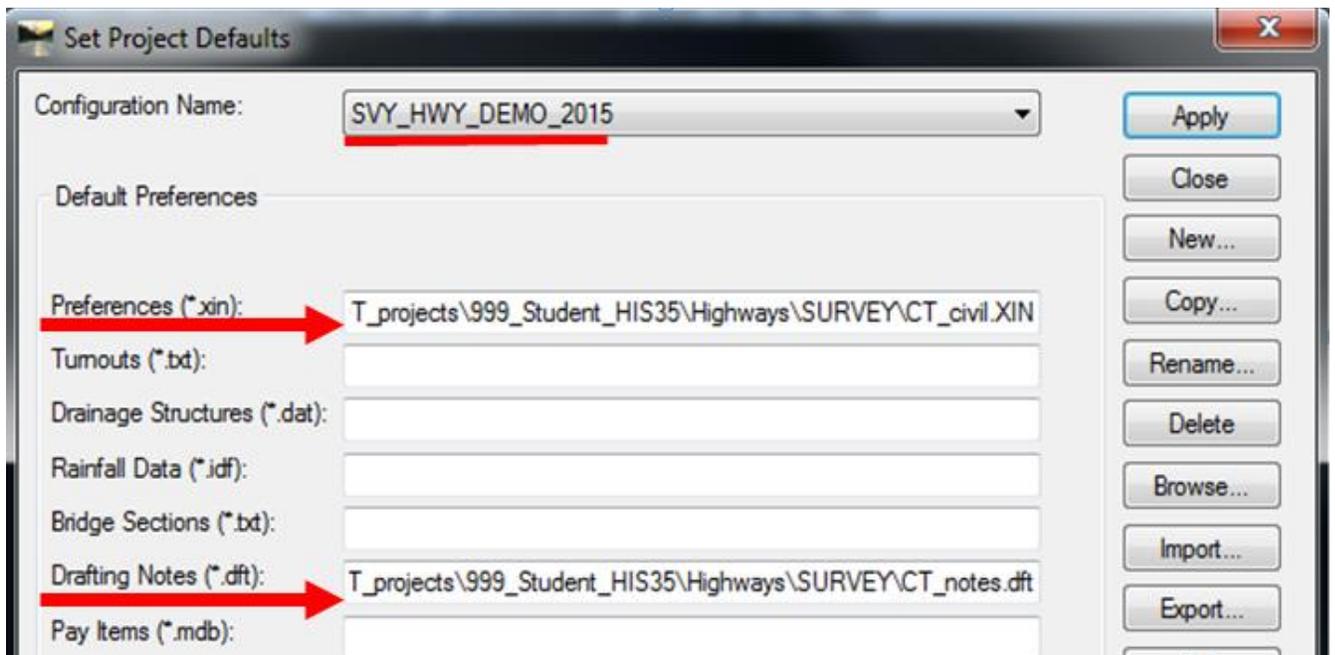
O. Now we will set the 'Default Directory Paths' for our project. Click within the **Project Default Directory:** field, click the **Browse** button and go to your project folder: **X:\999_Student_HISxx\Highway\SURVEY**; click **Open**. Now copy this line into the other fields. See Figure below, your Set Project Defaults box should look same.
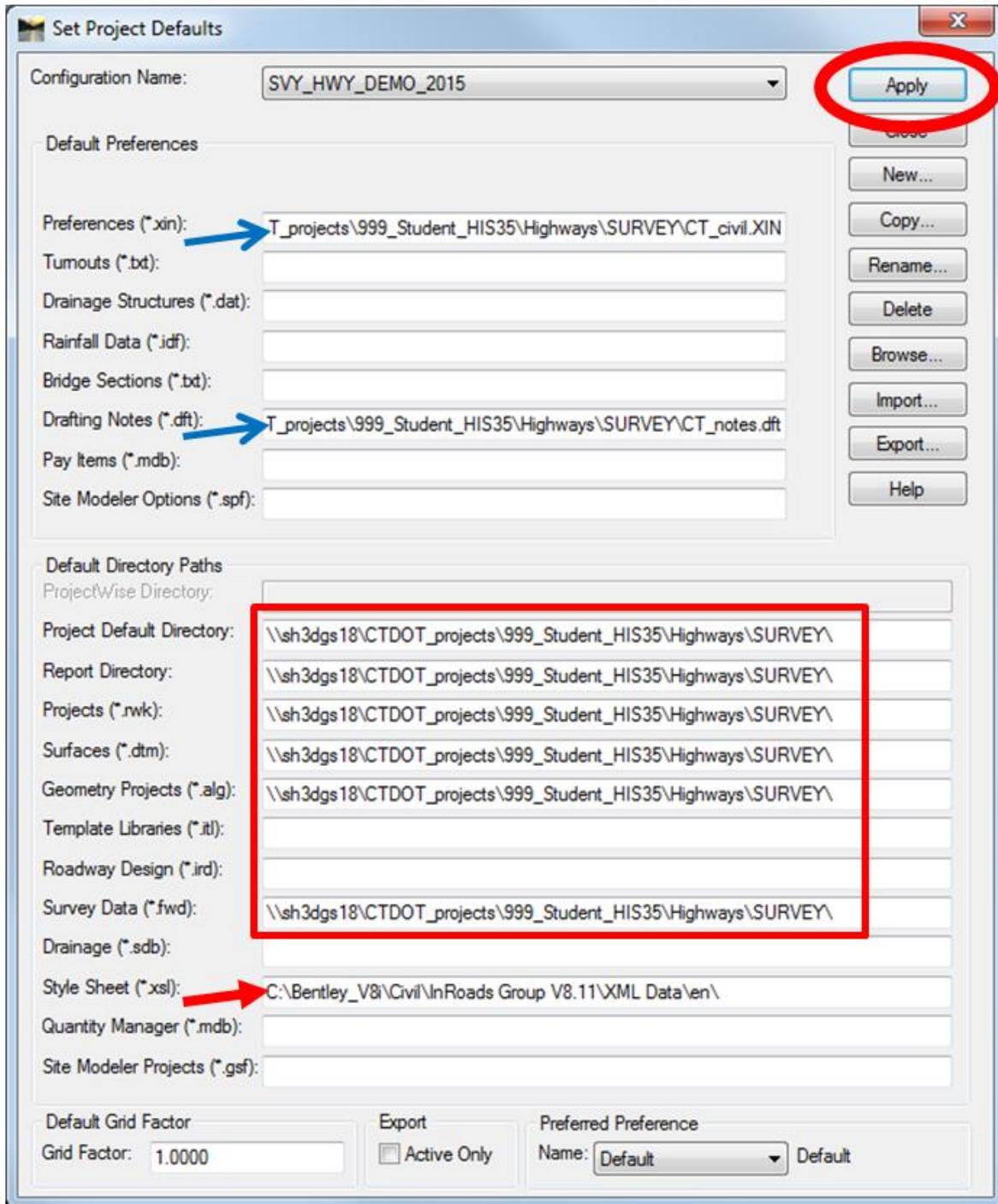
P. For Style Sheet (*xsl): Browse to: **C:\Bentley_V8i\Civil\InRoads Group V8.11\XML Data\en**, click **Open**. All paths have been set. Now click on **Apply** and **Close**.

Q. From the InRoads Menu Bar "reselect" **File > Project Defaults**. At the bottom of the dialog box select **Survey** for the Preferred Preference.   Click **Apply** and **Close**. One more time open Project Defaults to ensure Preferred Preferences are set to Survey.
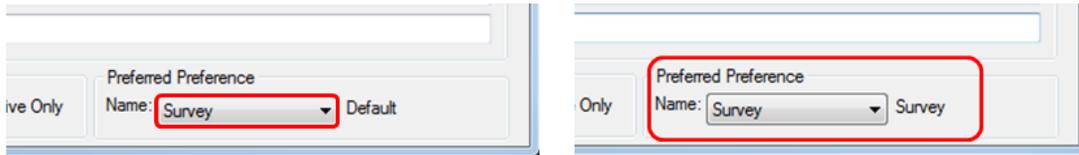
R. Next from the InRoads Menu Bar select **File > Project Options….** At the bottom select **Preferences…** . The Preferences should already be set to Survey. Close both.
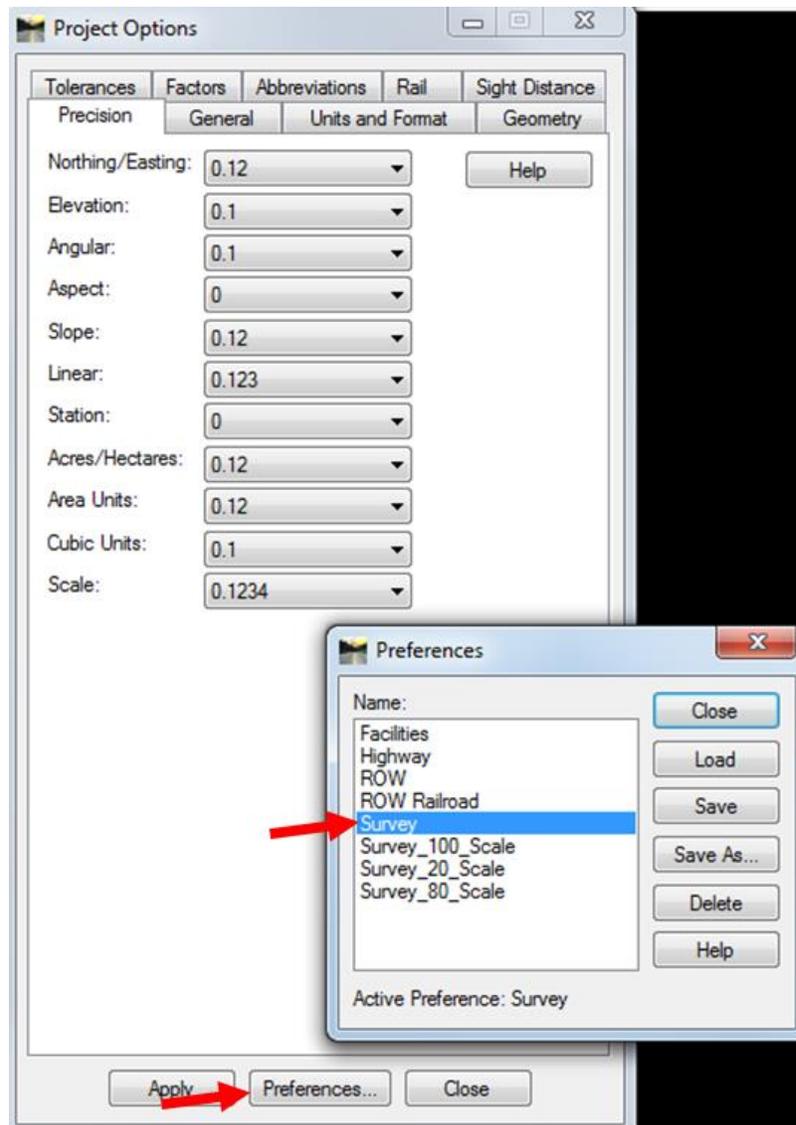
S. On the InRoads Interface right click next to Help and select **Locks**. One more time and select **Customize…**.
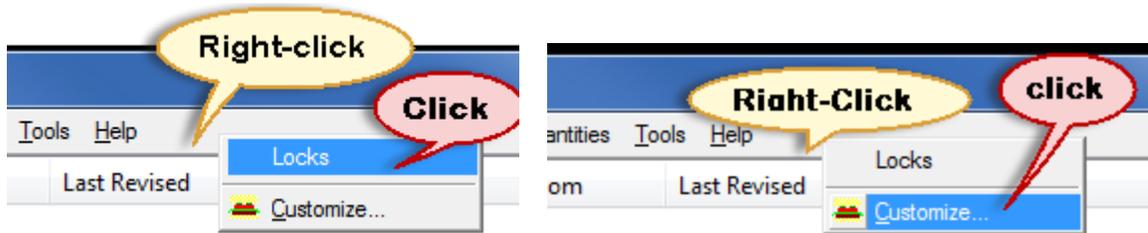
T. On the Customize dialog box toggle on **Survey** and **View Survey Data** and click **Close**. Dock the InRoads Menus.
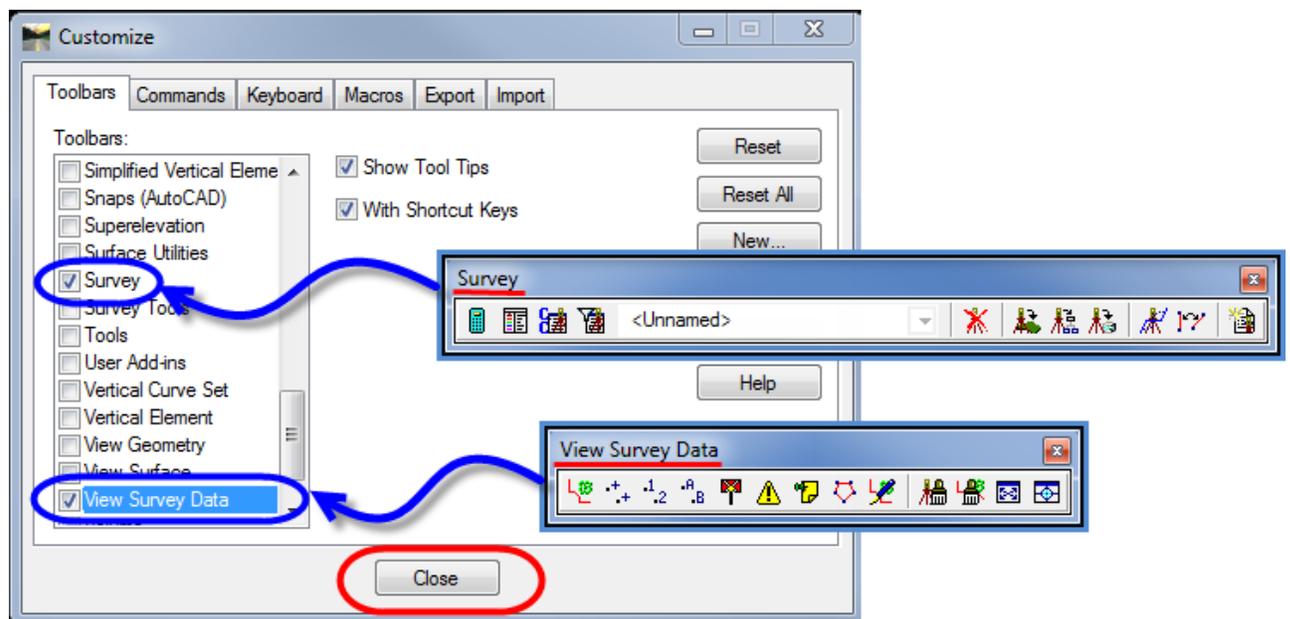
U. You completed **Lab 1 - Start Up**.

