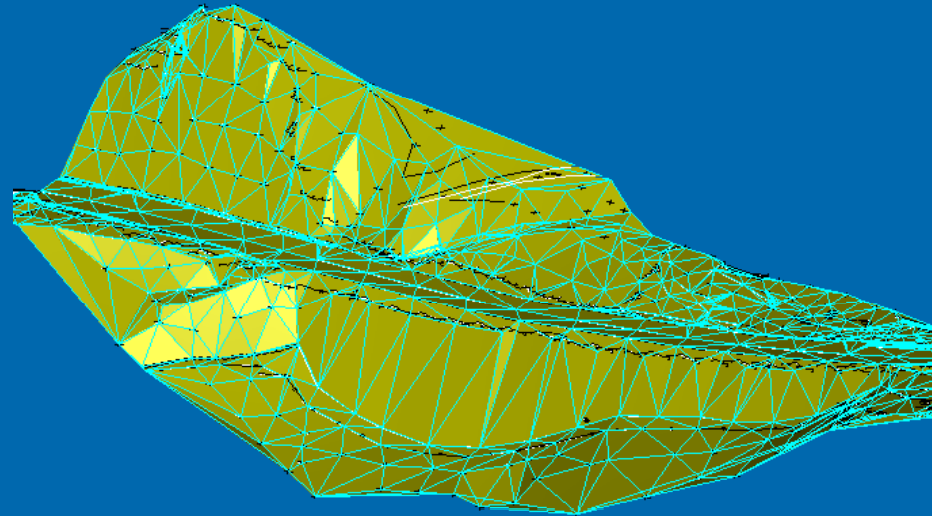




# Surfaces - Objectives

- Cover the Basic DTM Point Types
- Creating a new InRoads Surface
- Surface processing in InRoads
- Loading 3D data into a Surface
- A bit about Surface Properties
- Overview of the View Surface commands
- A glimpse of the DTM Design/Editing tools
- A bit about earthwork volumes
- InRoads Locks, ... a beginning

# Digital Terrain Models



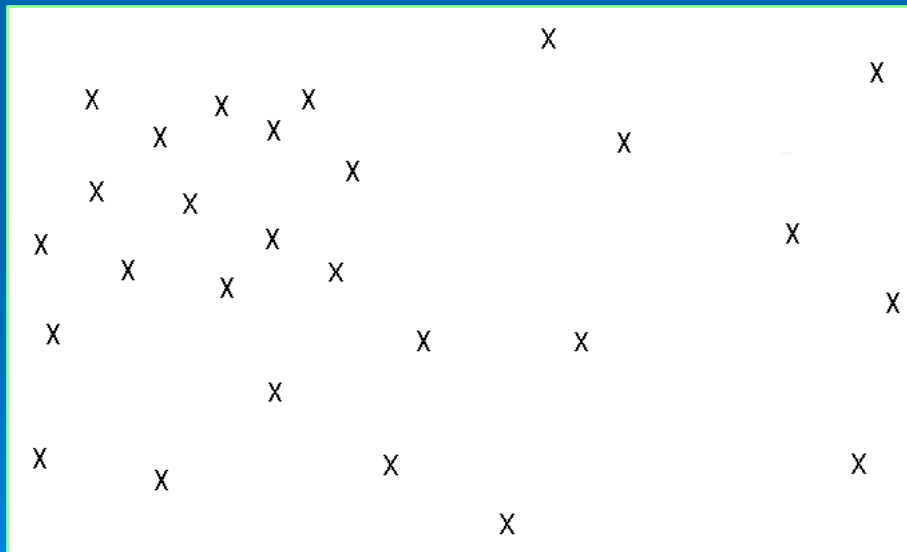
- Digital Terrain Models are 3-D surfaces
- Representing:
  - Existing conditions
  - Design conditions
- Surfaces are key to many InRoads operations

# Surface Point Types

- The software uses several different types of points:
  - Random points.
  - Breakline points.
  - Interior boundary points.
  - Exterior boundary points.
  - Contour points.

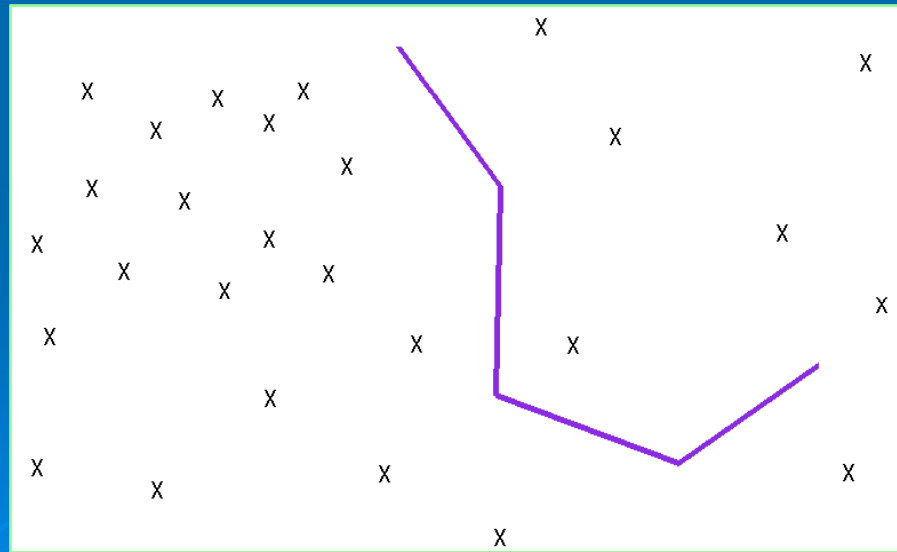
# Random Points

- Random, or regular points, are singular points with X, Y and Z coordinates
- They have no direct relationship with other points.



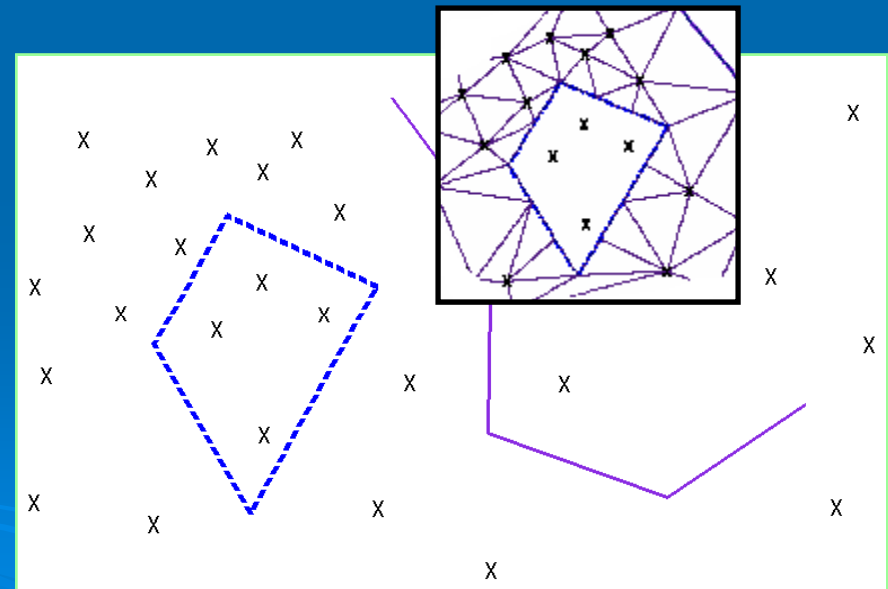
# Breaklines

- Breaklines are used in a surface model where a linear relationship exist along a path
- Two or more points are required to define a breakline.



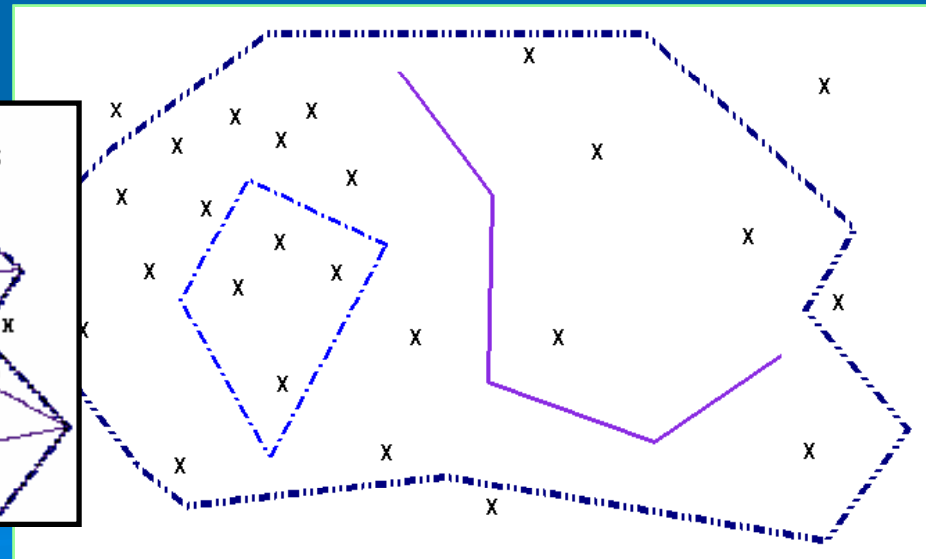
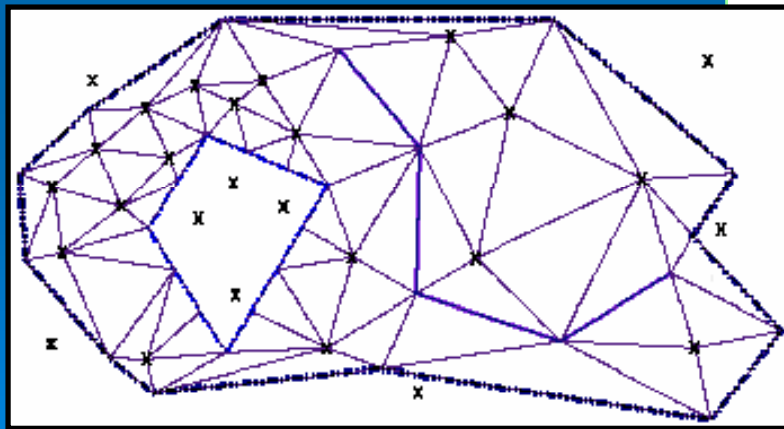
# Interior Boundary

