

# Chapter 3 - Initial Surface Procedures

In the CDOT process, existing ground surfaces are created by Survey and any proposed models by Design. When presented with either of these for the first time, it is good practice to review the surface information and familiarize yourself with the data contained in the surface. It is also good to double-check the surface for any errors or omissions before they become larger issues after the surface has been used for modeling or volume calculations.

Using the techniques outlined here, you can review the data in the surface and view the data graphically, both of which allow you to check for problems and familiarize yourself with the data.

## **Chapter Objectives:**

- To become familiar with the process used to analyze the data in an unknown surface.
- To be able to view DTM data graphically for a visual analysis of a surface.

## Reviewing Surface Data

InRoads provides useful tools for reviewing surface data, including surface point data as well as the properties of features and components that are contained in the surface.

### **Section Objectives:**

- To learn the techniques available to review surface information before viewing the data.
- To be able to spot potential issues in a surface prior to it causing major problems.

## Surface Properties

The *Surface Properties* dialog allows you to change the name, description or preference associated with the surface. By accessing the *Advanced* tab, you can also set the named symbology to be used when displaying the surface ground line in profiles and cross sections. The *Advanced* tab also allows the establishment of *Offsets* that can later be displayed when creating or updating a profile.

The *Surface Properties* dialog is accessed from several locations including the *More* option on the *Triangulate Surface* dialog. It may also be accessed directly from the pull-down menu or from the right-click menu in the workspace bar of the InRoads menu.

## 1. Select **Surface** > **Surface Properties**

Data Range		
Point Type:	Total	
	Minimum	Maximum
Northing:	1531966.21	1559691.32
Easting:	3235499.38	3304750.88
Elevation:	6328.23	6795.73

Data Totals				
	Active	Features	Deleted	Total
Random:	19745	377	4184	23929
Breakline:	14548	1314	8	14556
Contour:	0	0	0	0
Inferred:	0		0	0
Interior:	0	0	0	0
Exterior:	768	1	8480	9248
All Points:	35061	1744	12672	47733
Triangles:	66573		775	67348

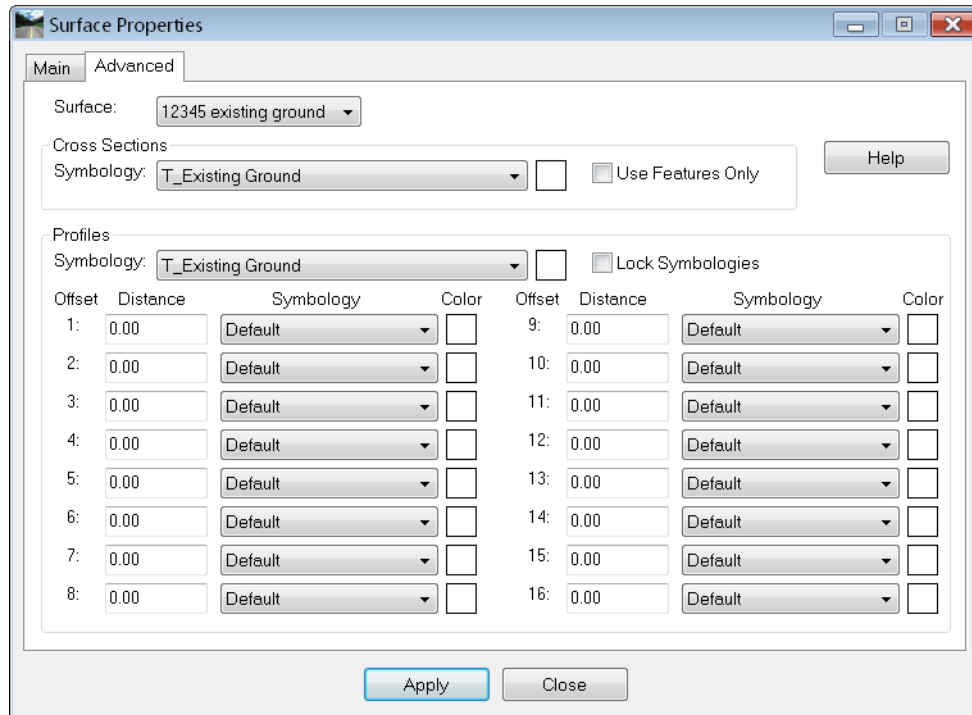
On the **Main** tab, you can:

2. Select a **Surface** from the drop-down - this is set to the active surface by default.
3. Change the **Name** of the DTM as it is shown in dialog boxes. This does not change the name of the DTM file on the hard drive.
4. Change the **Description** of the surface.
5. Set the **Maximum Length** - see the explanation on **Maximum Length** in the Triangulation section.
6. Set a **Preference**. The available preferences are surface display preferences. Selecting one here and toggling on the **Style** lock forces the view commands to use this preference and does not allow the dialog box to display for **View Contours**, **Triangles**, etc.
7. Set the **Type** of the surface. The type is critical to how the surface reacts in **End Area Volumes**. Options include **Existing**, **Design**, **Substratum** and **Ignore**. For details on these options, see the **InRoads Online Help**.
8. **Extended Data Checks** - toggle on to check DTM integrity (during triangulation) for crossing breaklines and miss-matched elevations.
9. **Lock Triangulation** - sets the triangulation so InRoads' commands will not automatically retriangulate the surface. For example, if this is a surface from survey that you do not want to alter, toggle this option on.