Section 2   Electronic Survey Data

2.1   Importing Survey Data - *Lab 2*

A.   In InRoads Menu/Interface select **File > New.** , click on the **Survey Data** tab. In the name field type in: **SVY_HWY_Demo_2015**. Click **Apply** and **Close.** In your InRoads interface click on the Survey tab (bottom of interface) under Survey Data your file should show.
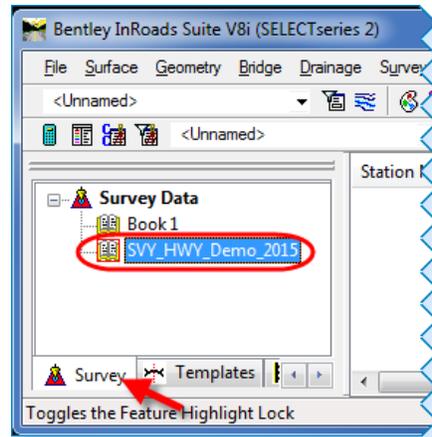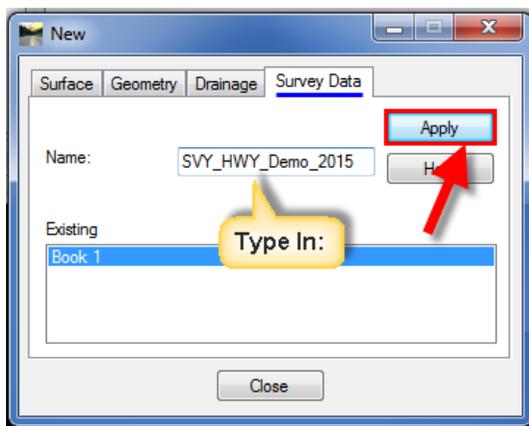
B.   Now you have to save your survey data (*fwd) file. From the InRoads menu select **File > Save As,** for **Save as type:** select **Survey Data (*fwd)** from the pull down menu.   For **Active:** select **SVY_HWY_Demo_2015**. This should populate the 'File name:' with: **SVY_HWY_Demo_2015.fwd**. Click on **Save,** then Click **Cancel** to close the box.
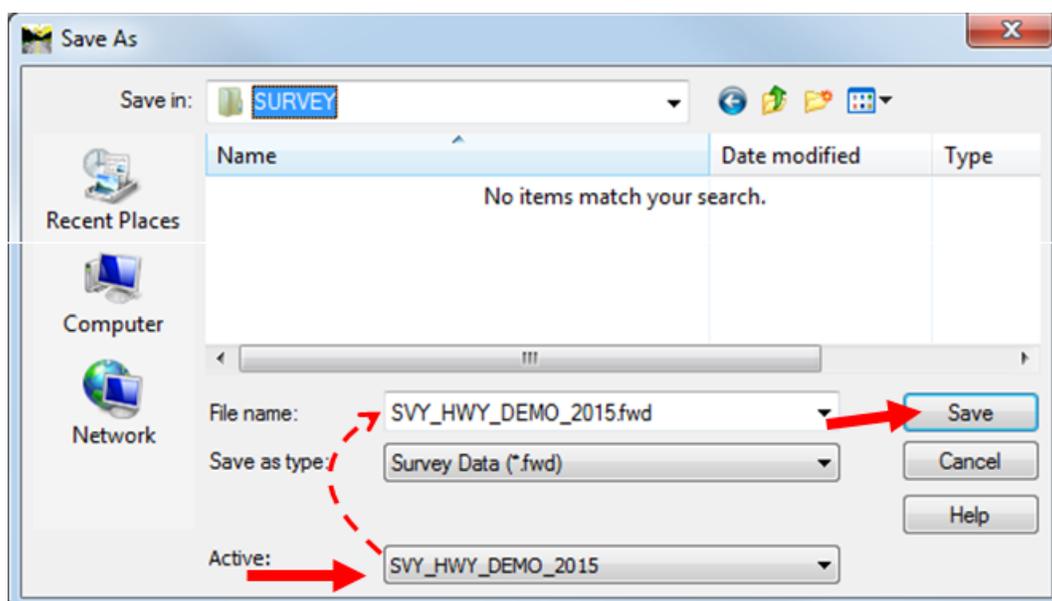
C. Next you will import survey data to your field book. Click on **File > Import > Survey Data...**
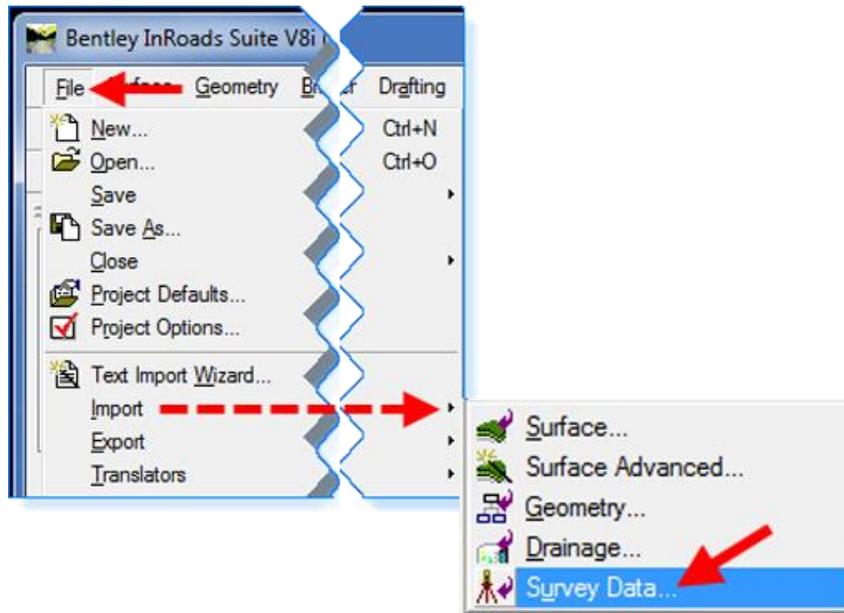

D. In the Import box, find your project folder in the '**Look in**:' box and go to your project s Survey folder, for this lab: **X:\999_Student_HIS##\Highway\SURVEY**. Next for '**Files of type:**' select **TDS(*rw5)** (1); highlight/select the file: **SVY_HWY_Demo_2015.RW5** (2); now click on **Import** (3). The Import box will disappear and reappear. After the Import box reappears click **Close.**

E. In the InRoads menu, click on your Survey Data: **SVY_HWY_Demo_2015** and it should populate. Also in your MicroStation view your survey should show, zoom in to better see it.
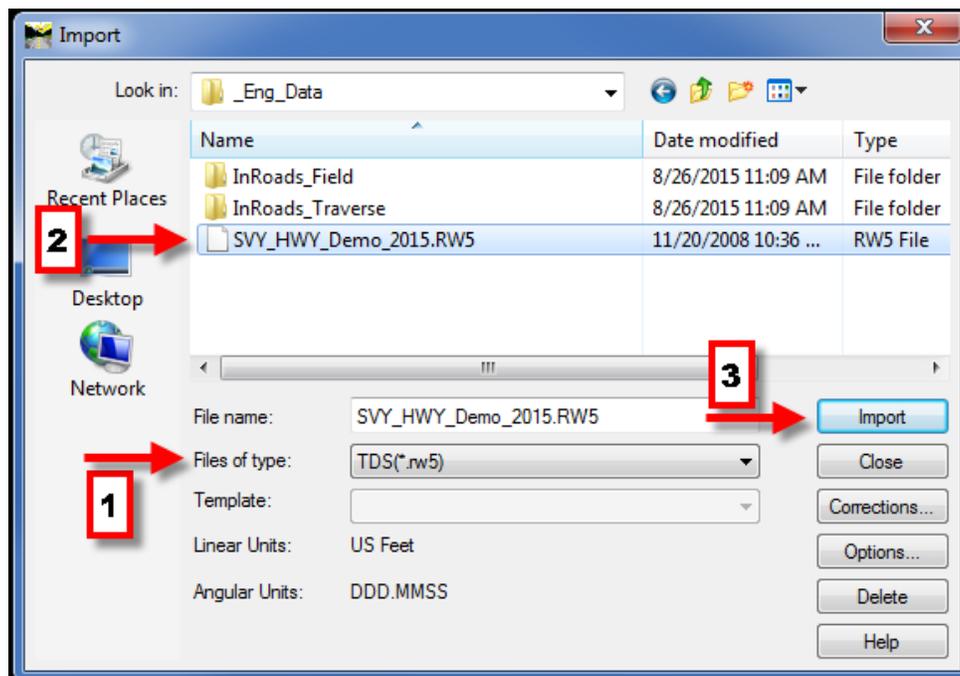
F. In the InRoads menu click on **Tools > Survey Options…** see figure below to set your Survey Options box.
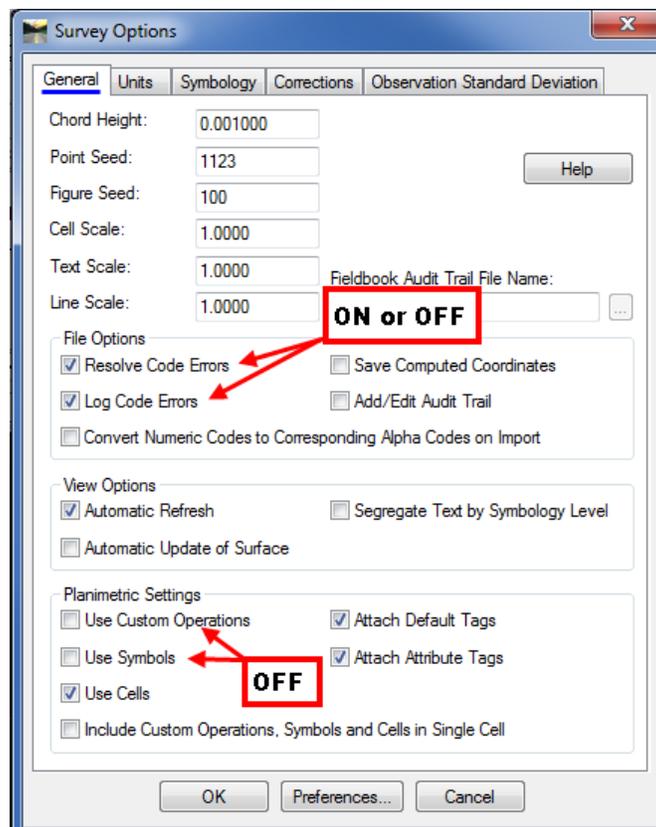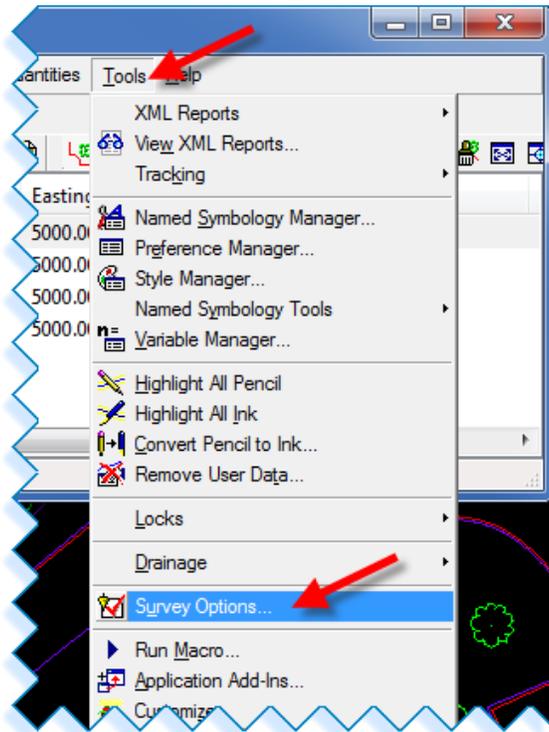
2.2   Fixing Code Errors