- Interior boundaries define void areas
  - No computations occur inside these void areas.
  - Must be a closed figure
  - A single surface can have many Interior Boundaries
- Can be collected around perimeters of ponds, buildings, lakes or inaccessible



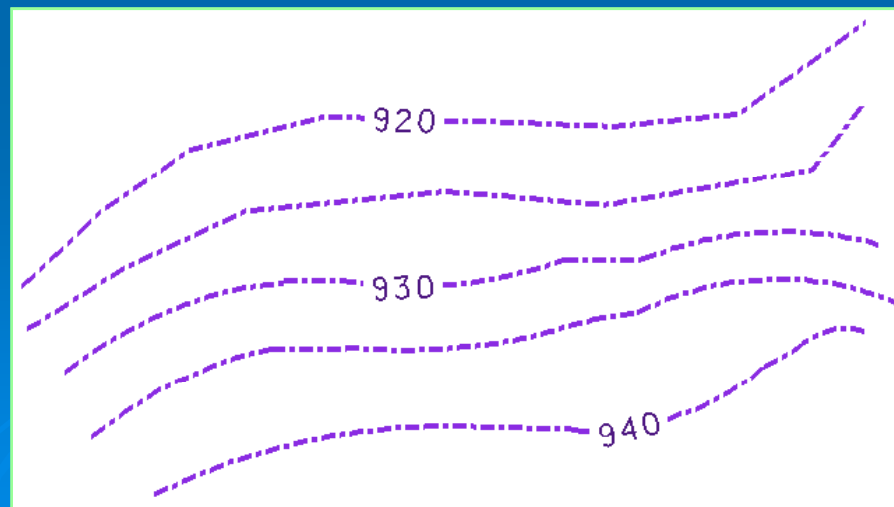
# Exterior Boundary

- Exterior boundary points are used to limit the outer extent of the model.
  - No computations occur outside the exterior limit.
  - Only 1 exterior boundary can be defined per model.



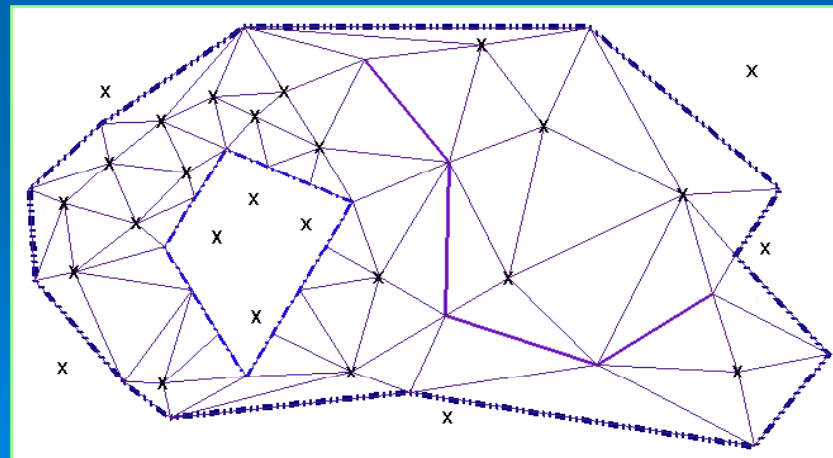
# Contours

- A contour is a graphic element in which all points are at a single elevation.
- Contour points are generated from aerial photographs or from existing quadrant maps from the United States Geographical Survey.



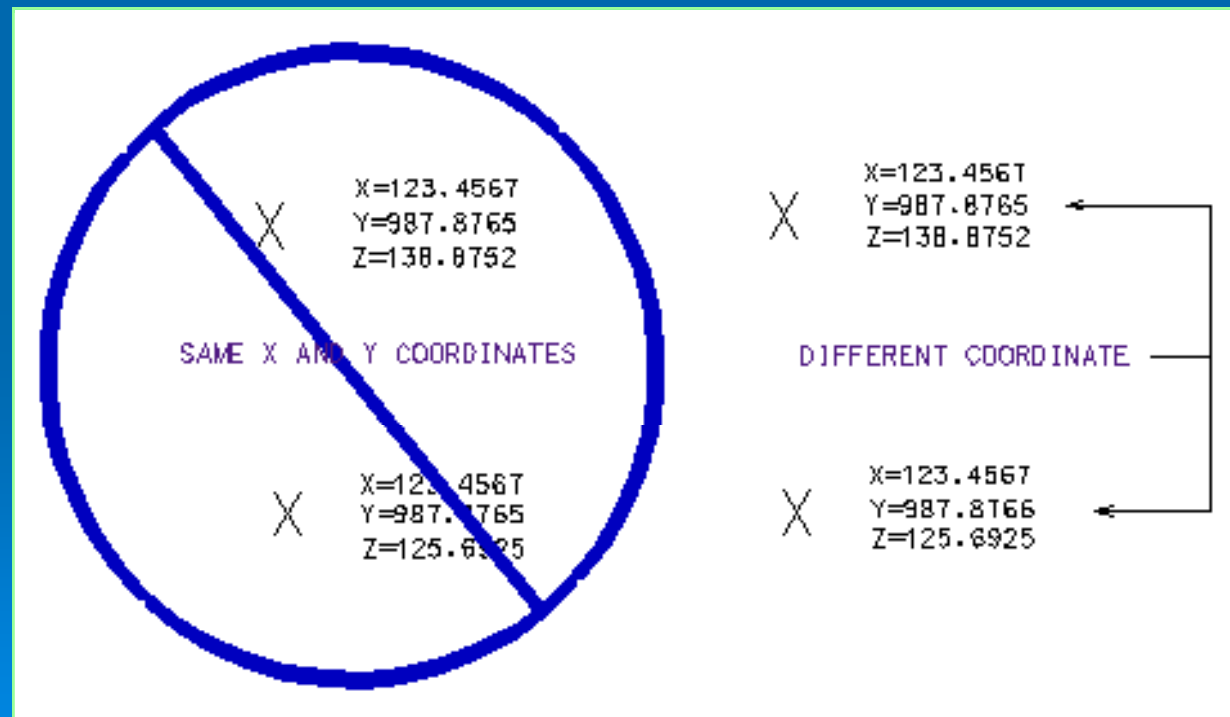
# Creating a Surface

- First add the 'components' that define the elevational controls
- Next, processing associates and forms the relationships between all the data contained in the surface model



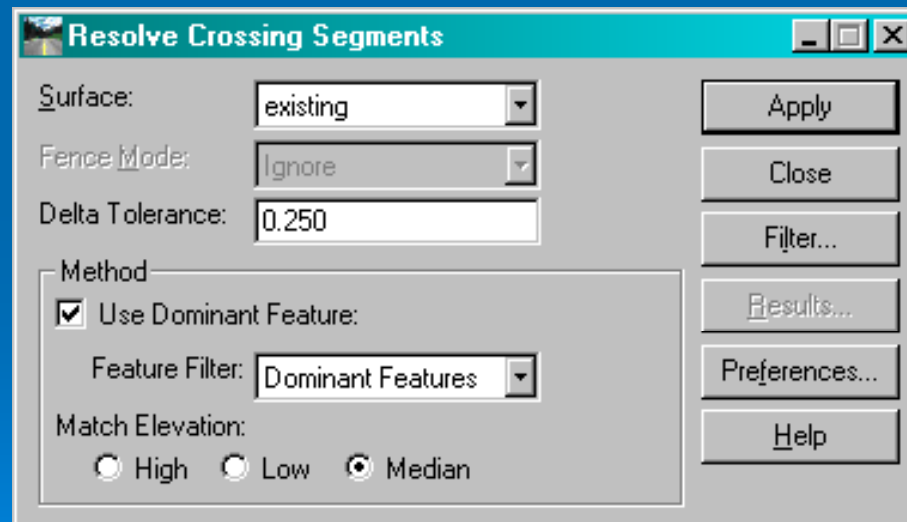
# Data Conflicts

- The InRoads DTM allows only one Z (elev.) value for each X-Y coordinate.

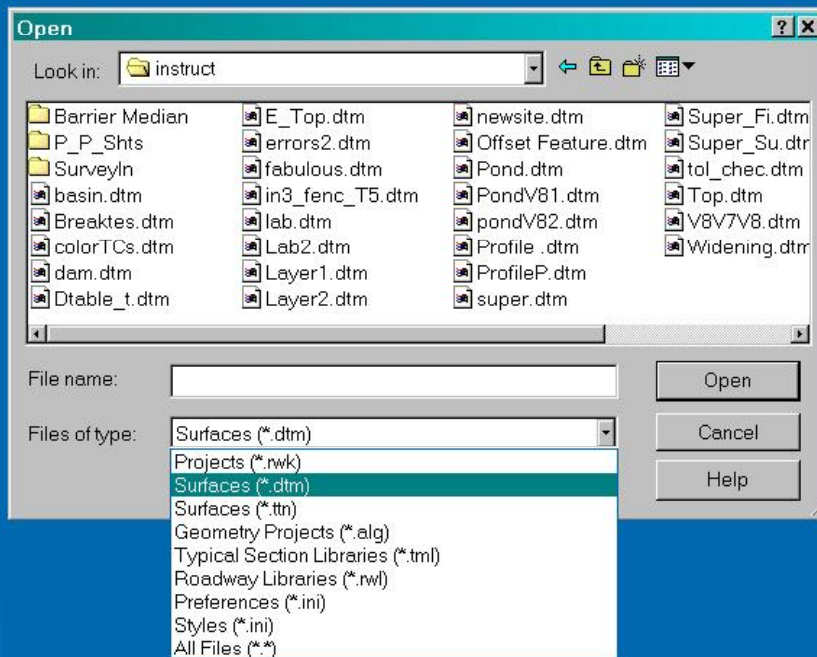


# Resolving Data Conflicts

- InRoads will still 'auto-resolve' the crossing breaklines when it triangulates
- Another tool has been added to help here