**Note:** Compressing the surface retriangulates it even if this option is on.

10. The **Data Range** category allows you to select a type of features and review the coordinate range it includes.
11. The **Data Totals** allow you to review the numbers of points and features for each type of feature.
12. The **Report** button generates a separate window summarizing surface properties. The generated report can be printed, written to the CAD file, or stored as an ASCII file.

On the *Advanced* tab:

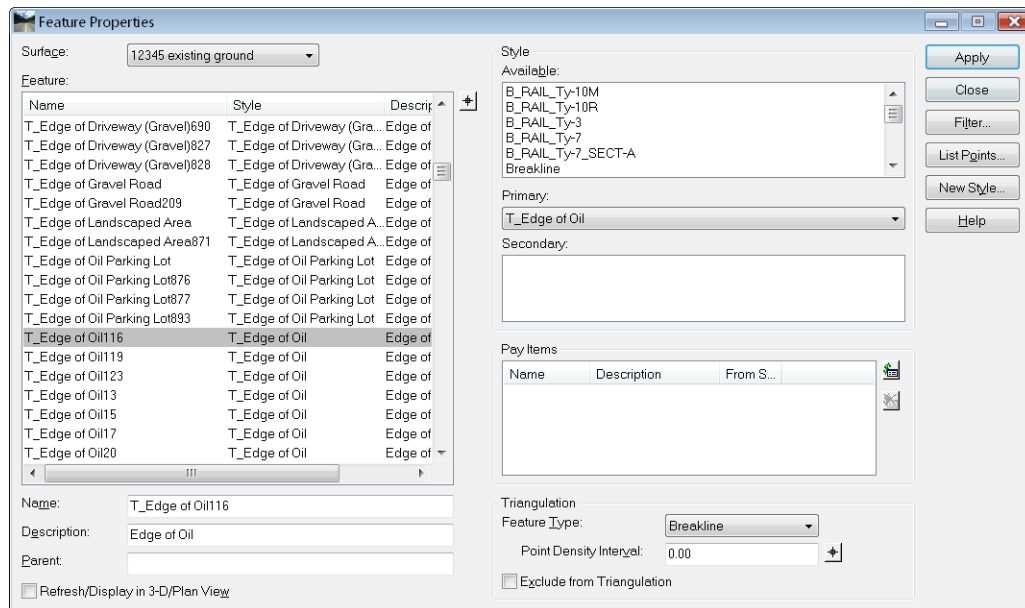


13. **Cross Section Symbology** sets the named symbology used for the display of ground lines on cross sections. In the *CDOT XIN* file, there are symbologies created for use here. **T\_Existing\_Ground** for the existing topo and **D\_SURFACE\_\*** for design surfaces.
14. **Use Features Only** prevents the surface line on the cross section from following the triangles. Instead, it is drawn by connecting the dots between the features in the surface. This should typically be off for existing surfaces and on for design surfaces.
15. **Profile Symbology** sets the named symbology used for the display of ground lines on profiles. In the *CDOT XIN* file, there are symbologies created for use here. **T\_Existing\_Ground** for the existing topo and **D\_SURFACE\_\*** for design surfaces.
16. **Lock Symbolologies** will force each of the offsets to use the same symbology specified above.
17. The **Offset** category is for establishing surface offsets for display on profiles. Up to 16 offsets may be specified by defining the offset distance - positive values for offsets to the right and negative values for offsets to the left of the centerline. Each offset may have its own symbology.
18. Choose **Apply** if you make any changes.
19. Choose **Close**.

## Feature Properties

The *Feature Properties* dialog allows you to review a DTM by analyzing the individual features, and make changes to names, descriptions, etc.

1. Select **Surface > Feature > Feature Properties**.



2. Select the *Surface* from the drop-down.
3. The *Feature* list shows all the features in the selected surface along with their styles and descriptions.

**Note:** The dialog honors the active feature filter if the *Feature Filter* lock is on.

**Important!** Features that appear red indicate their Style cannot be found in the currently loaded *XIN* file. Check to see if the correct Style is associated with the feature. If so, check to see that the correct *XIN* is loaded.

4. The *Name* and *Description* of the highlighted feature may be edited.

**Note:** Options other than *Name* can be edited for multiple features at one time. Select the features from the list using <Ctrl> or <Shift> keys or by using the Right-click menu to *Select All*.

5. If features are edited, before choosing Apply, the *Refresh/Display in Plan View* option can be toggled on to update the graphics with the new attributes.

- For a listing of the coordinates for each vertex in a feature, highlight the feature and select **List Points**. This is a good way to evaluate the elevations of the feature.