2.2.1   Fieldbook Data Dialog Box

This command lets you manage your field data. You can add, edit, delete, and find stations and observations with the resizable Fieldbook Data dialog box. The Stations List contains occupied stations. Selecting a station in the Stations List affects the Observations List. The Observations List contains observations that were shot from the station points.

2.2.1.1   Stations List

Station Name - indicates the name of the occupied station. Stations are listed in the order in which they were gathered in the field.

Northing - indicates the northing coordinate for each station.

Easting - indicates the easting coordinate for each station.

Elevation - indicates the elevation for each station.

Code - indicates the control code associated with each station.

Status indicates the relevant status code(s) for each station. The status codes are:

N - the point has Notes.

E - the point has been Edited.

F - the point is a keyed-in (Fixed) coordinate.

A - the point has Attributes.

V - at least one of the attributes has a Value.

I - an Inserted point.

C - an adjusted point.

Backsight Point - indicates the name of the backsight point for the selected station.

Backsight Direction - indicates the backsight direction from either a north or south azimuth

Instrument Height - indicates the instrument height for each station.

Notes - indicates notes for the selected station.

Attributes - indicates attributes for the selected station.

2.2.1.2   Observations List

Point Name indicates the name of the observation. When you open or import a survey data file, if a fixed point is encountered that has the same name but different coordinates from a previously encountered fixed point, the name of the second occurrence of the point is assigned a suffix of _1. The suffix for each subsequent occurrence is incremented (_2, _3, and so on).

Northing - indicates the northing coordinate for each point.

Easting - indicates the easting coordinate for each point.

Elevation - indicates the elevation for each point.

Code - indicates the feature code(s) associated with each observation.

Status indicates the relevant status code(s) for each observation. The status codes are:
N - the point has <u>N</u>otes.
E - the point has been <u>E</u>dited.
F - the point is a keyed-in (<u>F</u>ixed) coordinate.
A - the point has <u>A</u>ttributes.
V - at least one of the attributes has a <u>V</u>alue.
I - an <u>I</u>nserted point.
C - an adjusted point.

Horizontal Observation - indicates the horizontal angle for each observed point.

Vertical Observation - indicates the vertical angle for each observed point.

Slope Distance - indicates the slope distance to each observed point.

Target Height - indicates the height of the prism above the observed point.

Notes - indicates notes for the selected observation.

Attributes - indicates attributes for the selected observation.

2.2.2   Point Codes

Each station or observation in the field book is assigned a point code. The point code consists of two parts, an alpha/numeric code and a control code. By assigning an alpha/numeric code to a particular station or observation, that point will be associated to one or more styles listed in the Style Manager (part of the *.XIN file). By assigning a control code to a station or observation the construction of the planimetric graphics (arcs and line segments) related to that point are determined. The process of combining alpha/numeric codes with control codes is called point coding. Surveyors typically record point codes in the field. In *InRoads Survey*, the point codes are activated from the Field Book Data dialog box by right-clicking in the Stations list or the Observations list. The alpha/numeric codes and control codes embedded in the field book data, act in concert to define the construction and symbology of planimetric figures.

Control Codes describe geometric relationships among stations/observations in the field book. There are 15 control codes in *InRoads Survey*. Control Codes entered incorrectly in the field can to be edited and fixed in the Field book.

Feature	Description	Control Code
Start	Start a line	ST
Close	Close an object	CL
Point of Curvature	Start a curve	PC
Point of Tangency	End a curve	PT
Exclude from Triangulation	No DTM information	DNC
Random	Random point type in surfaces generated by Survey Data to Survey	RND
Rectangle	Form a rectangle based on two shot points and a taped distance	RECT
Close Rectangle	Close a rectangle based on three shot points	CLSR
Nontangent Curve	Use in conjunction with the PC and PT to specify a nontangent curve	NT
Join Point	Join to a specified point number	JPT
Join Nearest Code	Join to the nearest previously shot specified code	JNC
Distance	Form a closed or open shape based on two shot points and taped distances	DIST
Template	Set up a template to run multiple linear features	TMPL
Cross Section Code	Cross section code	XS
Add to Adjustment Set	Defines a foresight unknown point to be included with adjustments data	ADJ
Extend Arc	Closes an arc with another arc based on three field points, creating a circle	EXTARC

2.2.3 Style Manager and Alpha/Numeric codes

The XIN file allows the user to create a feature usable by all areas of the product. Survey point data is typically composed of two key aspects:

- *Point location (Northing, Easting and Elevation)*

- *Physical characteristics of the object being recorded (Style Manager).*

Each Survey Style has been predefined with CTDOT standard properties including:

- *Named Symbology (color, line weight, line style, cell, text size and font)*

- *Codes - Alpha Codes and a Numeric Code.*

- *Custom Operations*

A style is associated with a particular station or observation in the field book only when the appropriate *alpha/numeric code* is used and the *CTDOT XIN* is loaded.   A point entered in the field with the incorrect code will not have the correct style or have no style associated to it when it is imported into the InRoads Fieldbook.

The object's physical characteristics are modeled in the style. In other words, styles define symbology (and more) for representing various real-world objects.

Example – Suppose a utility pole was shot at a certain point. The surveyor wishes to place a cell to represent the utility pole in the CAD file at the point location. A style has been created that controls which cell is placed at the point, the cell scale, rotation of the cell, level of the cell, and so on.

Example – Suppose a series of points representing an edge of pavement has been collected. A style has been created that controls the color and line style of the graphics representing the edge of pavement.

The previous examples contain what are considered generic properties (cell, line style, level, color, and so on). The surveyor often records more specific physical characteristics, and the style can model these specific characteristics using attributes and custom operations, as in the following example.

Example – Suppose a manhole was shot at a certain point. In addition to a cell at the point, the surveyor records an ID number of the manhole, as well as incoming and outgoing invert elevation. A style has been made that controls the cell, and also recognizes three specific attributes (manhole ID number, invert in, and invert out). Then using custom operations in *InRoads Survey*, data related to the three attributes can be displayed for each manhole shot.

Associating stations/observations with styles is part of the process called point coding.

2.3   Edit Survey Data - *Lab 3*

A. Select **Survey > View Survey Data** and **click** on **Names**. In the MicroStation view window the Point Names will now show.   (Even when zoomed in they are very small.)
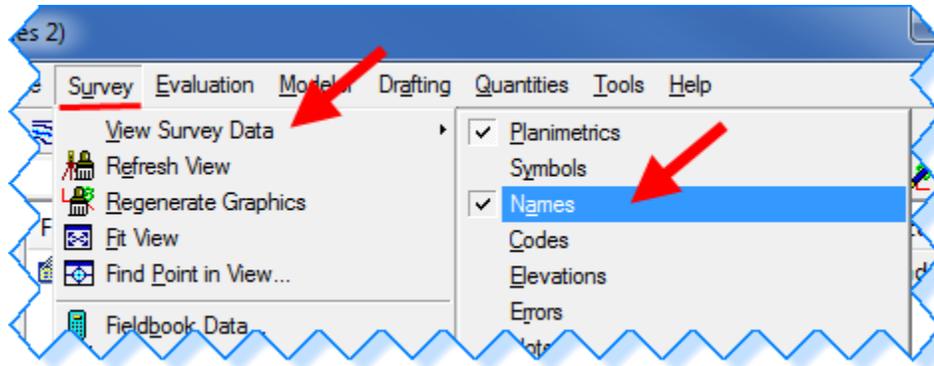
B. Select Survey > Find Point in View.
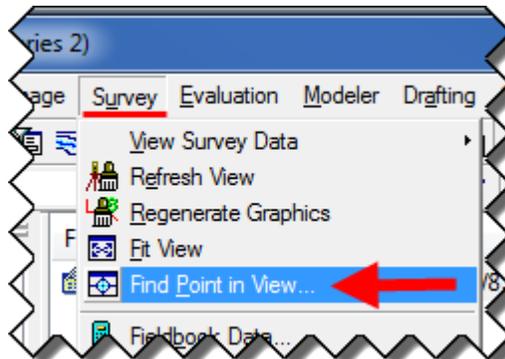
C. When the Find Point in View dialog appears, **enter** the **point number 184** and **radius: 2** (feet) and click **Apply**. This will center the point to the screen and everything that is within a 2 ft. radius.
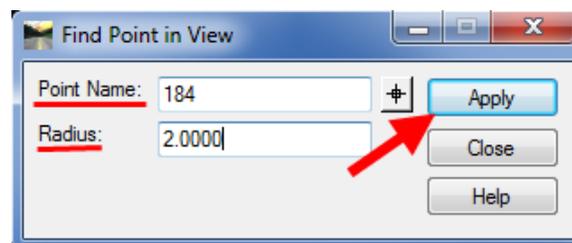
D. Select the **Survey > Fieldbook Data…** from the Survey Menu.

E. After the Fieldbook Data dialog appears select the **'selector button'** from the Observation section this will cause the dialog to minimize and InRoads will prompt you to identify a point. Data point near point # 184. The minimized dialog might be covering the prompt, just move it out of the way.

F. The Fieldbook Data dialog will display again with the point 184 selected. **Right-Click** on the highlighted line and select **Edit…**

G. The **Edit Observation** dialog box will display. In the Code field after 507 type in **ST PC** and click **Apply**. **Click Close**.
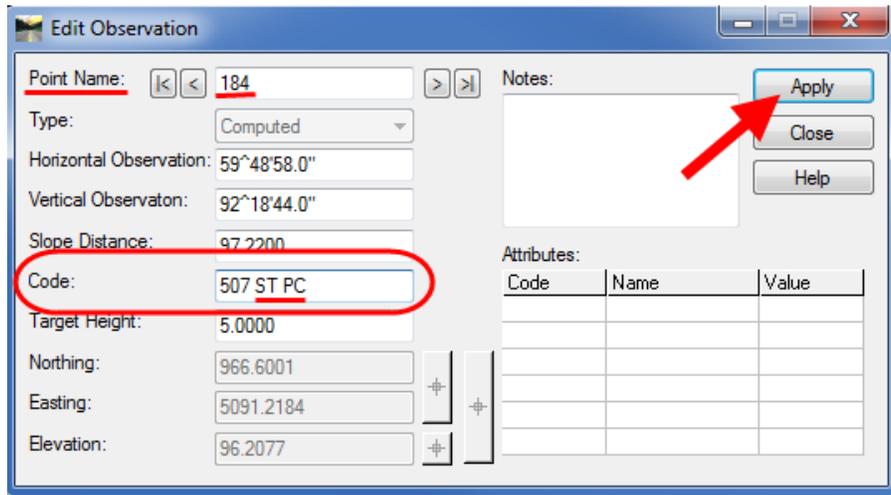
Note: Planimetric figures in InRoads Survey are graphical representations of objects with linear characteristics as shown in this first edit. The Feature Style used for a row of shrubs is named SHRUB ROW and has been created with a Numeric code 507. To begin a planimetric figure on a particular station or observation, a code plus the designated start control code: **507 + ST PC** must be specified. Any subsequent station or observation containing the code 507 is included in the planimetric figure until another ST code is encountered.