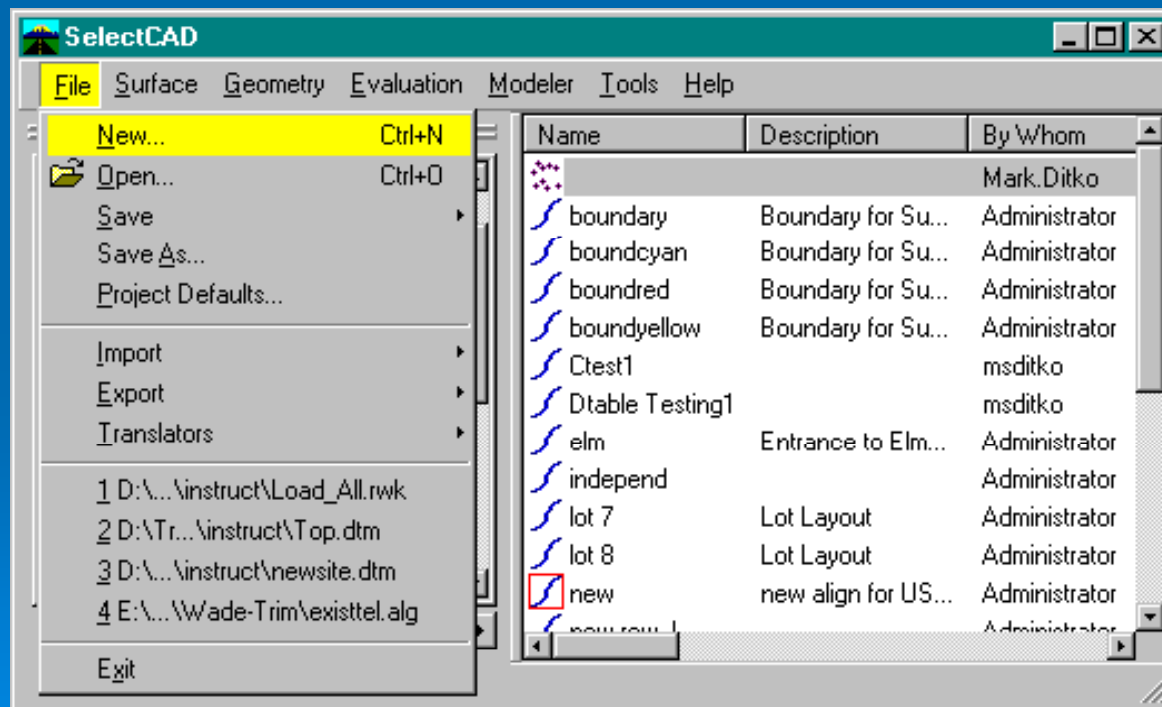
# Opening Existing InRoads Files



- Select *Surface (\*.dtm)* from the *Files of type:* pick box
- The select the surface that you wish to open
- File>Open* is used to open any existing InRoads data that you may have

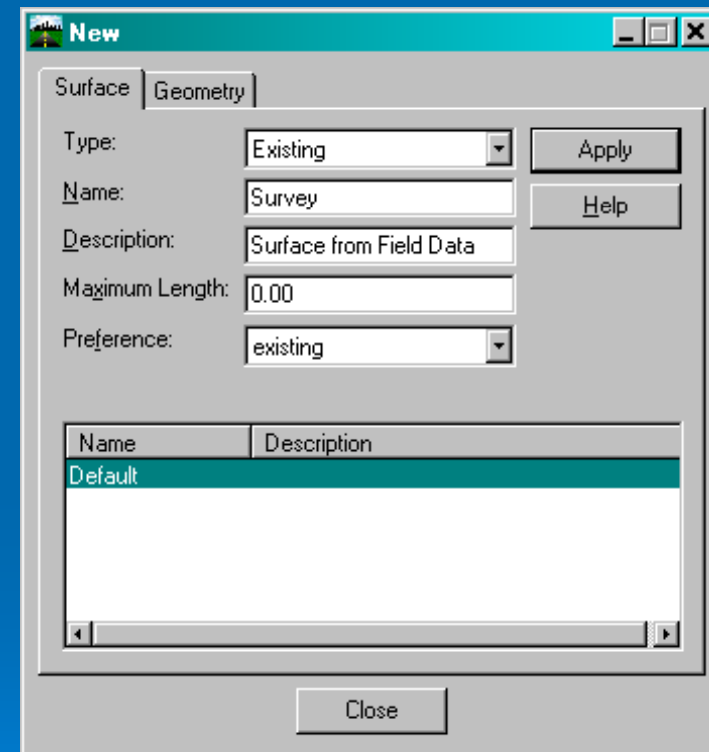
# New DTM Data 'holders'

- *File > New* calls up a dialog box for the creation of a memory 'slot' to store new surface data.

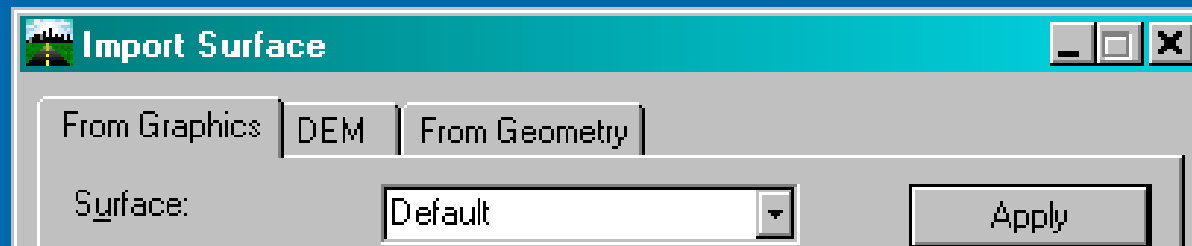


# Creating a Surface 'slot'

- The *File > New* is used to create a placeholder
  - Set the Tab to *Surface*
  - Key in the information
  - *Apply* it
  - The 'slot' is empty
- **Type** setting:
  - Existing
  - Design
  - Substratum
  - Ignore
- This setting relates to the End Area Volumes

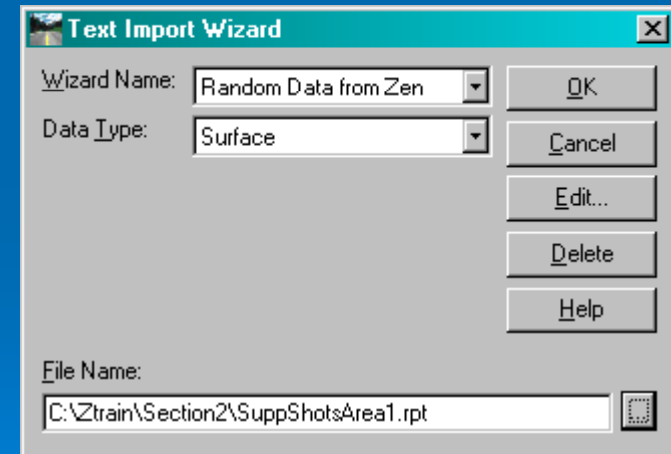


# Loading Surface Data

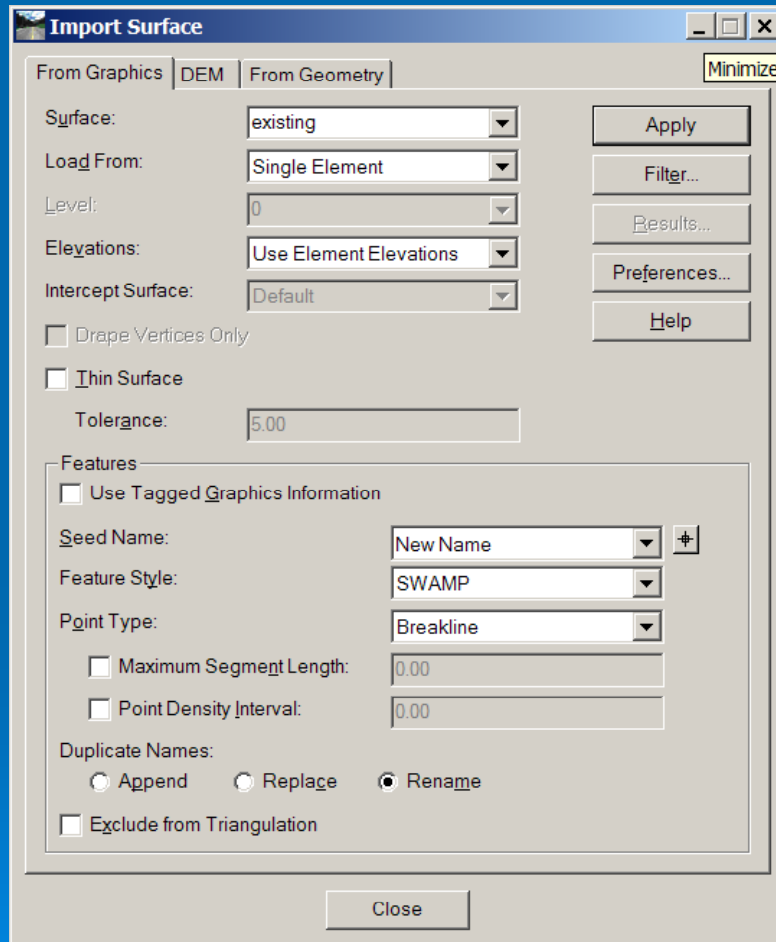


• *InRoads > File > Import > Surface...*

- **File > Text Import Wizard**
  - ASCII surface information
  - ...



# Loading Graphical Data



## From Graphics tab

 Set the *Surface*

 Load From...