Point	X	Y	Z	Distance Along Feature
1	3271470.09	1558288.15	6593.14	0.00
2	3271519.88	1558277.58	6590.92	50.95
3	3271569.46	1558266.85	6588.68	101.73
4	3271620.83	1558255.73	6586.32	154.34
5	3271678.55	1558243.20	6583.84	213.45
6	3271738.88	1558230.43	6581.38	275.17
7	3271794.31	1558218.44	6579.12	331.93
8	3271852.35	1558206.08	6576.81	391.31
9	3271913.85	1558193.04	6574.81	454.21
10	3271973.83	1558180.20	6572.94	515.58
11	3272030.74	1558167.99	6571.59	573.80
12	3272080.76	1558157.64	6570.52	624.89
13	3272151.69	1558142.72	6569.60	697.38
14	3272206.88	1558130.89	6569.18	753.82
15	3272246.80	1558122.49	6568.97	794.62
16	3272294.50	1558112.63	6569.12	843.33
17	3272333.11	1558104.31	6569.27	882.82
18	3272391.06	1558091.77	6569.75	942.12
19	3272447.47	1558079.50	6570.19	999.85
20	3272498.95	1558067.88	6570.31	1052.62

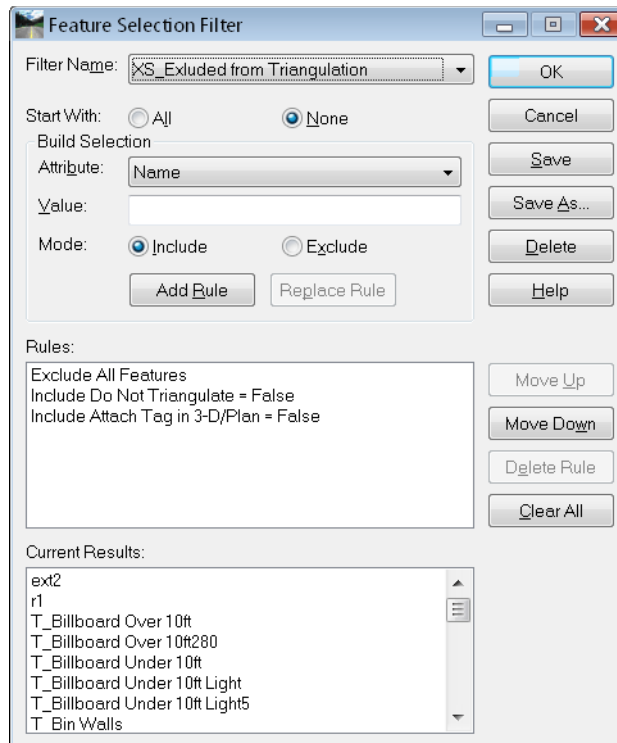
See the *InRoads Online Help* for additional information on other options.

- If changes are made to a feature, be certain to choose **Apply**.
- Close the dialog when done reviewing the features.

## Feature Selection Filters

*Feature Selection Filters* provide a method of segregating features for use in other commands. For example, if you are working with the breaklines that form a ditch, you can use a selection filter containing just those breaklines, then turn on the *Feature Filter* Lock. Future commands that use features will show only those specified by the filter as being available.

**Feature Filters** are stored in *CDOT-Preferences.ini*. The CDOT configuration contains predefined filters.



### Locks affecting Features

**Filter Name** – Lists the name of the **Feature Filter** that is currently active. It has no affect if the **Feature Filter** lock is off. If the **Feature Filter** lock is on, it will limit dialog boxes to showing only the features that are within the filter. Feature Filters are stored in the **XIN** file and are accessed by using the drop-down arrow next to the name.



**Feature Filter lock** – If on, activates the current filter. If off, has no affect and all surface features are shown in boxes that list features. Shown here in the off position.



**Feature Highlight lock** – If on, when you choose a feature from a dialog box, the feature will graphically highlight whether it is displayed in the design file or not. Shown here in the off position. This lock should typically be kept off; if on, the opening of dialogs that list features is much slower as all the features will highlight initially.

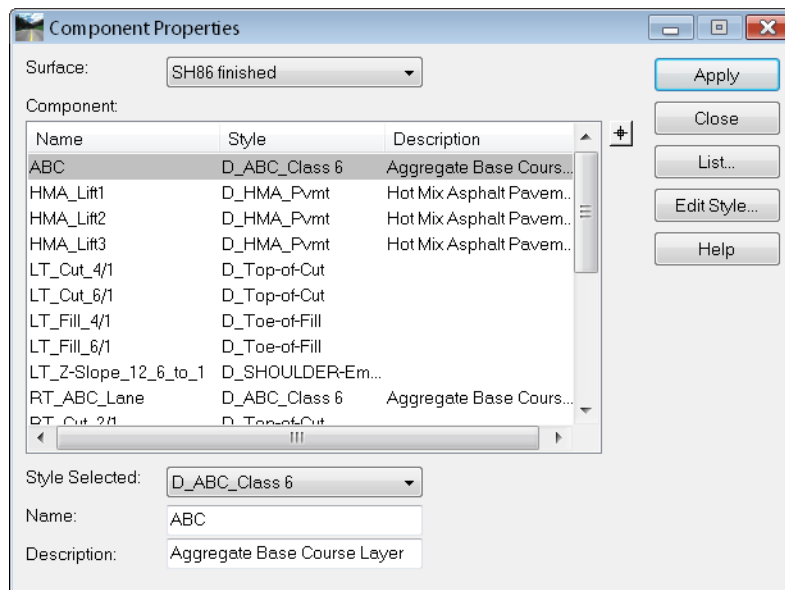


## Component Properties

The *Component Properties* dialog allows you to review each of the components contained in the selected surface. You can also make changes to the *Name*, *Description* and *Style* as necessary.