Features like catch basins and manholes are not typically part of a planimetric figure because they are usually single shot points that have cells or attributes representation, so this point has no start code.
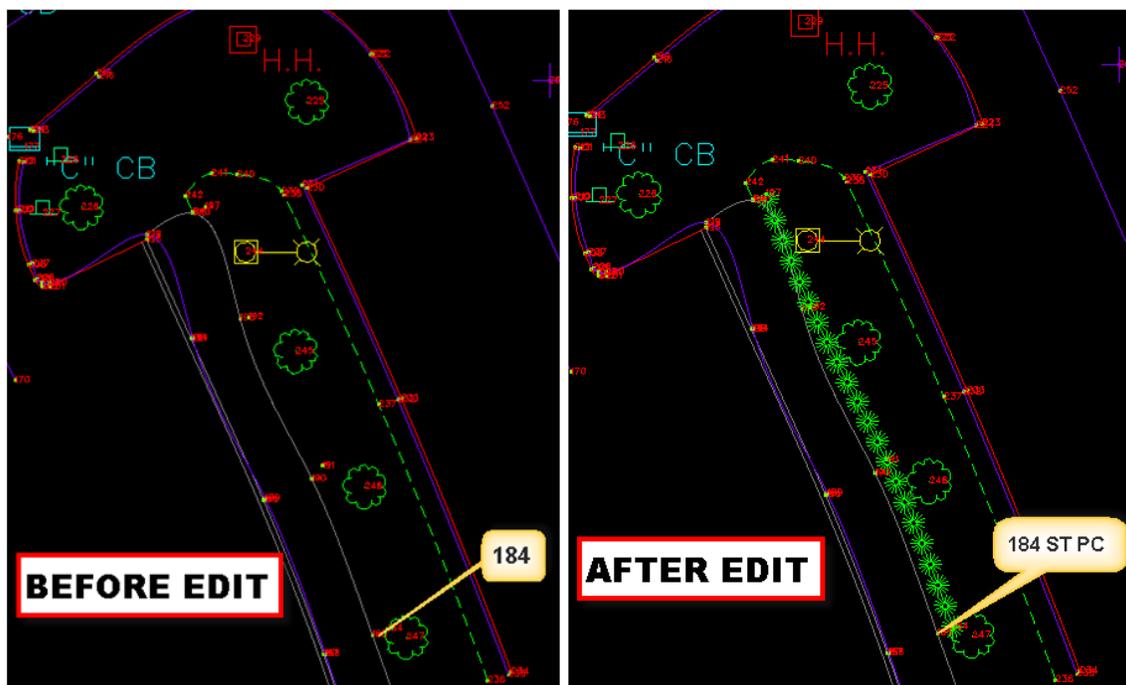
Now two more points will be edited.

H. In the Fieldbook Data dialog box select the selector button [⊕] from the Observation section, this will minimize the dialog once more and InRoads prompts you to identify a point. Data point near point # 198.

I. Edit this point name and add PT NT after Code: 109.

J. Edit point name 199, add PT NT after Code: 109 999.

K. Edit point name 121, add PT after Code: 999.

L. Edit point name 122, add PT after Code: 104.

Section 3   *Create Surface*

Now that we edited the points, we want to save the graphics to the design file.

3.1   Writing Survey Data to Graphics - *Lab 4*

A.   Select Survey > View Survey Data > Write Survey Data to Graphics.
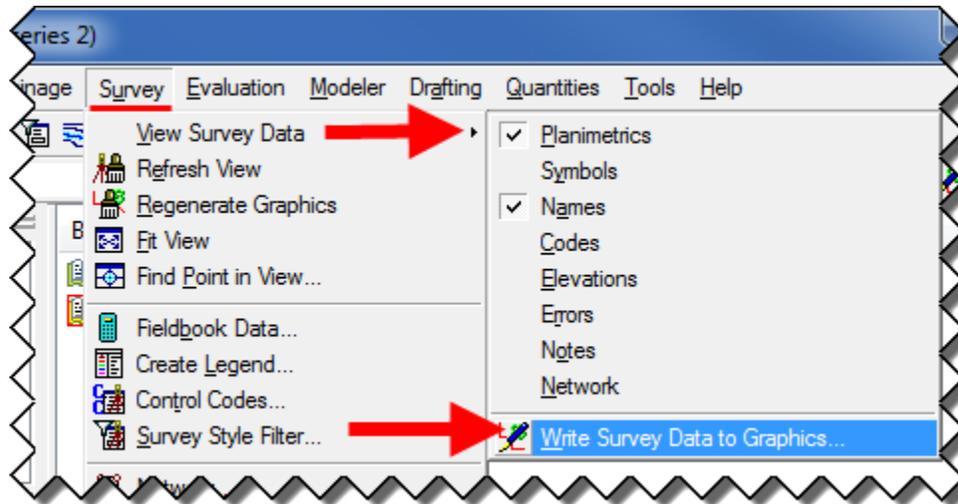
B.   Within the **Include:** field, select (check on): Planimetrics, Names, Codes, Elevations and Notes.

C.   Select **Apply** and then **Close**. This will write the graphics to the design file.
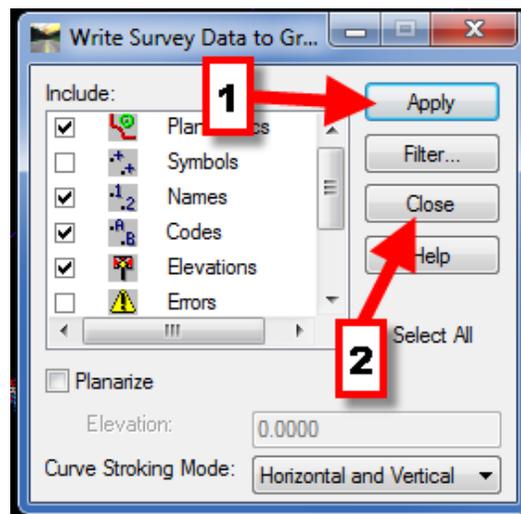
3.2   Survey Data to Surface – *Lab 5*

Now we will use our Fieldbook data (survey data) to create the existing surface (*.dtm).

A. From the InRoads main menu bar select Survey > Survey Data to Surface.
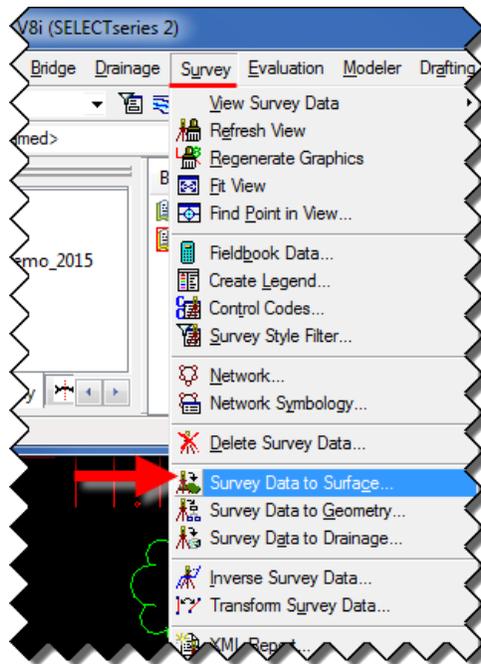
B. For Surface Name: input EXISTING.   Toggle ON Always use: and select Style from pull-down. Toggle OFF Triangulate Surface. Your Survey Data to Surface box should look as the figure below. Click OK.
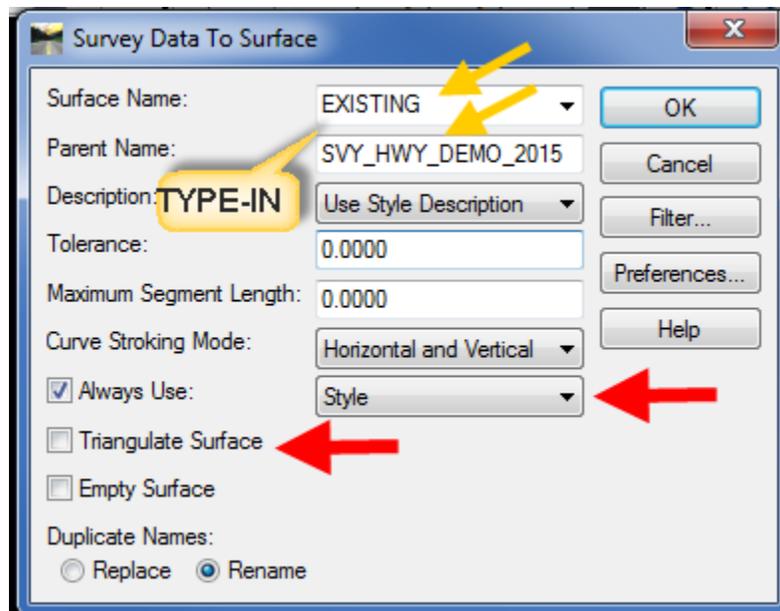
C. Select Surface > Triangulate Surface, the dialog box opens.   For Surface: select EXISTING and toggle ON Extended Data Checks. In the Results portion click on More… .
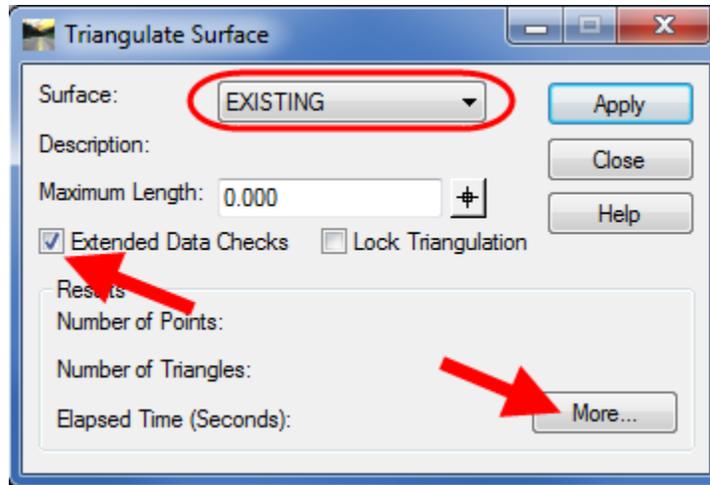
D. The Surface Properties dialog box opens. On the Main tab change the 'Preference:' to Survey.
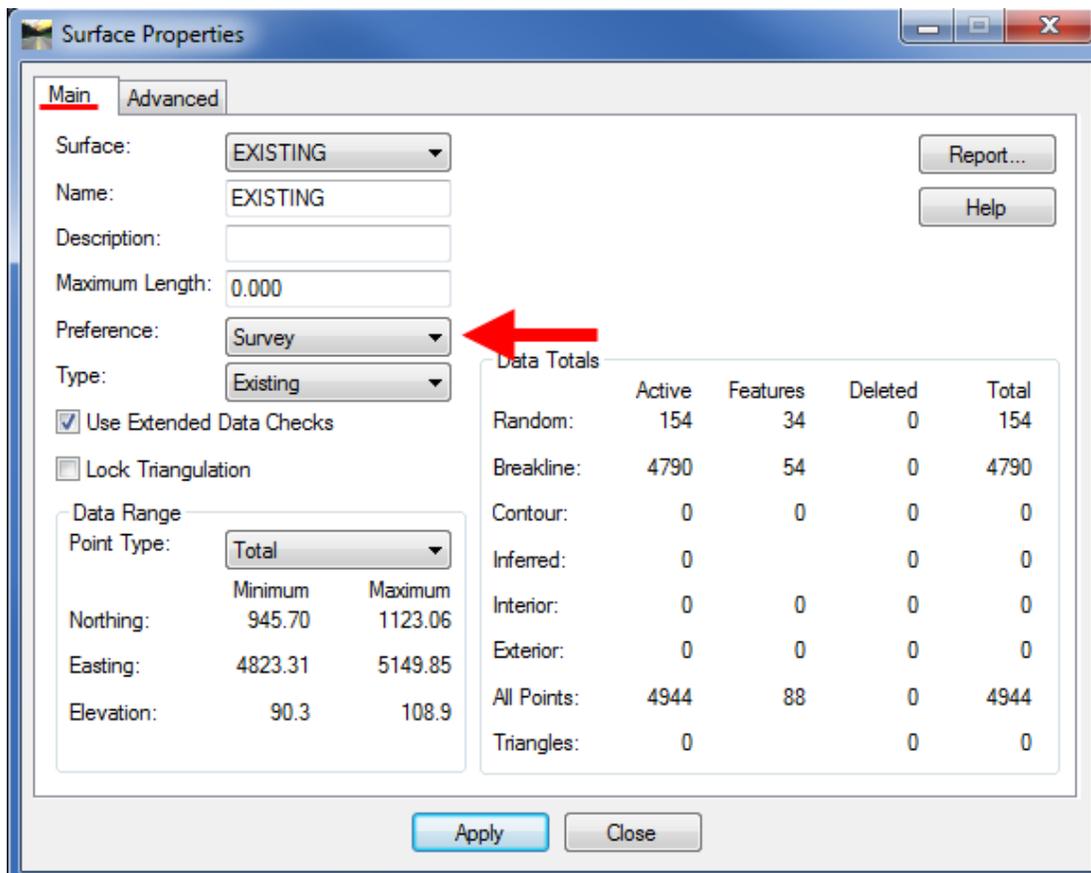
E.   On the Advanced tab change Cross Section and Profile Symbology to EXISTING.