 Define the 3 Feature ID's

- Name (Unique)

- Style (1 to Many)

- Type (Point definition)

 Other Data Specific:

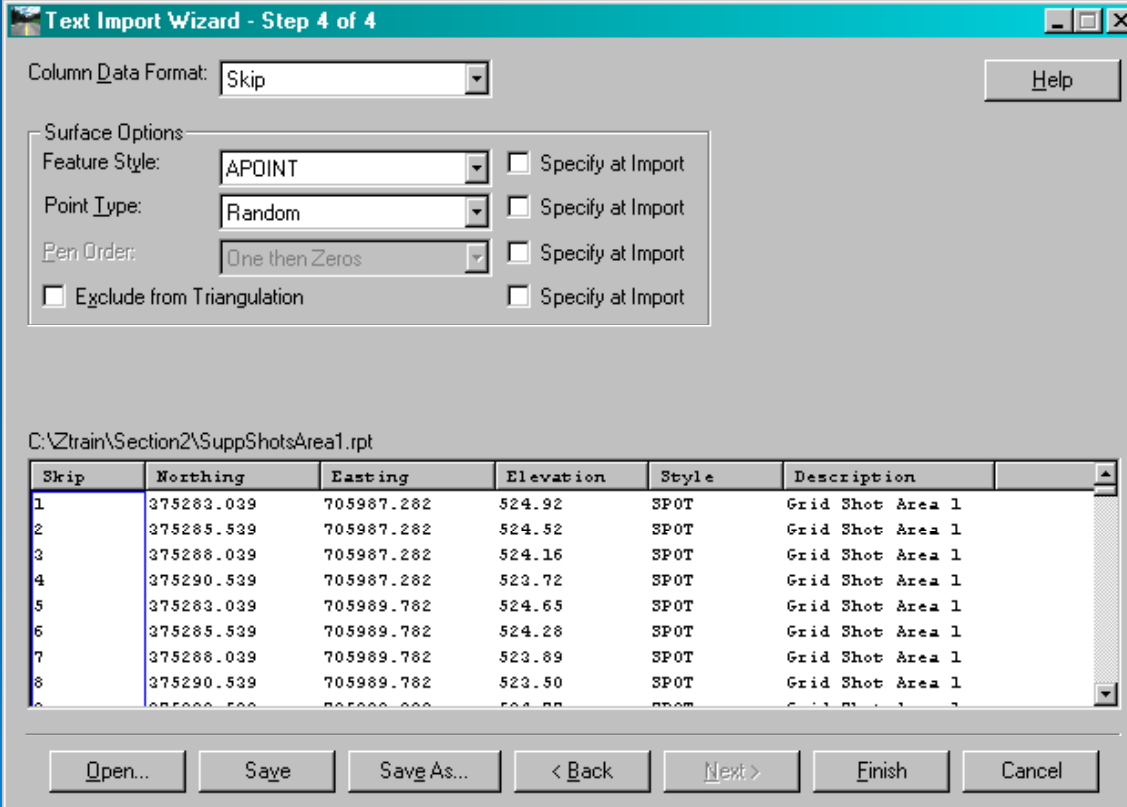
- Thin Surface

- Max Segment Length

- Point Density Interval

# Loading ASCII Data

- The *From ASCII* tab is replaced by the TIW



Text Import Wizard - Step 4 of 4

Column Data Format: Skip

Surface Options:

Feature Style: APOINT  Specify at Import

Point Type: Random  Specify at Import

Pen Order: One then Zeros  Specify at Import

Exclude from Triangulation  Specify at Import

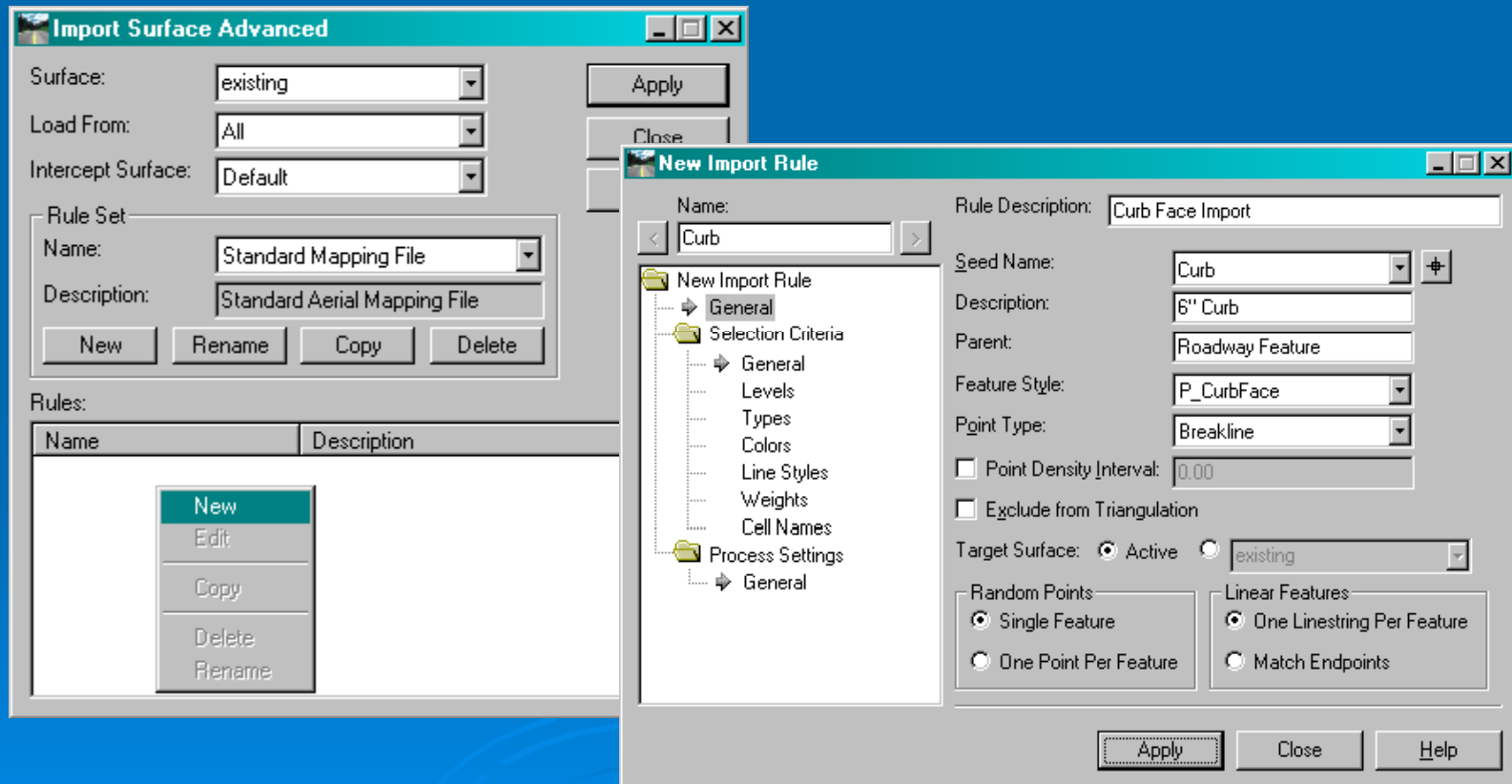
C:\Ztrain\Section2\SuppShotsArea1.rpt

Skip	Northing	Easting	Elevation	Style	Description
1	375283.039	705987.282	524.92	SPOT	Grid Shot Area 1
2	375285.539	705987.282	524.52	SPOT	Grid Shot Area 1
3	375288.039	705987.282	524.16	SPOT	Grid Shot Area 1
4	375290.539	705987.282	523.72	SPOT	Grid Shot Area 1
5	375283.039	705989.782	524.65	SPOT	Grid Shot Area 1
6	375285.539	705989.782	524.28	SPOT	Grid Shot Area 1
7	375288.039	705989.782	523.89	SPOT	Grid Shot Area 1
8	375290.539	705989.782	523.50	SPOT	Grid Shot Area 1

Buttons: Open... Save Save As... < Back Next > Finish Cancel

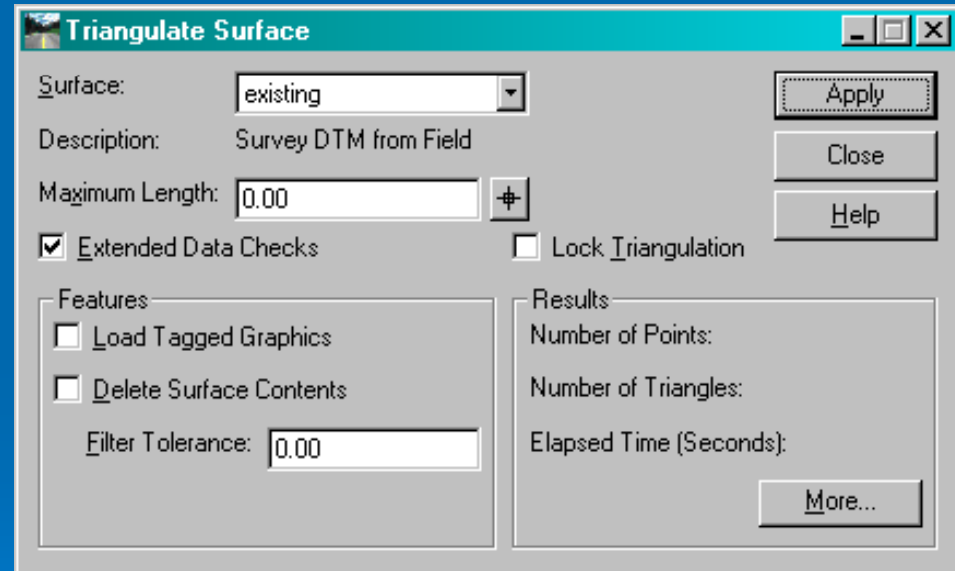
# Loading Graphical Data 2

- Advanced technique for graphical import



# Triangulate Surface

- Defines the data relationships within the surface model
- Select *Surface* > *Triangulate...*
- The *Extended Data Checks* option will correct and report on various problems that may be in your surface
- Lock Triangulation



# Surface Properties - Main Tab

Surface Properties

Main | Advanced

Surface: existing

Name: existing

Description: Survey DTM from Field (

Maximum Length: 0.00

Preference: existing

Type: Existing

Use Extended Data Checks

Lock Triangulation

Data Range

Point Type: Total

	Minimum	Maximum
Northing:	373533.728	375489.451
Easting:	704790.113	709579.777
Elevation:	519.593	651.357

Data Totals

	Active	Features	Deleted	Total
Random:	3512	152	100	3612
Breakline:	6146	526	162	6308
Contour:	2842	56	0	2842
Inferred:	0		0	0
Interior:	0	0	0	0
Exterior:	383	1	0	383
All Points:	12883	735	262	13145
Triangles:	20814		416	21230