**Important!** The Style associated with a component determines how the component's volume is categorized in *End Area Volumes*. Components with like Styles are automatically totaled in the reports.

1. Select **Surface > Feature > Component Properties**.



2. Select the *Surface* from the drop-down.
3. The *Component* list shows all the components in the selected surface along with their styles and descriptions.

**Important!** Components that appear red indicate their Style cannot be found in the currently loaded *XIN* file. Check to see if the correct Style is associated with the component. If so, check to see that the correct *XIN* is loaded.

4. The *Name* and *Description* of the highlighted feature may be edited and a new Style assigned.

**Note:** Options other than *Name* can be edited for multiple features at one time. Select the features from the list using <Ctrl> or <Shift> keys or by using the Right-click menu to *Select All*.

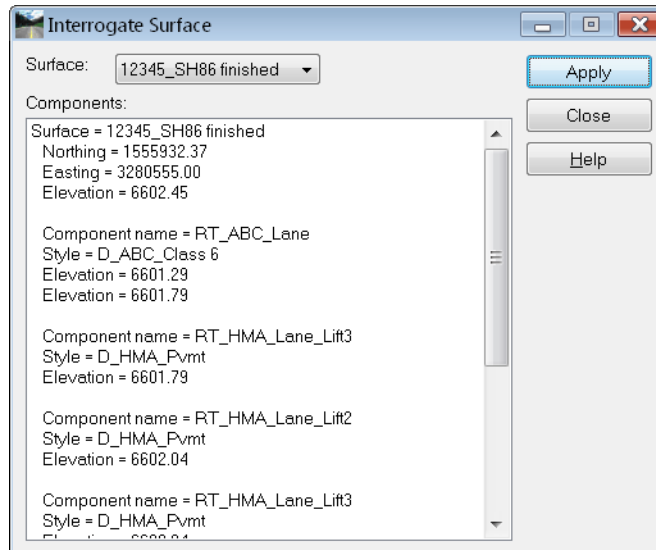
5. Select **List** to generate a report of the *Start* and *Stop* stations of the highlighted component along with a list of the features making up the component.
6. Choose **Apply** if there are changes made to a component.
7. Choose **Close**



## Interrogate Surface

**Interrogate Surface** is used to report information about surface components at a given coordinate. The command generates a report listing each component encountered at the specific location, including the elevation. If the component is encountered twice (for example the top and bottom of a lift), it is listed twice in the report, with an elevation for each occurrence. This command is only valid for design surfaces containing components.

1. Select **Surface > Utilities > Interrogate Surface**.

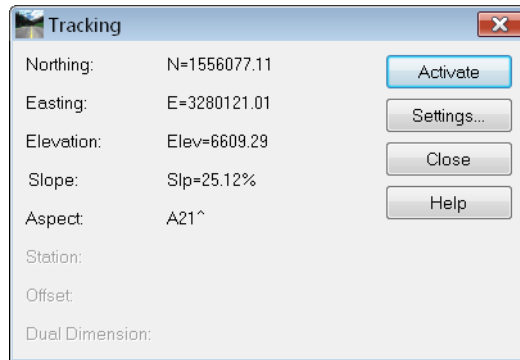


2. Select the **Surface** you want to inquire on from the drop-down list.
3. Choose **Apply**.
4. <D> at the location (or key in a coordinate) where you want to inquire.
5. The information on each component encountered at the location is listed in the dialog.
6. Continue Data Pointing and the report information will update with the new location information.
7. Choose **Close**.

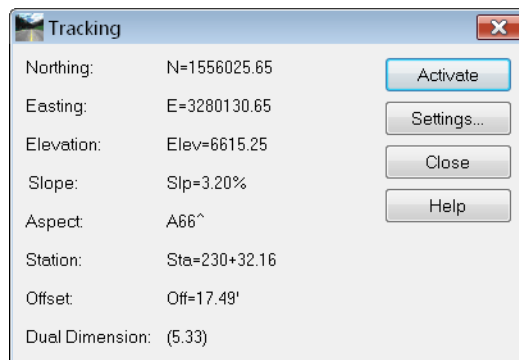
**Note:** The horizontal alignment used in creating the surface must be loaded as well as the surface.

## Tracking

The **Tools > Tracking > Tracking** command allows you to move your cursor and get a readout of the coordinate location and the interpolated elevation, as long as you are in a triangulated area. By toggling on the information you want, then choosing **Activate**, you can also Data point at any location and have the information written into the design file.