F.   Click Apply, after it processes click Close on the Surface Properties dialog box.
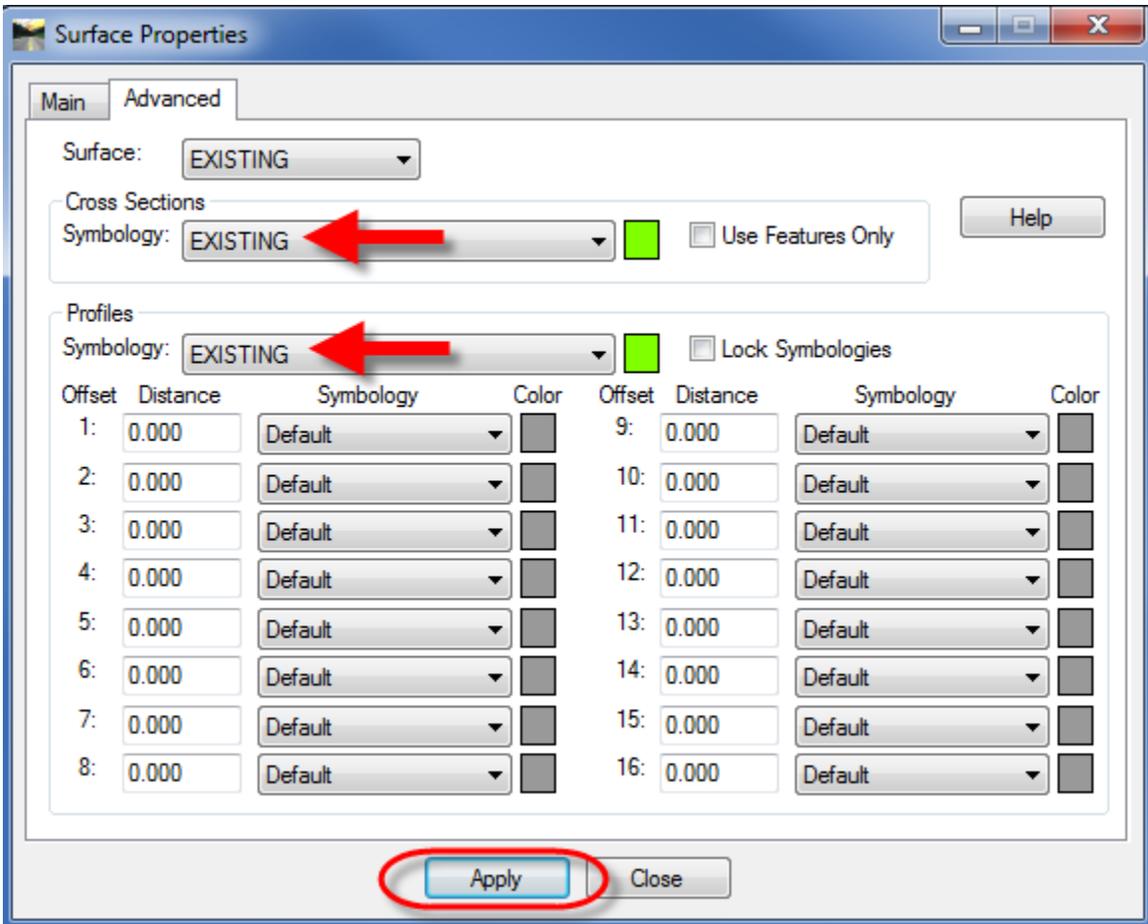
G.   On the Triangulate Surface dialog box click Apply and Close. Close any error log that may open.
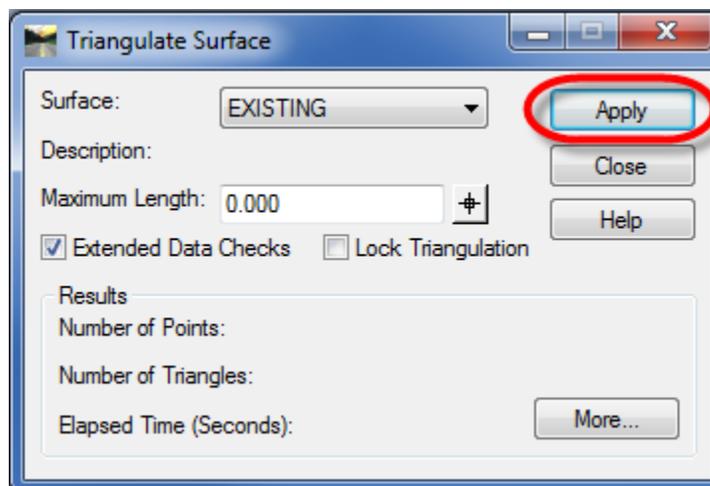
H. Save your field book. File > Save > Survey Data.
I. On the InRoads interface click on the Surfaces tab.
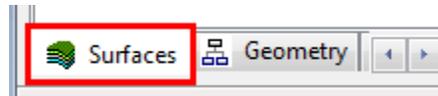
J. Within the Surfaces, you will find your EXISTING surface. Right-click on your EXISTING surface and click Save As ….
K. In the Save As dialog box, click on Active: select EXISTING. This will populate the File name: field.
L. Click Save. Click Cancel to close the box.
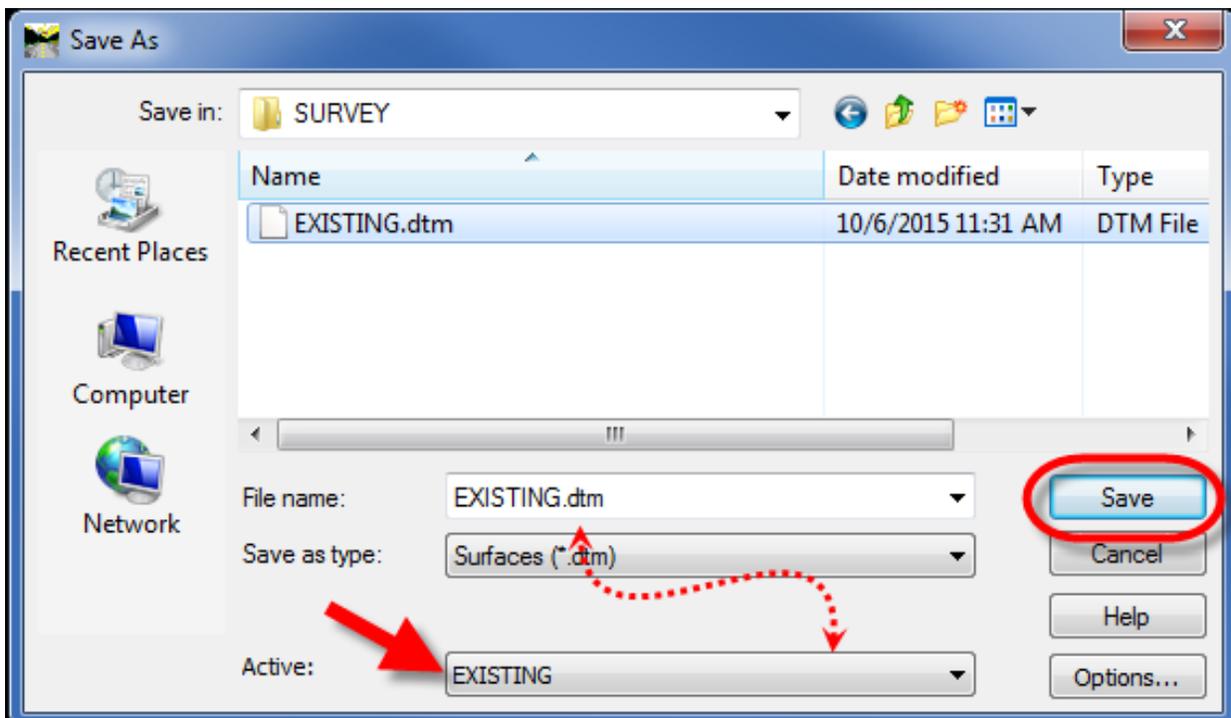
Section 4   Surface Editing

4.1   Fixing Crossing Breaklines – *Lab 6*

A.   Now that we created an Existing surface we can close our field book. In the **Survey tab**, right-click on the **Fieldbook > Close**. If a box to save changes pops up select **Yes.**