Report... Help

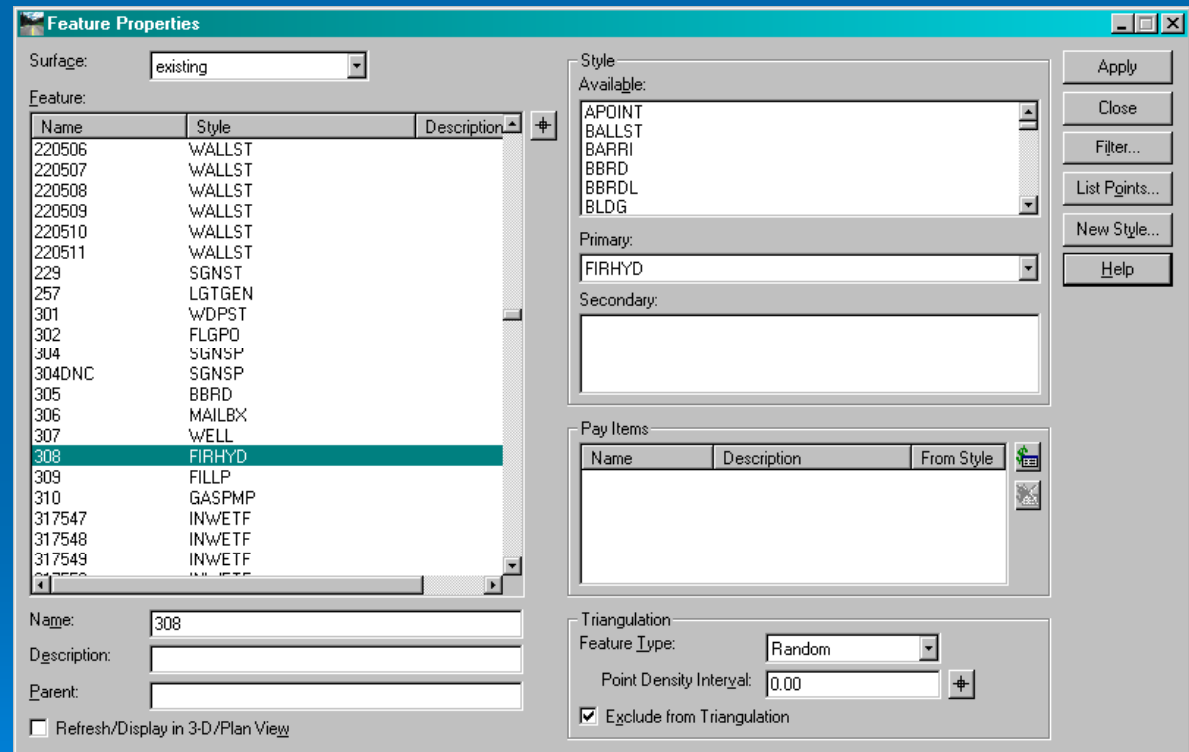
Apply Close

- Name
- Description
- Max Length
- Preference
- Type
- Data Range
- Data Totals
- Lock Triangles

# Feature Properties

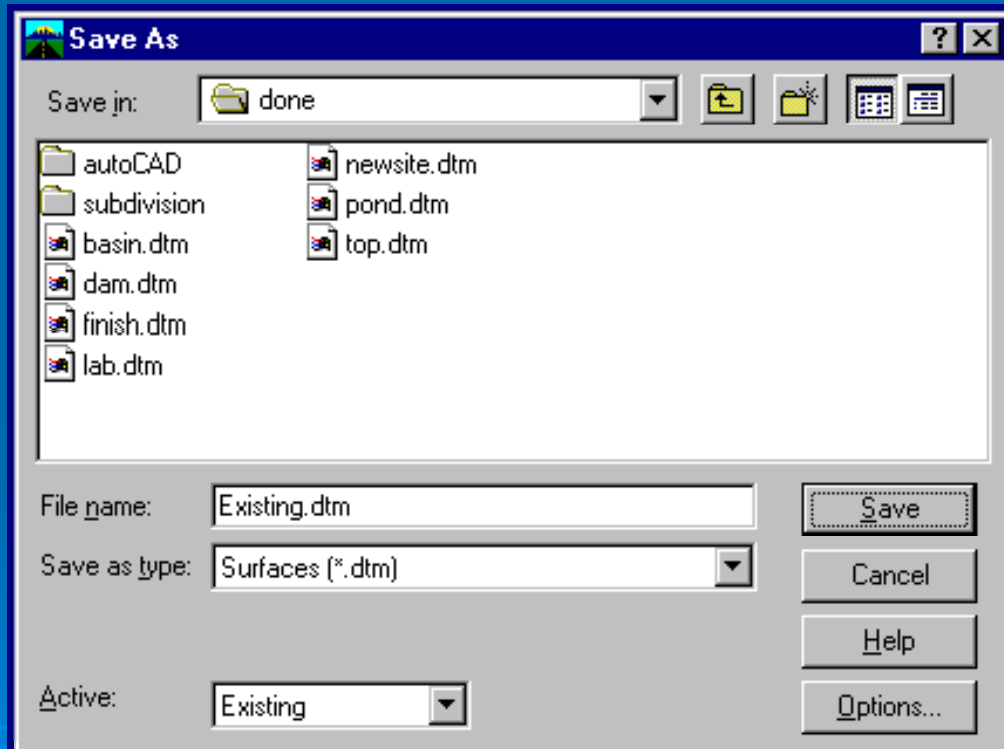
• *Feature Properties* show the complete Feature 'picture' for the surface

- Name
- Description
- Style
- Point Type
- Point Density
- Exclude from Triangulation
- Refresh...
- Primary
- Secondary

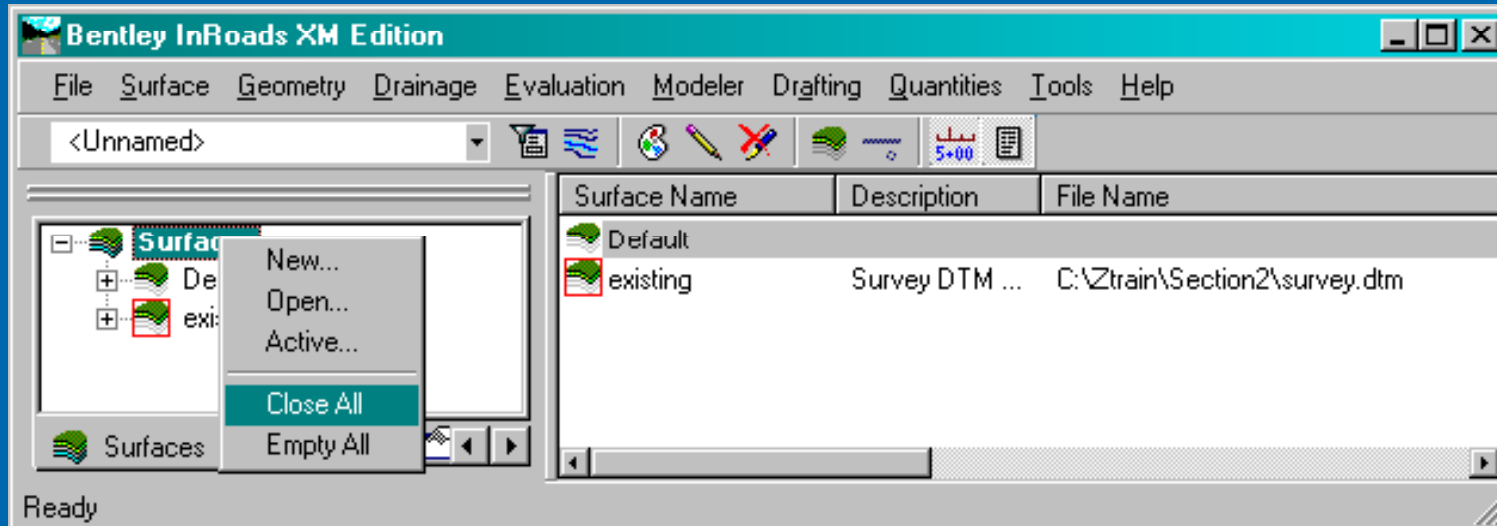


# Save Surface

- Saves the point and triangle information from the surface.
- To change the surface to be saved, toggle to the desired surface name at the bottom of the dialog box.