Note that the station and offset are also available for tracking when a geometry project is loaded and has an active alignment.



**Section Summary:**

- The **Surface Properties** dialog gives an overall picture of the surface in question including data coordinate ranges. Here, you can often spot elevations that are out of the ordinary range.
- **Feature Properties** allows the analysis of surface data on an individual feature level, including elevations of the vertices of features.
- **Feature Selection Filters** allow you to create a subset or group of features to view or review.
- **Component Properties** show the individual components that make up a surface.
- DTM issues, such as bad elevations can often be spotted using **Review** commands.
- If you want surface coordinate or slope information, use the **Tracking** tool. You can also write this information into the **DGN** file. If you have a geometry project loaded, this command will also provide station / offset data.

## Viewing a Surface

After reviewing surface data, you may also want to visually inspect the surface data. InRoads offers several surface view commands that can be used to spot surface problems and to become familiar with the surface.

### Section Objectives:

- To learn how the *View Surface* commands work in InRoads.
- To learn how to use the *Locks* that affect DTM displays.
- To be able to apply the appropriate preference to meet CDOT standards.

## Locks affecting Surface Displays


Two locks affect surface displays.





**Style lock** – If *Style* lock is on, the dialog box for the view command is not displayed. Instead, the display will be executed using the active surface and the preference assigned to the surface in the **Surface > Surface Properties** dialog.

**Important!** If you choose one of the View Surface commands and the dialog box does not appear, most likely the *Style* lock is on.



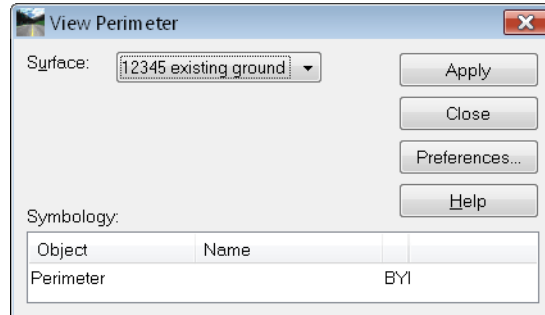
**Pen / Pencil and Delete Ink** – If the *Pencil* mode  is selected (as shown here), the graphics are updated whenever the same display command is selected again. For example, if you display the contours, then change to a different preference and display again, the old contours are deleted and the new contours are displayed.

If *Pen* mode  is selected there are two options. If *Delete Ink*  is off, the graphics are not updated when the same display command is selected again. Instead, another copy is placed in the design file. If *Delete Ink* is on, the graphics are treated like *Pencil* mode and the old one removed before the new ones are placed.

## Viewing the DTM Perimeter

The perimeter of a DTM is an outline of the current triangles, and therefore can only be displayed after a surface is triangulated. It should not be confused with an exterior boundary, which actually limits the triangulation. However, if there is an exterior boundary on the surface, the perimeter will be in the same location.

1. Choose **Surface > View Surface > Perimeter**.



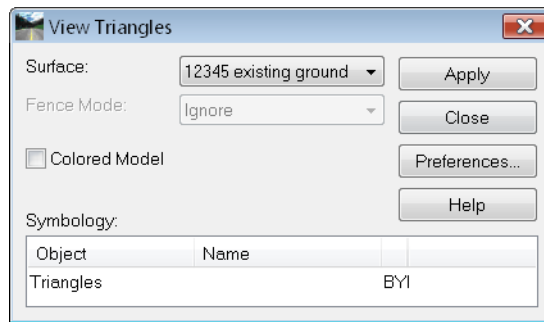
2. Select **Preferences** and choose the appropriate CDOT preference.
3. Choose **Load**, then **Close** the *Preference* dialog.
4. Select the *Surface* from the drop-down list.
5. Select **Apply** and the perimeter is drawn in the MicroStation file.
6. Select **Close**.



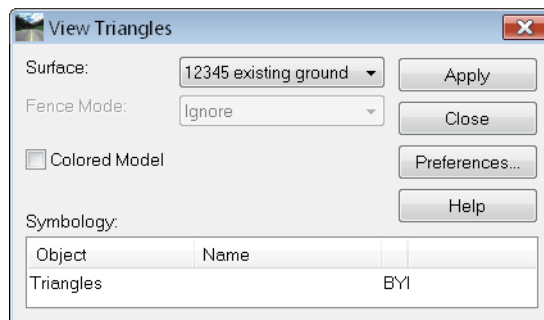
## Viewing Triangles

It is sometimes useful to display triangles when evaluating a surface. You can check to see if a feature is triangulating, if the triangles are being formed correctly or if there are erroneous or extraneous triangles in your model.