B.   Select **Surface > View Surface > Crossing Segments**.
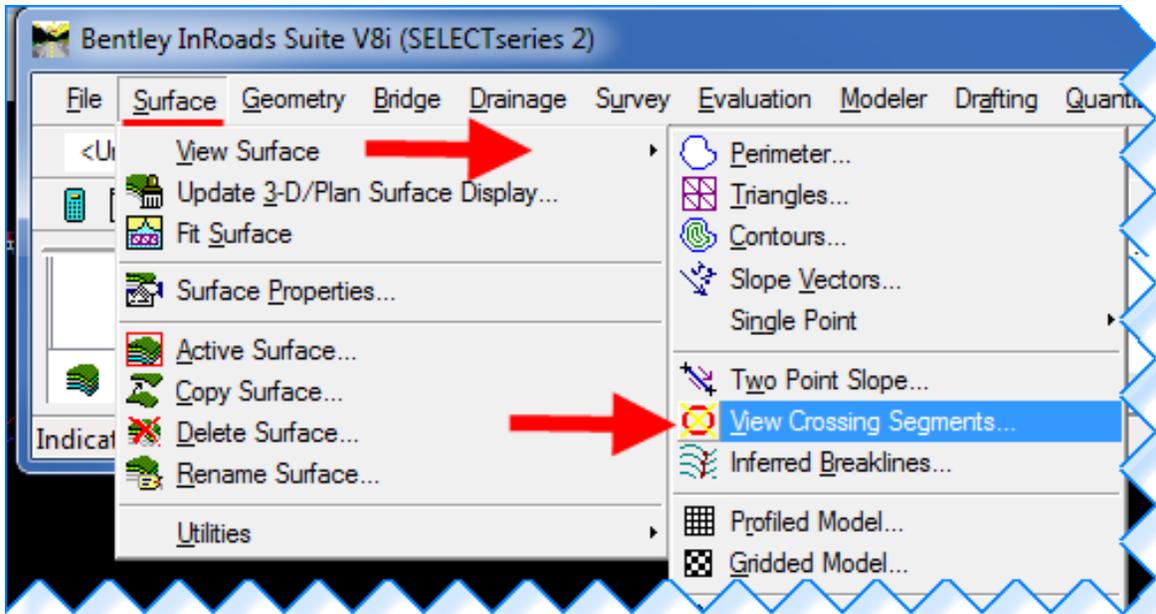
C.   Select your **EXISTING** surface. Select **Apply**. Then **Close**.
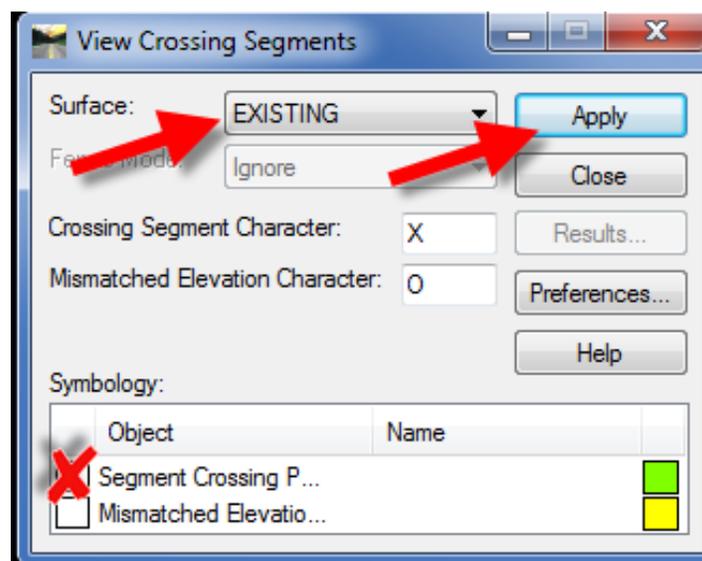
D. Within the MicroStation View Window you should see three (3) green crosses. These indicate where segments are crossing each other. Next we will fix this.
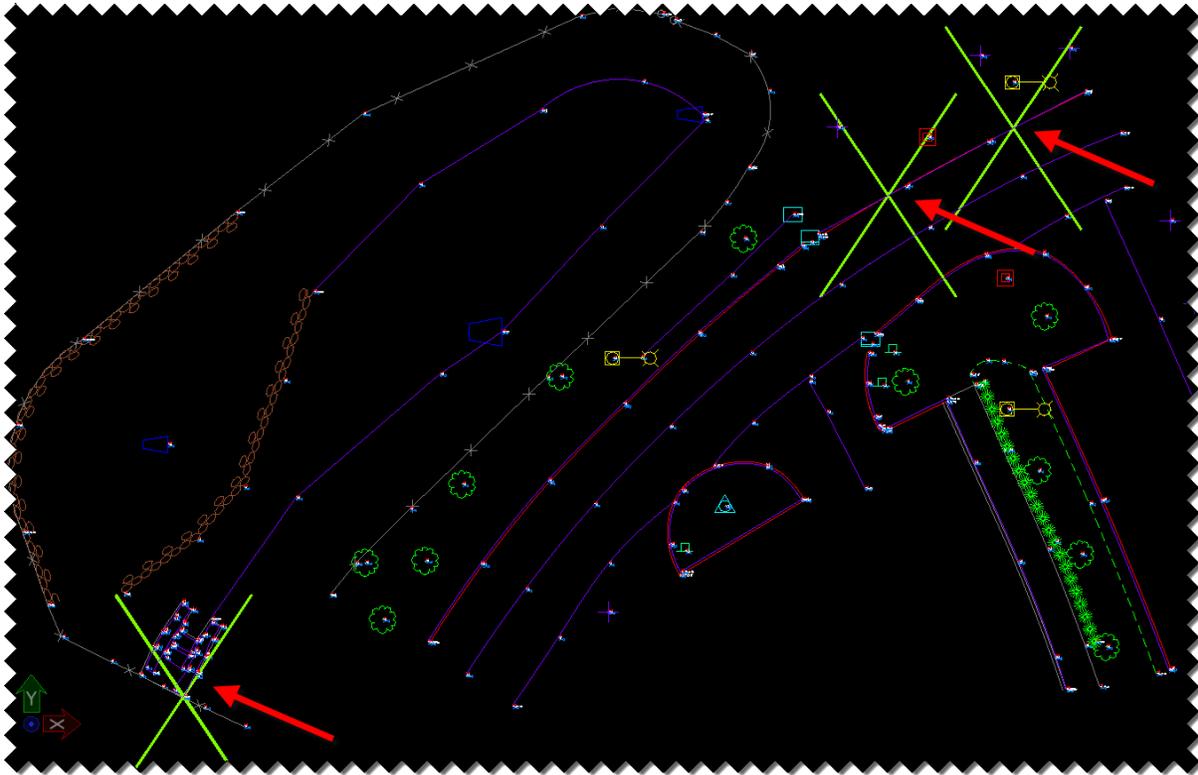
E. From the InRoads menu, select **Surface > Edit Surface > Edit Feature Point**.
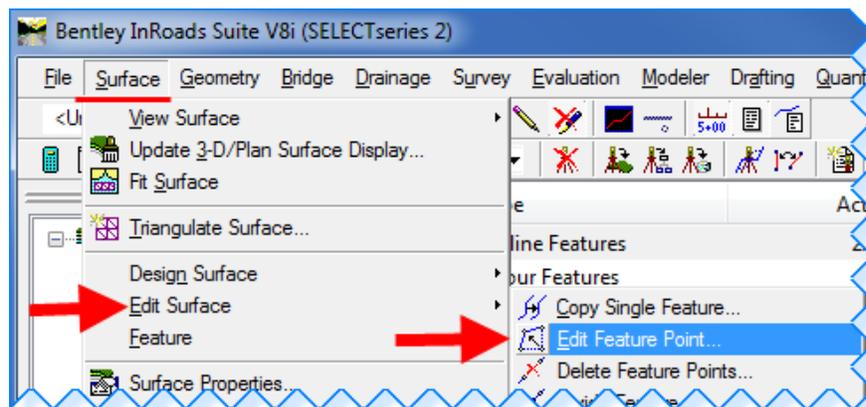
F. Within the Edit Feature Point dialog box. Select the **pick button** for **Feature:** .
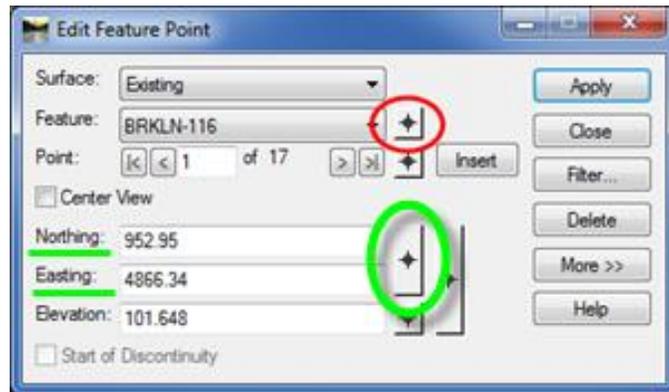
G. In the MicroStation view **zoom in** to the green crosses. **Select** the purple breakline feature at the bottom right of the spill way.
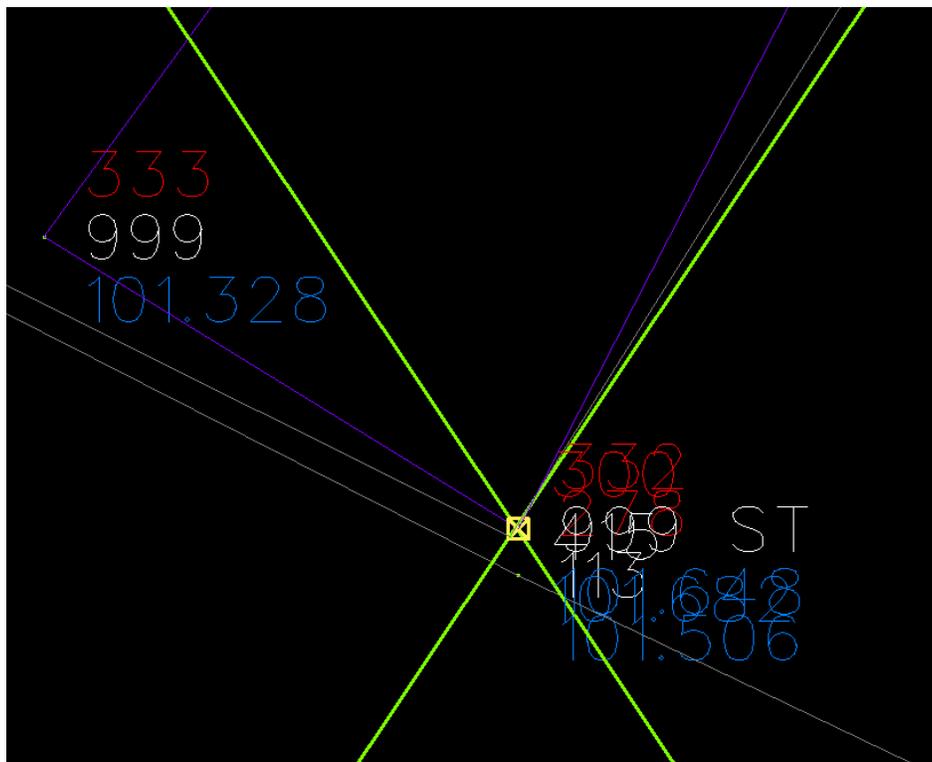
H. In the Edit Feature Point dialog box select the **Target Button** for the **Northing and Easting** coordinates and modify breakline to be within gabion spillway. Datapoint (left click) to a point within the gray spillway symbology. Select **Apply**. You have to **repeat** these steps for the second point. Delete the purple line and the green crosses outside of the spillway using the MicroStation delete tool.

I.   **Edit** the other errors (green crosses). Target the purple breakline feature (points 116, 117, 120 & 121) and toggle left/right to select the first crossing point.

J.   Target the **North/East coordinate** and modify the breakline to be behind the curbing, select **Apply**. For each crossing vertices along the feature select and modify each point making sure to click **Apply** after each point has been moved. Repeat until all points are behind the curb line.

K.   **Delete** the breakline (purple line) that is now incorrect and the green crosses using MicroStation delete tool.

L.   In InRoads select **Surface > Triangulate Surface** and select **Apply** and **Save** your surface.

4.2   Changing Surface Feature Properties – *Lab 7*

A.   Select **Surface > Feature > Feature Properties**.
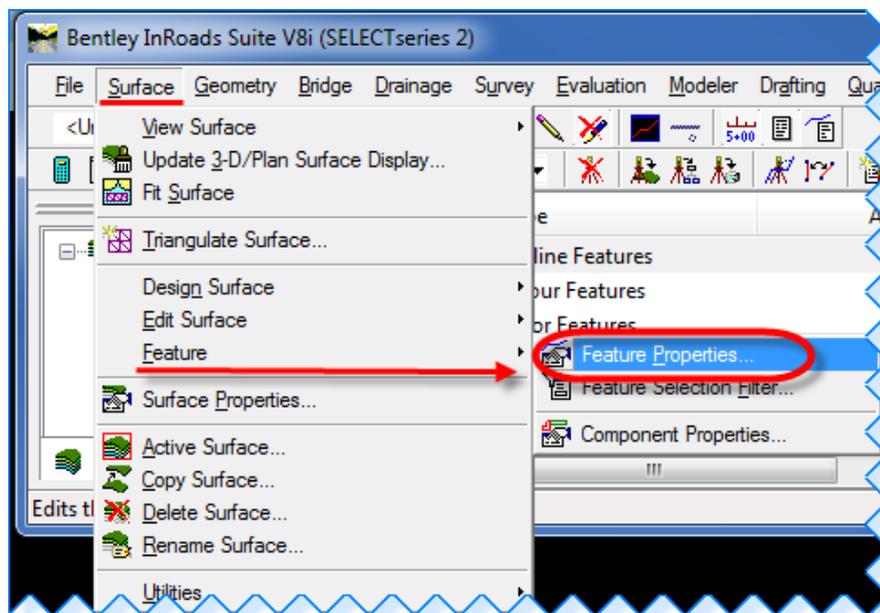
B.   In the Feature Properties dialog box **click** on the **Selector button** in the 'Feature:' area.
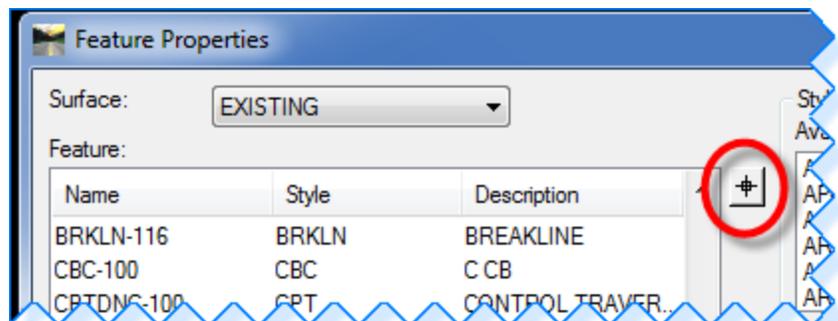
C. Pick the chain link fence surrounding the sedimentation control pond in the MicroStation view.