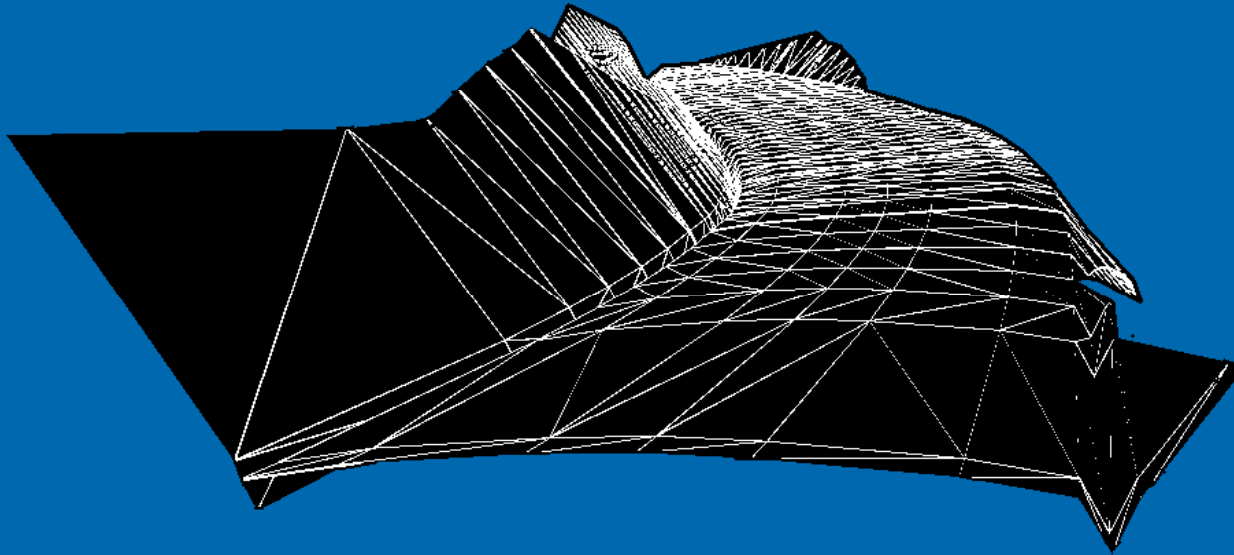
# 'Close' Data



## ● 'Flush' a surface from memory

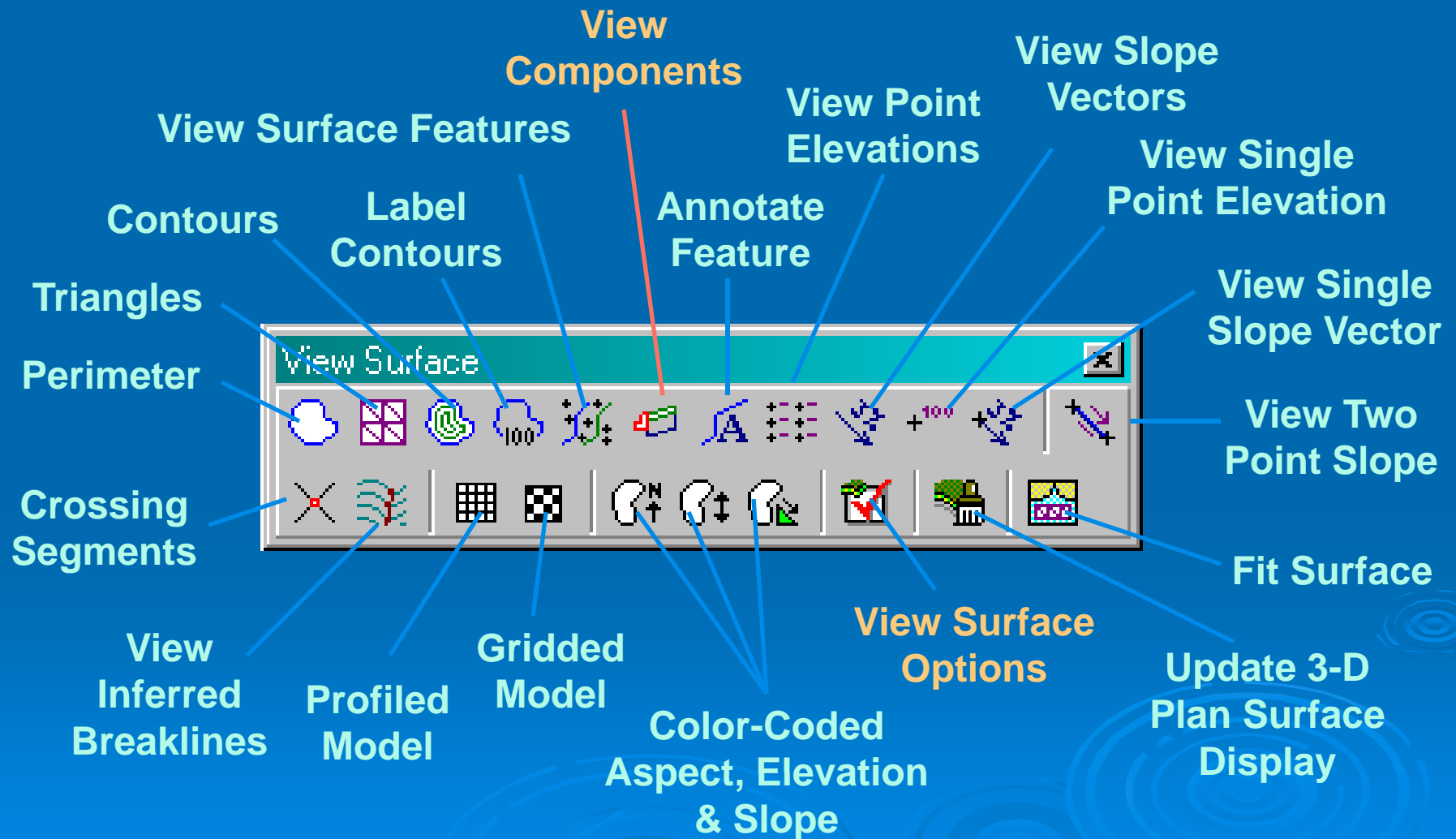
- You don't Delete InRoads data anymore, you 'Close' it

# DTM – Contents



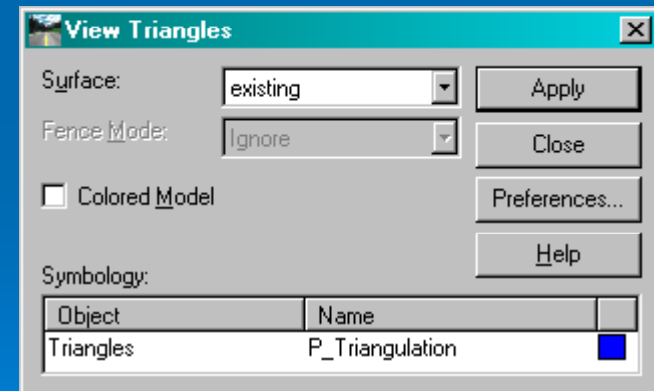
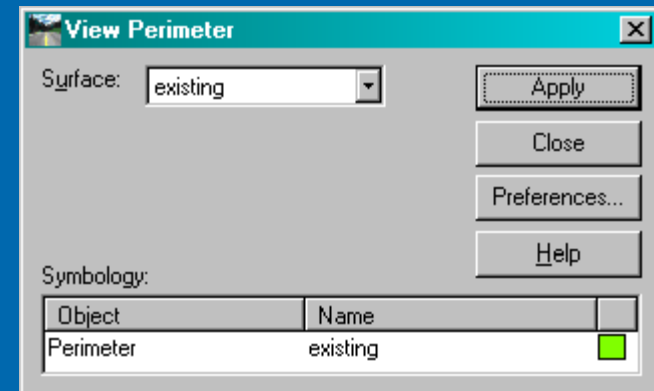
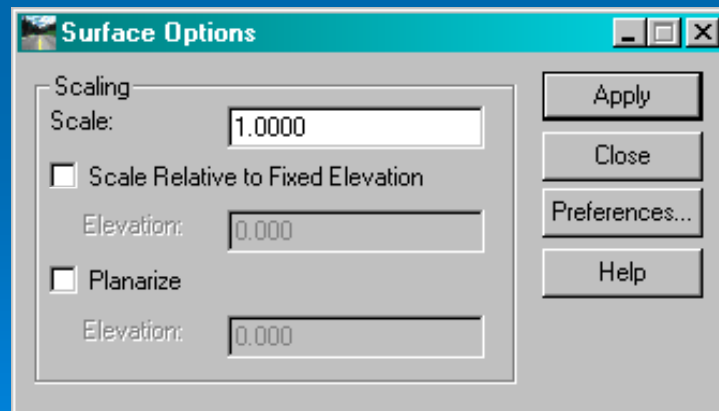
- Digital Terrain Models are composed of:
  - The 'pieces' or Features and
  - The Triangle network of relationships
- Some surface commands are Feature-based and others are Triangle-based.

# View Surface Commands



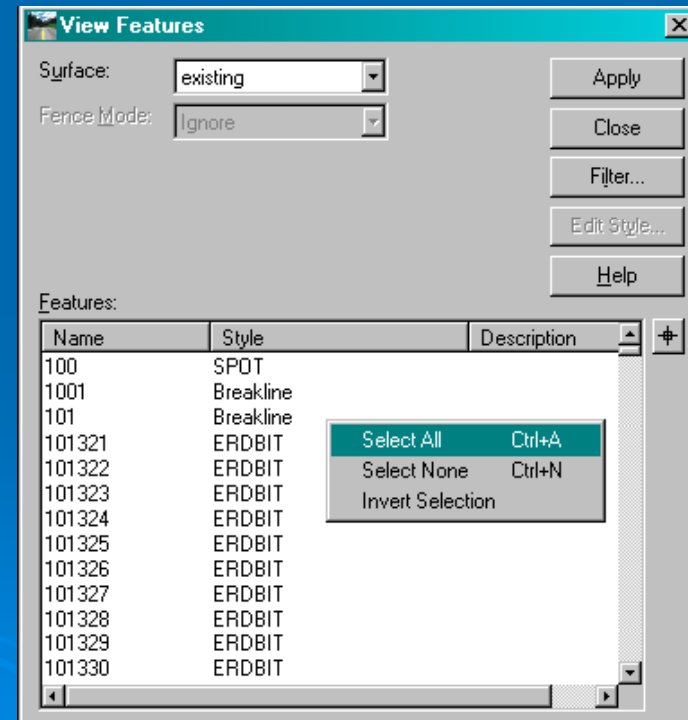
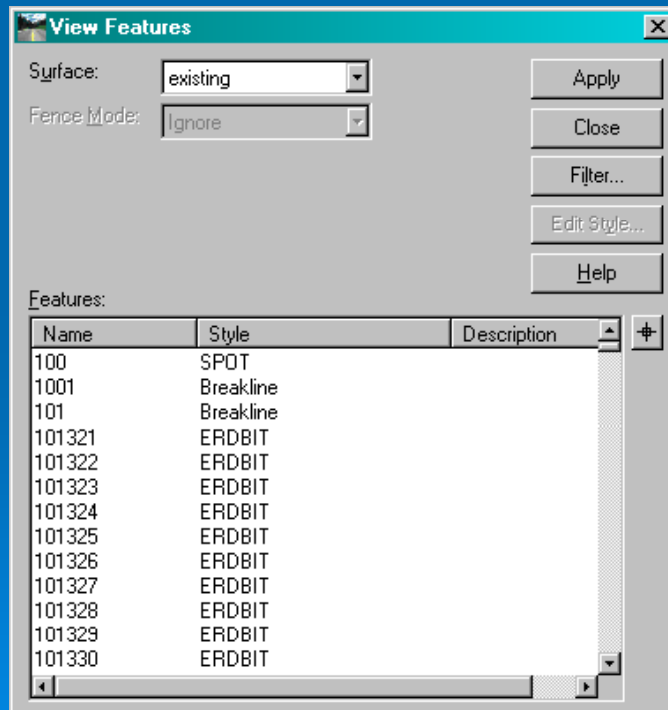
# Dialog Changes #1

- Slight visual differences
- View Commands have a common **Surface Options** dialog