1. Choose **Surface > View Surface > Triangles**.



2. Select **Preferences** and choose the appropriate CDOT preference.

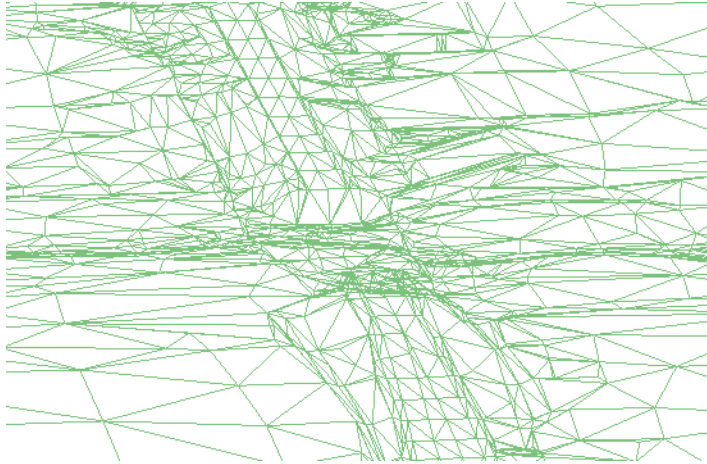


3. Choose **Load**, then **Close** the *Preference* dialog.

**Note:** If you are just displaying triangles for review, you may skip the preference step and use the default CDOT preference.

4. Select the *Surface* from the drop-down list.
5. The *Colored Model* toggle will display the triangles, and if two adjacent features share the same Style, the triangles formed in between the features are 'color-coded' according to the plan symbology of the Style.

6. Select **Apply** and the triangles are drawn in the MicroStation file.



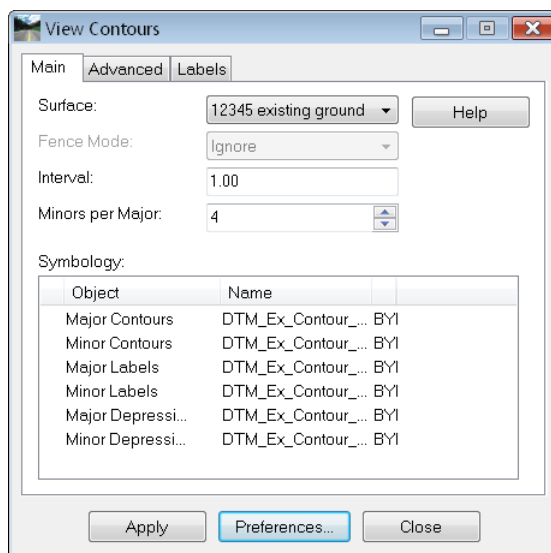
7. Select **Close**.

**Note:** The triangle display is a MicroStation graphic group. If you need to delete the triangles, they will delete as one if the **Graphic Group** lock is on.

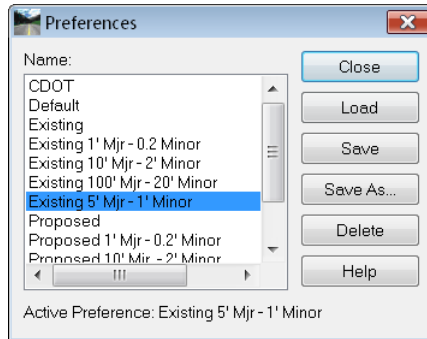
## Viewing Contours

The contours for a model may be displayed using the **Surface > View Surface > Contours** command. There are several preferences available in this command, depending upon the type of surface and contours you want to display.

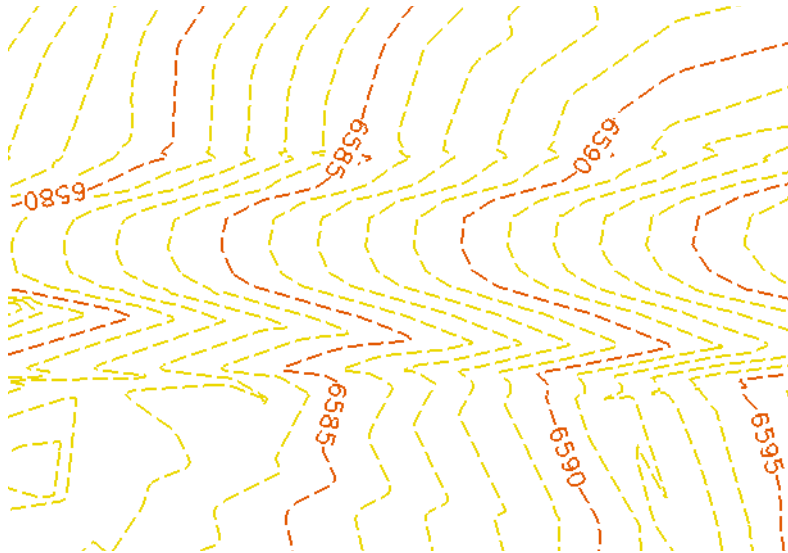
1. Choose **Surface > View Surface > Triangles**.



2. Select **Preferences** and choose the appropriate CDOT preference. The preferences are named according to proposed or existing and the interval. All display major and minor contours and the elevation labels. In addition, the **Proposed** preference displays major and minor depression contours. The preferences also set the level for displaying the contours, which in turn sets the ByLevel symbology.