D. One of the chain link fence feature lines should highlight, **select all** chain link features (**FECHLK**) within the Feature Properties box. **Change** the Triangulation Feature Type: from Random to **Breakline**.
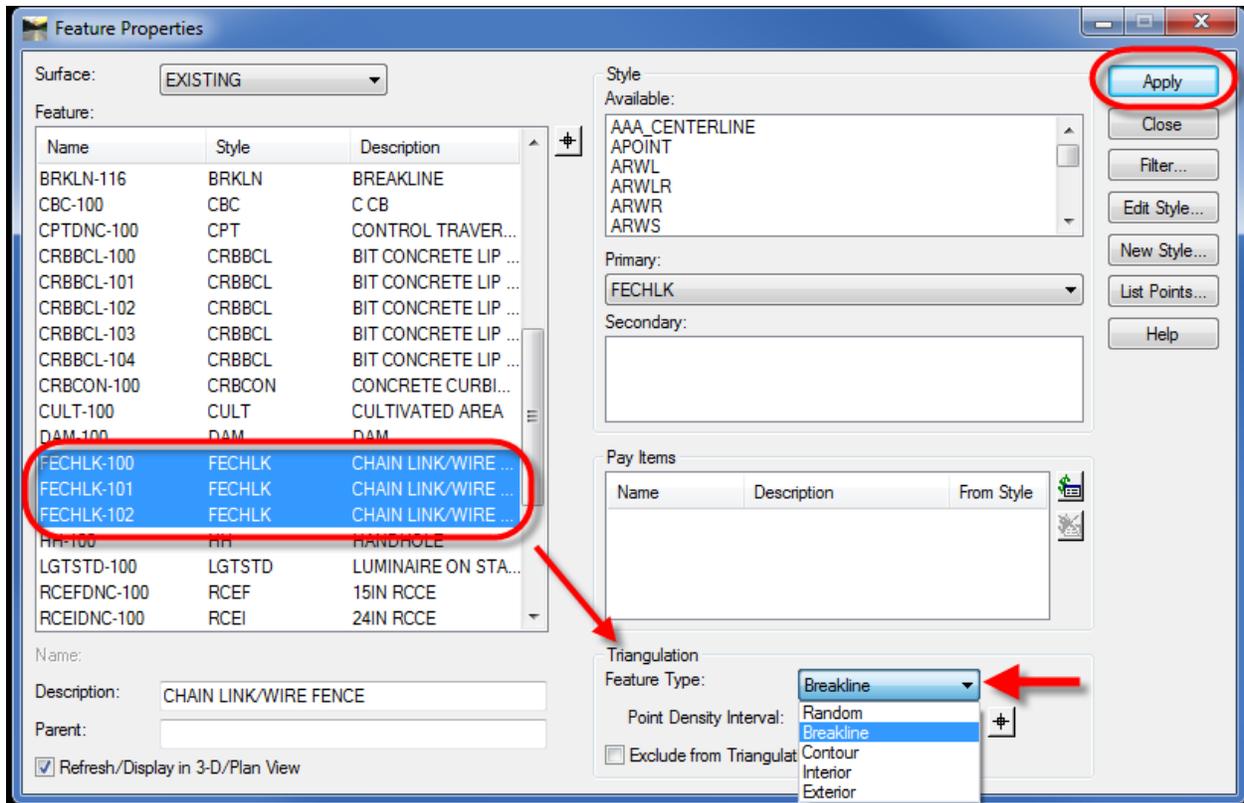
E. Select **Apply** and **Close**.

F. In InRoads select **Surface > Triangulate Surface** and select **Apply** and **save** your surface.

4.3 View Surface Tools – *Lab 8*

A. This lab shows InRoads users how to use the different viewing tools to display surface data including the perimeter, triangles, contours and contour elevations.

B. Make sure the style lock is **OFF**. The style lock will allow the dialog box to appear.

C. On the InRoads Main menu bar click on **Surface > View Surface > Perimeter**.
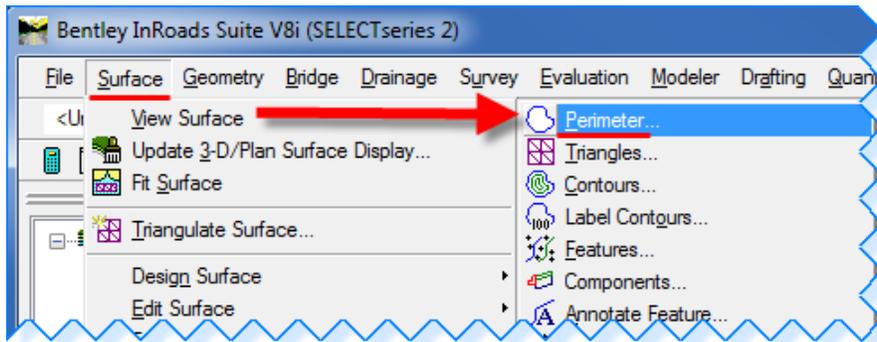
D. In the View Perimeter dialog box for Surface: select **EXISTING**. Then click the **Apply** button. Notice the line surrounding the parking lot; this is the limit of the existing surface.
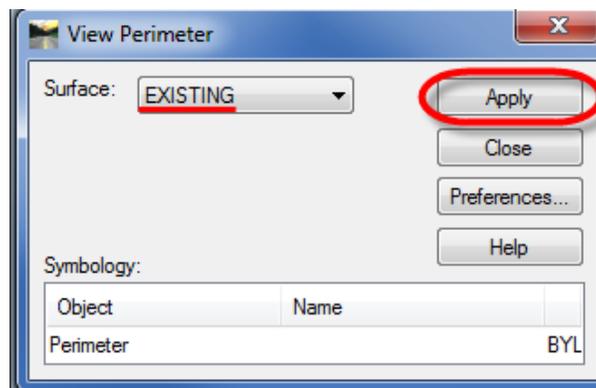
E. On the InRoads main menu click on **Surface > View Surface > Triangles**.
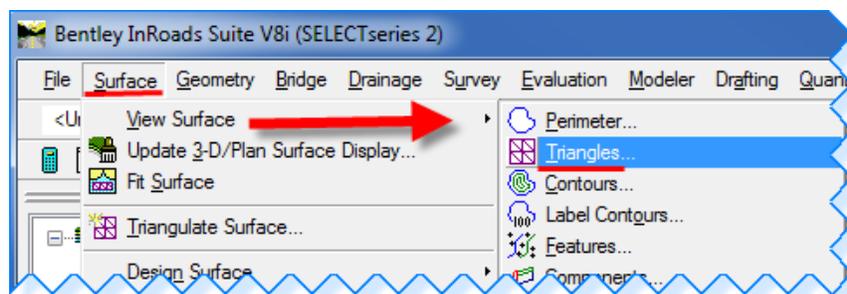
F. In the View Triangles dialog box for Surface: select **EXISTING**. Then click **Apply**. Notice the triangles appearing in the parking lot.
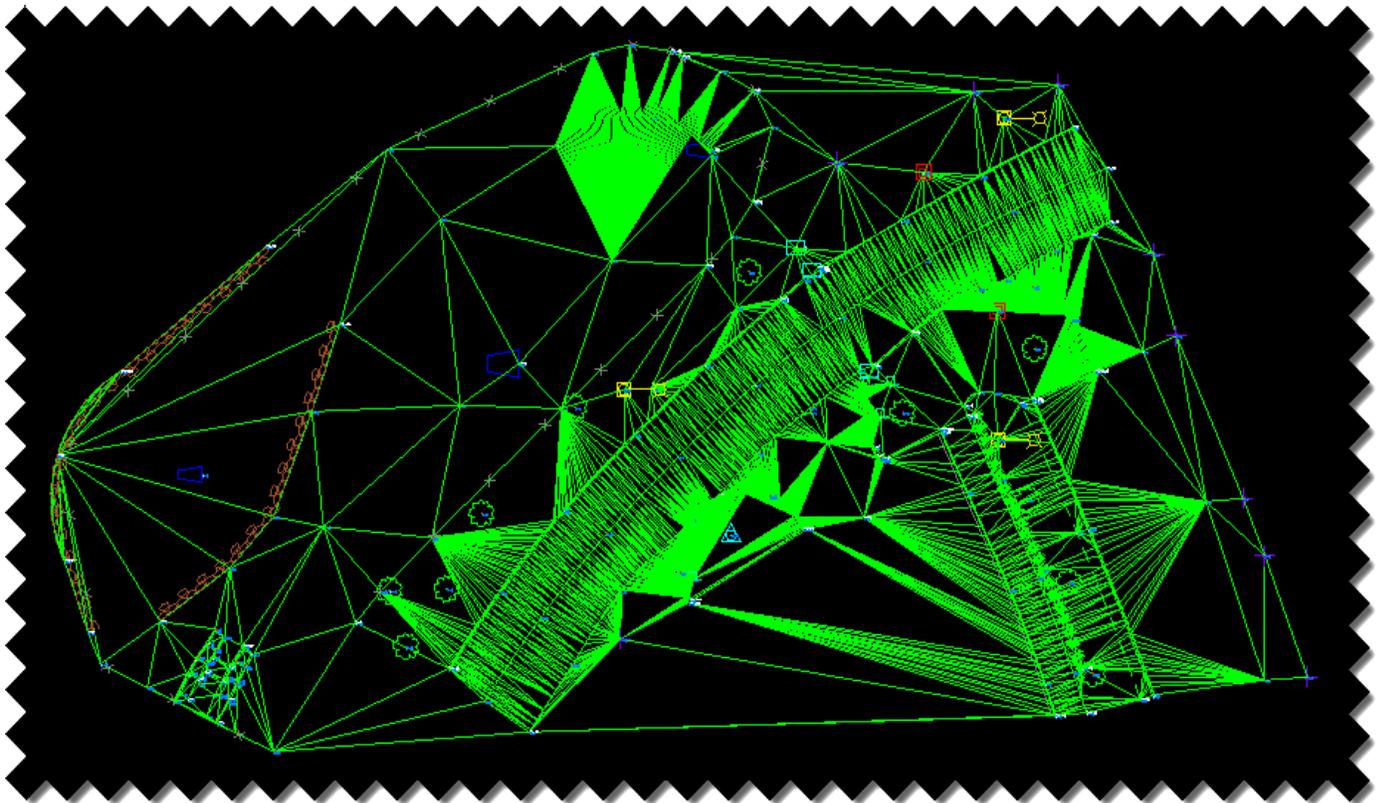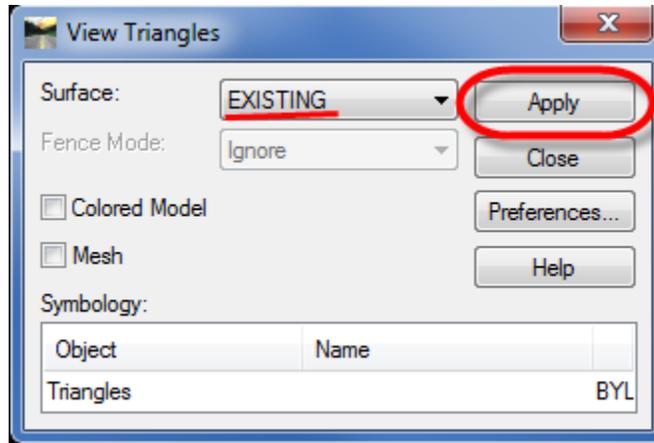
G. Looking at the triangles you can see some triangles need to be deleted.   We will do this next, but first save your EXISTING surface.