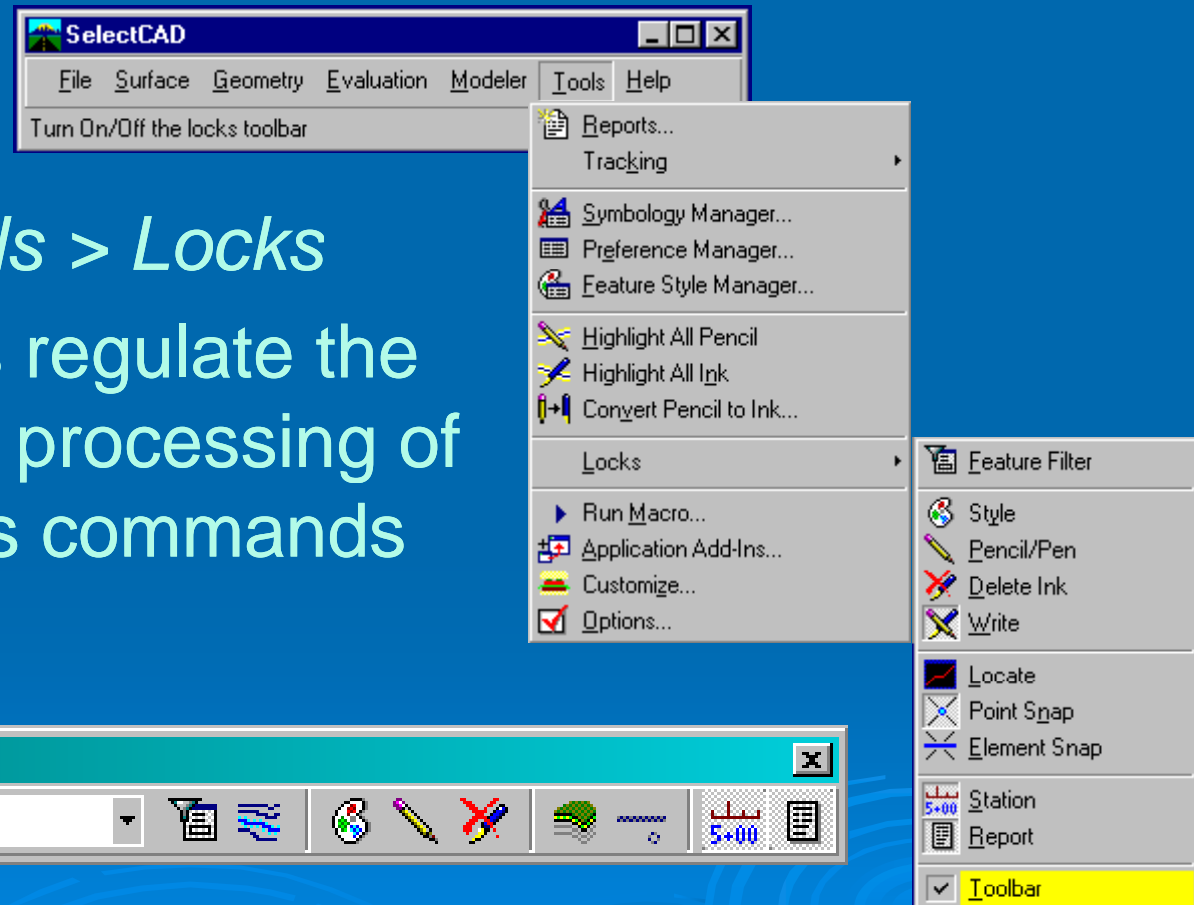
# Dialog Changes #2

- Some of the buttons have been removed and replaced with right-clicks



# InRoads Locks

- *InRoads > Tools > Locks*
- These Controls regulate the output, input or processing of certain InRoads commands

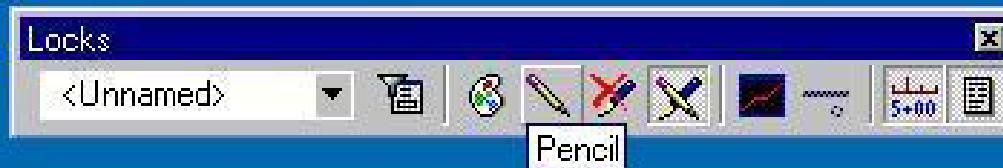


# Pen / Pencil Lock

- ***Pen / Pencil*** relates to what occurs on later re-display of that InRoads item
- The CAD package itself does not care about this setting, only InRoads.

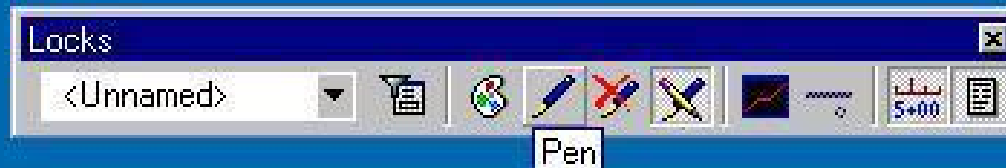


# Pencil Setting



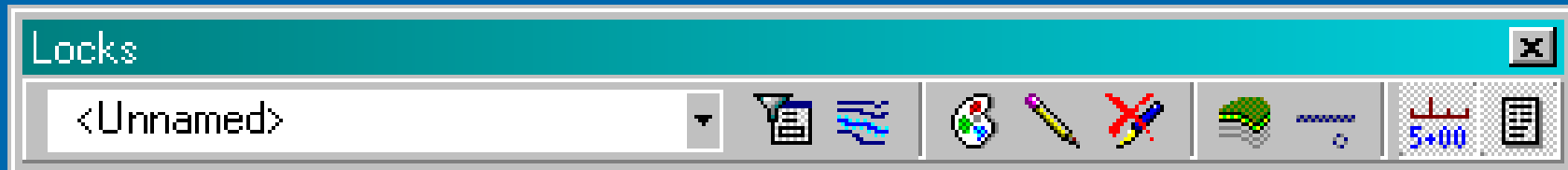
- Information displayed is physically written to the design file, but it is considered a 'Draft' version.
  - An alignment is written to the design file in 'Pencil'; the alignment is revised in InRoads and then re-displayed; the previous graphics are updated resulting in 1 alignment in the CAD file.
  - Contours are displayed in 'Pencil'; revising the DTM in InRoads and re-displaying contours will update the current ones resulting in 1 set of contours written to the CAD file.
- Use *Pencil* to update earlier graphical versions after modifications are made and displayed.

# Pen Setting



- Information displayed is physically written to the design file, and considered **'Final'**
  - An alignment is written to the design file in 'Pen'; the alignment is revised in InRoads and then re-displayed; this results in 2 alignments written to the CAD file.
  - Contours are displayed in 'Pen'; revising the DTM in InRoads and re-displaying contours results in 2 sets of contours in the CAD file.
- Use *Pen* mode to retain earlier graphical versions after modifications are made and displayed.

# InRoads Locks



- FYI - No more **Write Lock**, InRoads is in permanent 'Write Lock on' mode
  - Get used to it, it's gone
- **Feature Highlight Lock** will highlight the selected surface feature in the CAD view
- **Tool Tip** indicates the position of the lock

Feature Filter Lock Off

Style Lock Off

Report Lock Off

Feature Filter Lock On

Style Lock On

Report Lock On

# Surfaces – Summary 1

- The **5 DTM Point Types** are Random, Breakline, Interior & Exterior Boundaries and Contours
- **ASCII & Graphical** 3D DTM input is common
- **Triangulation** is required to produce a surface
- Surfaces have a **.DTM** file extension
- On **redisplay**, Pen is retained / Pencil is updated

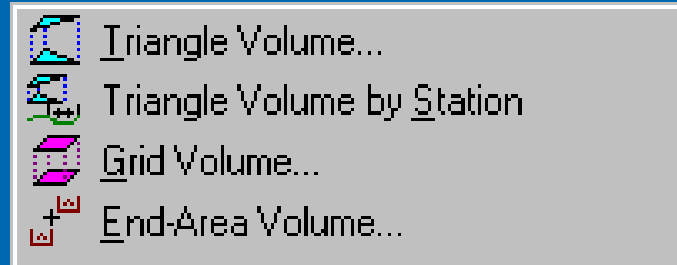
# Surfaces – Hands on

Lecture Pause ...

... Start Lab, Chapter 2-3

# Volume Methods

- **Triangle Volumes** - the precise volume between any 2 InRoads DTMs
- **Grid Volumes** - used to calculate an estimated volume between 2 DTMs, or to match calcs made against a gridded mass grading plan
- **End-Area Volumes** - generates volumes based on the historically used cross section method
- **Triangle Volume by Station** – Triangle Precision with End-Area Volume stationing control (V8.3 only)



# Triangle Volumes

- 2 triangulated surfaces are required before calculating triangle volumes (and grid volumes)
- Triangles are projected between the original surface and the design surface
  - The software then forms three-sided prisms from these projections
- The volume of cut and fill is calculated from the prisms.