3. Choose **Load**, then **Close** the **Preference** dialog.
4. If you do not want labels, you may toggle them off.
5. Select the **Surface** from the drop-down list.
6. Select **Apply** and the contours are drawn in the MicroStation file.



7. Select **Close**.

For information on additional options, see the **InRoads Online Help**.

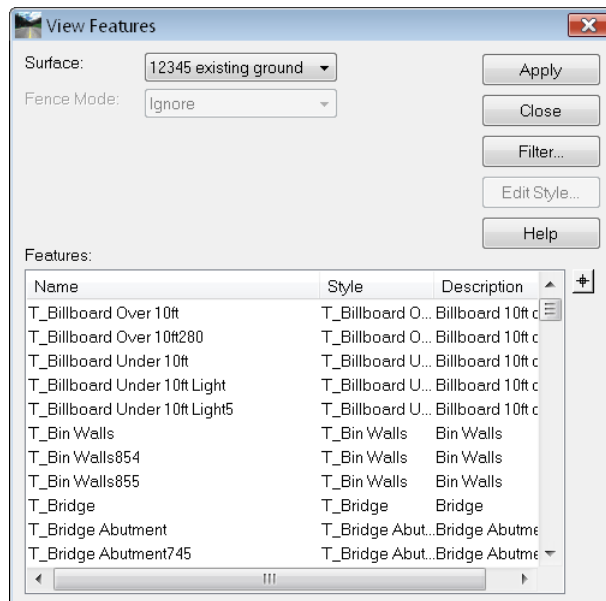
**Note:** The contour display is a MicroStation graphic group. If you need to delete the contours, they will delete as one if the **Graphic Group** lock is on.



## Viewing Features

The features for a model may be displayed using the **Surface > View Surface > Features** command. There are several preferences available in this command, depending upon the type of surface and contours you want to display.

1. Choose **Surface > View Surface > Features**.



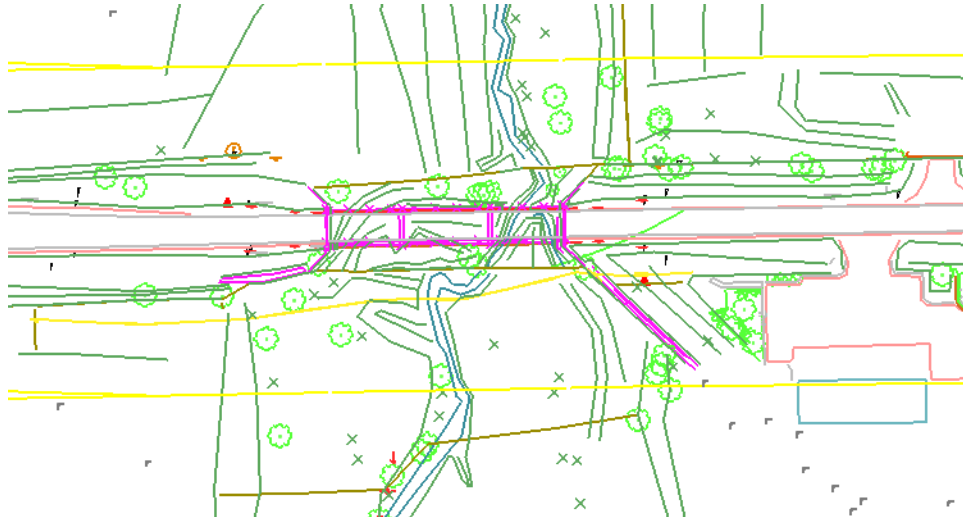
2. Select the **Surface** from the drop-down.
3. The **Feature** list shows all the features in the selected surface along with their styles and descriptions.

**Note:** The dialog honors the active feature filter if the **Feature Filter** lock is on.

**Important!** Features that appear red indicate their Style cannot be found in the currently loaded **XIN** file. Check to see if the correct Style is associated with the feature. If so, check to see that the correct **XIN** is loaded.

4. Highlight the feature or features you want to display. You can right-click and choose **Select All**, **None** or **Invert** the selection.

5. Select **Apply** and the features are drawn in the MicroStation file, using the associated Style to determine the Named Symbology to use.



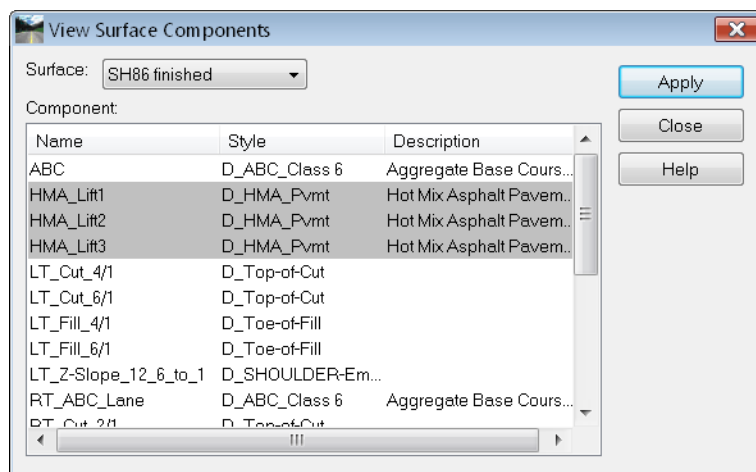
6. Select **Close**.