H.   From the InRoads menu select **Surface > Edit Surface > Delete Triangle…** .
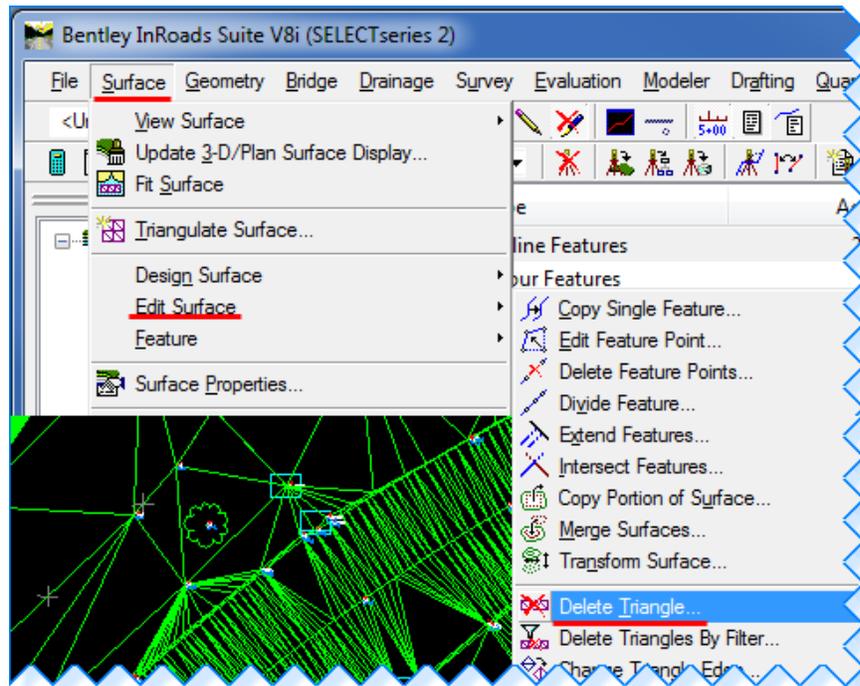
I.   **Select** the **EXISTING** surface on the Delete Triangle dialog box. Click **Apply.** Now select the triangles you want to delete. See the figure below as guide.
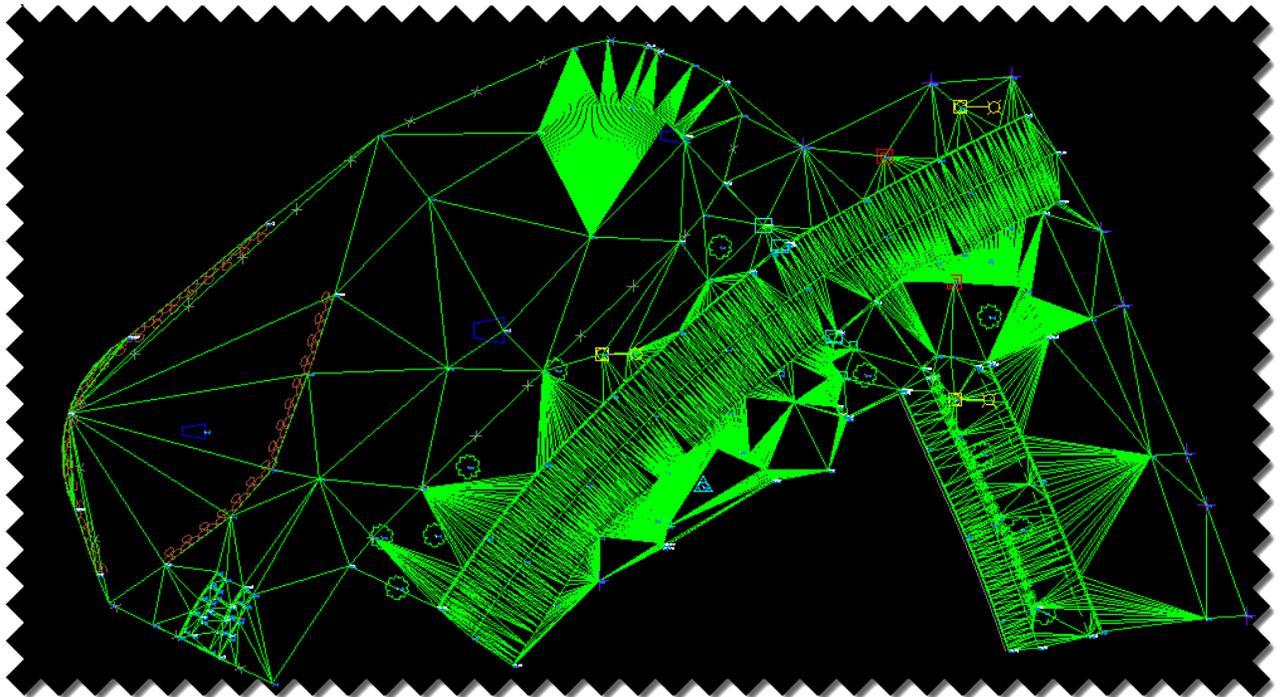
J. **Cancel** out of the delete Triangle command. **Save** your **EXISTING** surface.

K. Using MicroStation tools with **graphic group on delete** the display of the perimeter and triangles.

L. **Redisplay** the perimeter and the triangles. View in MicroStation view. Then **delete** the triangles.

M. On the InRoads main menu bar click on **Surface > View Surface > Contours**.
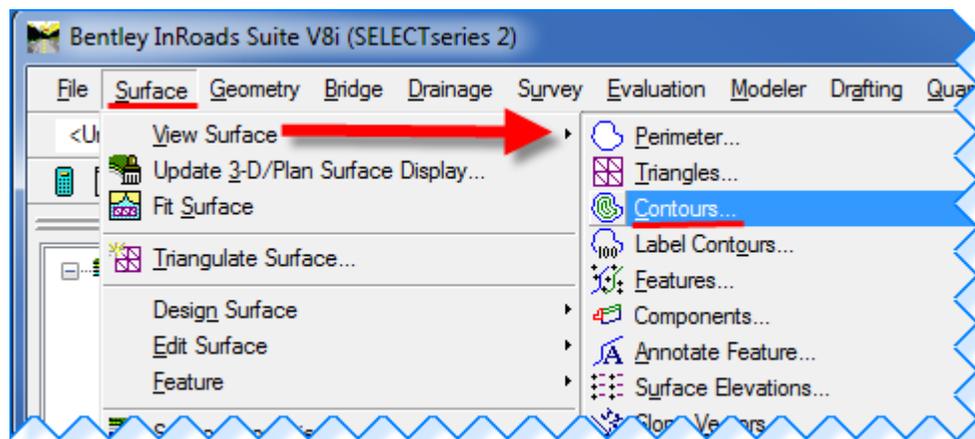
N. The View Contours dialog box opens. Make sure **Preferences…** are set to **Survey**. On the Main tab ensure **Minors per Major:** is set to **4**. Click on **Major Contours, Minor Contours** and **Major Labels**. Click **Apply**.
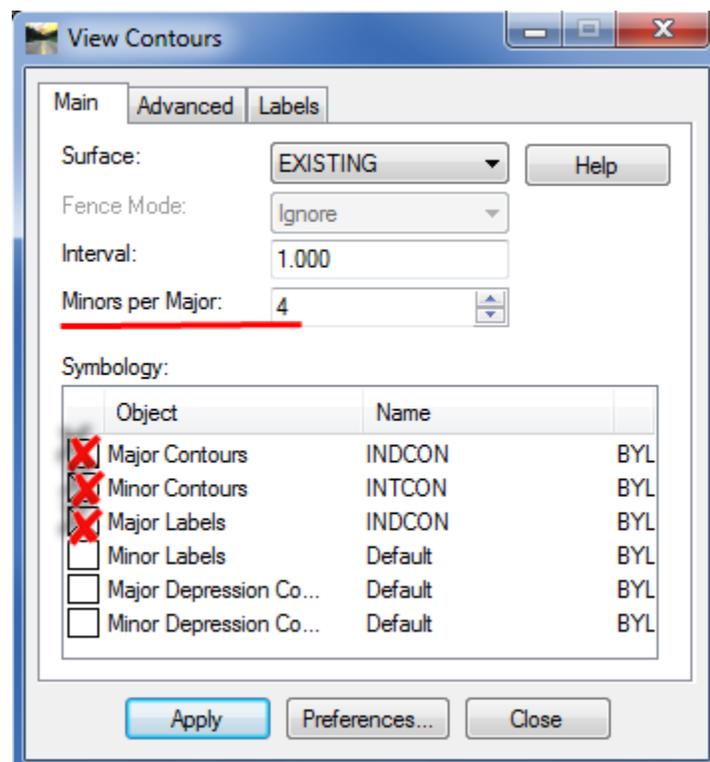
O. After the contours display **Close** the View Contours box.
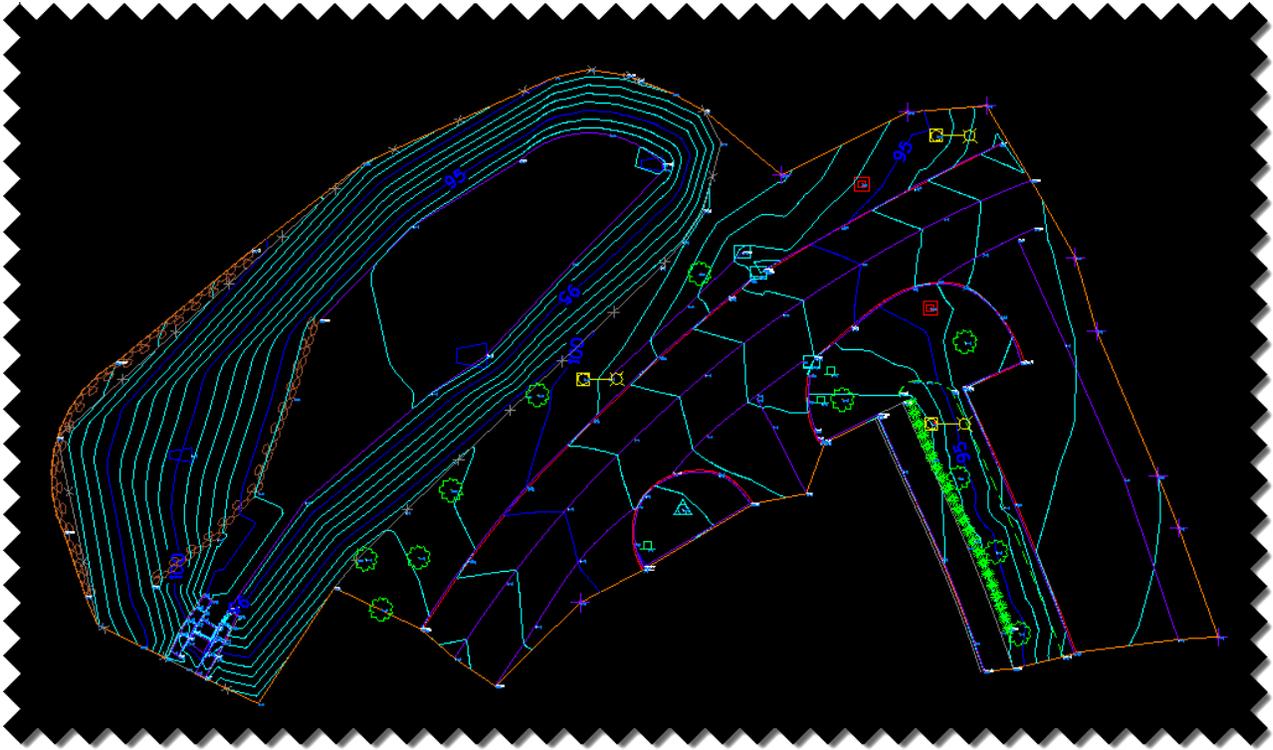
Exit out of your project making sure you save your work. Exit out of InRoads and MicroStation.