# Triangle Volumes

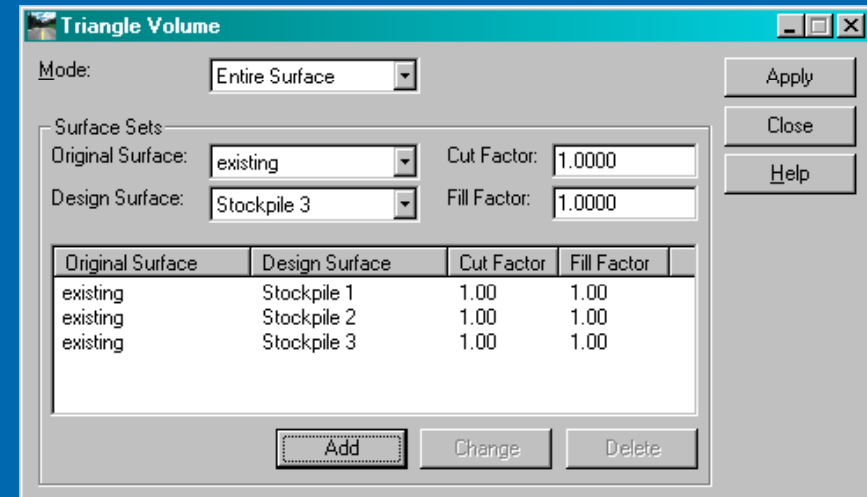
## 3 Modes:

- Entire Surface
- Fence / Region
- Selected Shapes

## Identify the Original Surface & Design Surface

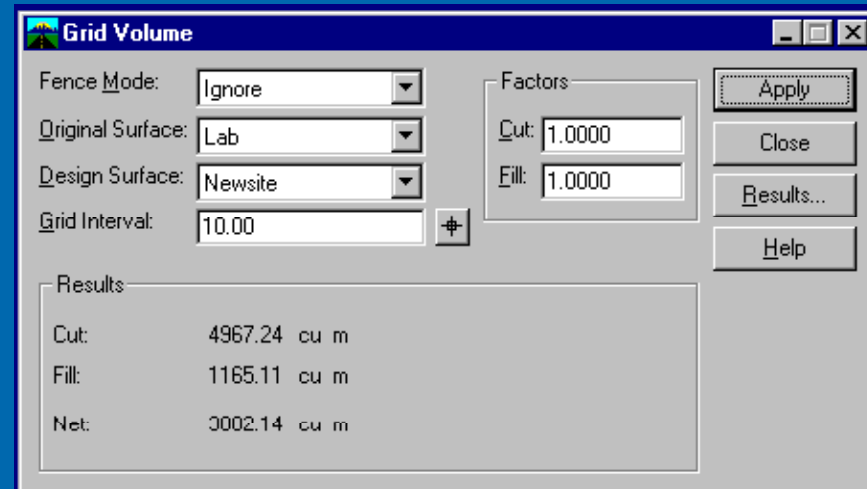
## Cut / Fill; Shrink / Swell; Expansion / Contraction Factors can be used if desired

## Functionality to run multiple volumes at a time has returned to the Triangle Volumes

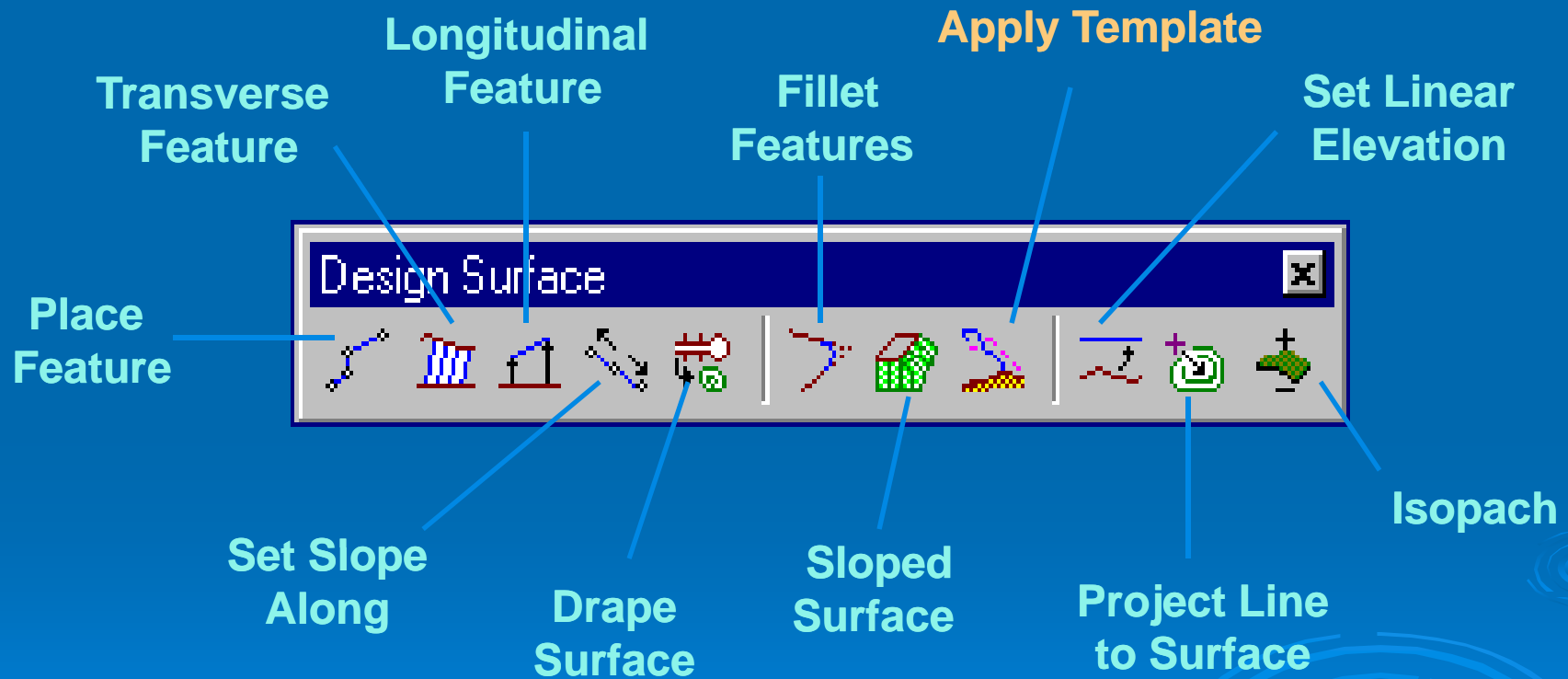


# Grid Volumes

- Two triangulated DTMs are compared against a grid overlay
- Cut / Fill is computed within each grid cell
- The size of the grid cell is defined by the user
- The smaller the grid size, the more accurate the results, but with slower processing.



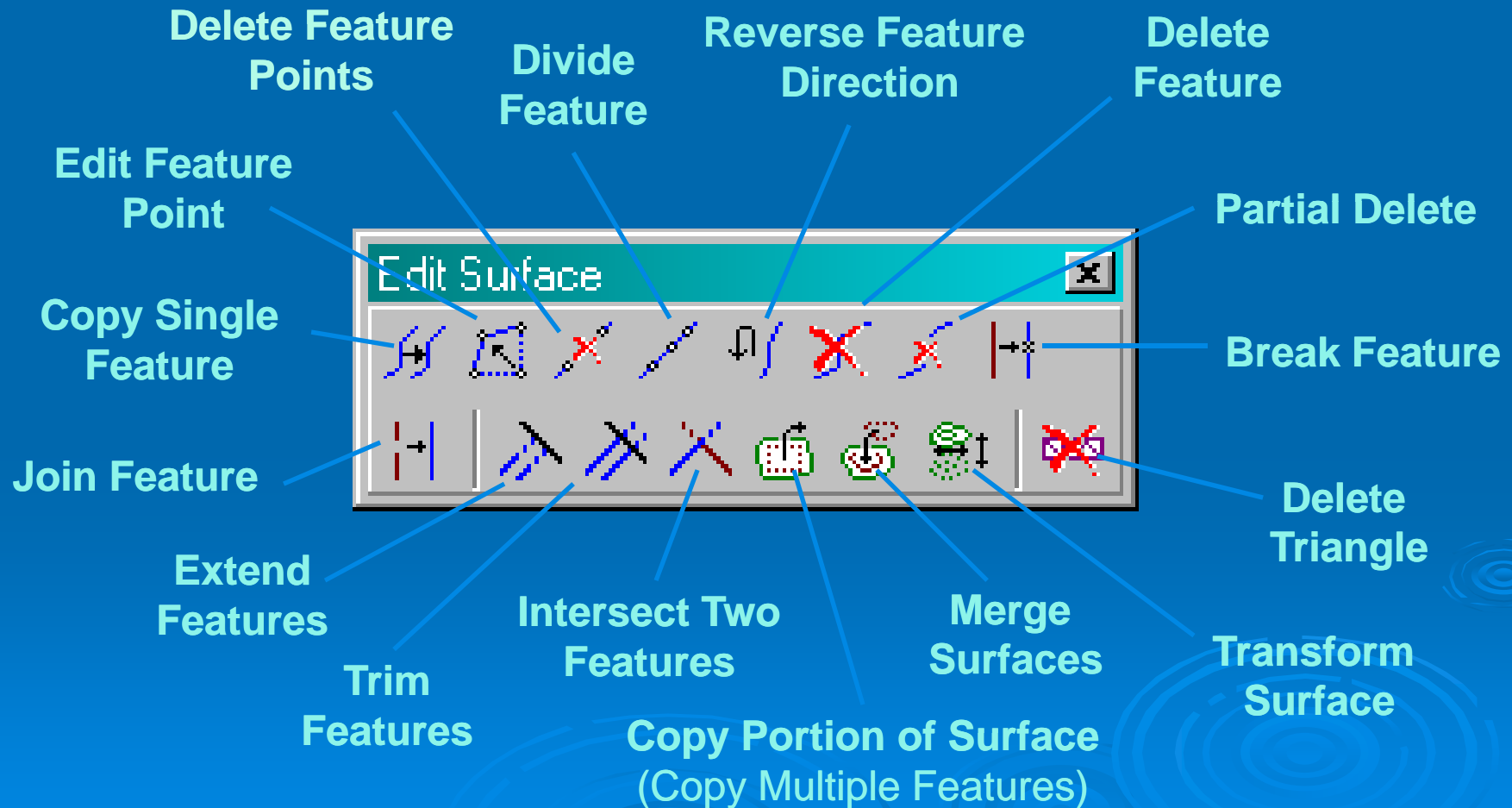
# Surface Design Commands



# Feature Editing in Plan

- Some Edit tools have **dialog boxes** (... means that a dialog box will follow)
- Some Edit tools don't have dialog boxes
- Watch the **InRoads Prompts!** (If there isn't a dialog box following prompts is required)

# Edit Surface Commands



# Surfaces – Summary 2

- The 5 DTM Point Types are Random, Breakline, Interior & Exterior Boundaries and Contours
- ASCII surface data is input with the Text Import Wizard
- Triangulation is required to produce a surface
- Lock Triangulation will not allow the triangles to change
- Triangle Volumes are able to run multiple volumes at once and require two triangulated surfaces
- New tools have been added to assist with crossing breaklines, elevational busts and centralized options
- Surfaces have a .DTM file extension
- There are a handful of specialized surface design tools along with a collection of surface editing tools that work directly with the DTM
- On redisplay, Pen is retained / Pencil is updated