**Note:** The feature display is not a MicroStation graphic group. If you need to delete the features, they must be deleted individually, as a selection set, with a fence or using Update 3D/Plan Surface Display as described below.

## Viewing Components

Components are 3D shapes created by Roadway Designer as defined in Templates. They typically only reside in proposed models. Since they are critical to accurate volume calculations when shown on cross sections, it is often necessary to view them in the design file for evaluation purposes.

1. Choose **Surface > View Surface > Components**.

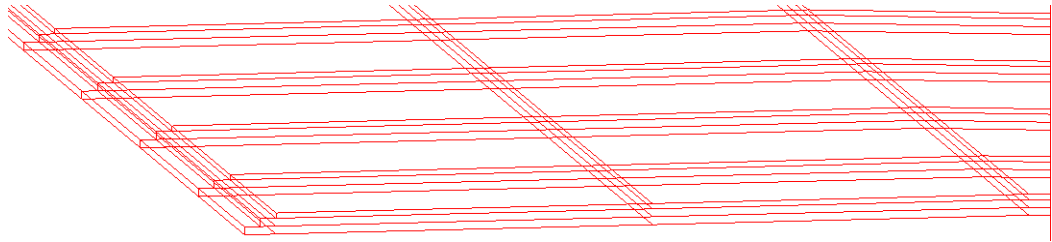


2. Select the **Surface** from the drop-down.

- The **Component** list shows all the features in the selected surface along with their styles and descriptions.

**Important!** Components that appear red indicate their Style cannot be found in the currently loaded **XIN** file. Check to see if the correct Style is associated with the component. If so, check to see that the correct **XIN** is loaded. If not, you can change the Style associated with a component using **Surface > Feature > Component Properties**.

- Highlight the component or components you want to display. You can right-click and choose **Select All**, **None** or **Invert** the selection.
- Select **Apply** and the components are drawn in the MicroStation file, using the associated Style to determine the Named Symbology to use.



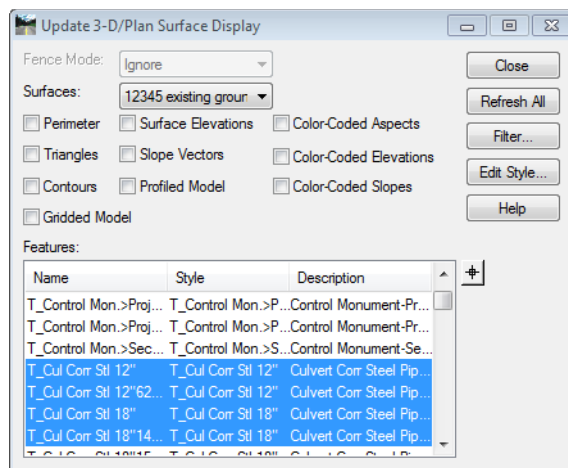
- Select **Close**.

## Update 3-D/Plan Surface Displays

The Update 3D/Plan Surface Display command is very useful for displaying surface information in the MicroStation file. Rather than choosing individual surface display commands, you can use this one command to display the perimeter, triangles, contours, features, etc. What makes it even more useful is the option to turn these same displays off.

The one down-side to using this command is the inability to choose a preference to control the display. If *Style* lock is off, the displays requiring a preference automatically use the **Preferred Preference** as defined by the *XIN* file - in this case, the preference named *CDOT*. If *Style* lock is on, they use the preference assigned to the surface in *Surface Properties*.

1. Choose **Surface > Update 3D/Plan Surface Display**.



2. If using a fence, select the appropriate *Fence Mode*.
3. Select the *Surface* from the drop down menu.
4. Toggle the Item or Items to turn on or off in the design file.
5. Highlighting features from the *Features* list displays those features in the design file.

**Note:** The dialog honors the active feature filter if the *Feature Filter* lock is on.

**Important!** Features that appear red indicate their Style cannot be found in the currently loaded *XIN* file. Check to see if the correct Style is associated with the feature. If so, check to see that the correct *XIN* is loaded.

6. Select **Close**.

**Note:** The feature display is not a MicroStation graphic group. If you need to delete the features, this is a very handy method, since you do not have to create a selection set or make certain they are inside a fence to delete the entire set of features at once.

### Section Summary:

- The view surface commands provide a visual look at the DTM.
- Several preferences are available to ensure the displays meet CDOT standards.

- The *Update 3D/Plan Surface Display* dialog is a quick interface to most of the surface display commands.

### **Chapter Summary:**

- DTMs should be reviewed and checked for accuracy when presented for the first time, or when created.
- Existing ground DTMs are created by Survey and can be reviewed and/or viewed as a check and familiarization process.
- Review commands provide a means of checking elevations, features, styles, etc. without displaying the DTM in the MicroStation file.
- View commands display the DTM for a visual check.

