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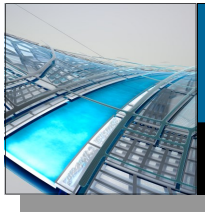

AutoCAD Civil 3D 2018

TRAINING COURSE

Level I: Essentials (4-day)

INSTRUCTORS

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DESCRIPTION

This Level I training class introduces the model-based design technology in Autodesk's Civil 3D and provides the core for its application in civil engineering and planning projects. Over the four-day period, each student will learn the basics of objects, styles, terrain modeling, parcels, road design, site grading, project data sharing, gravity and pressure pipe networks, plan production, and working with survey data.

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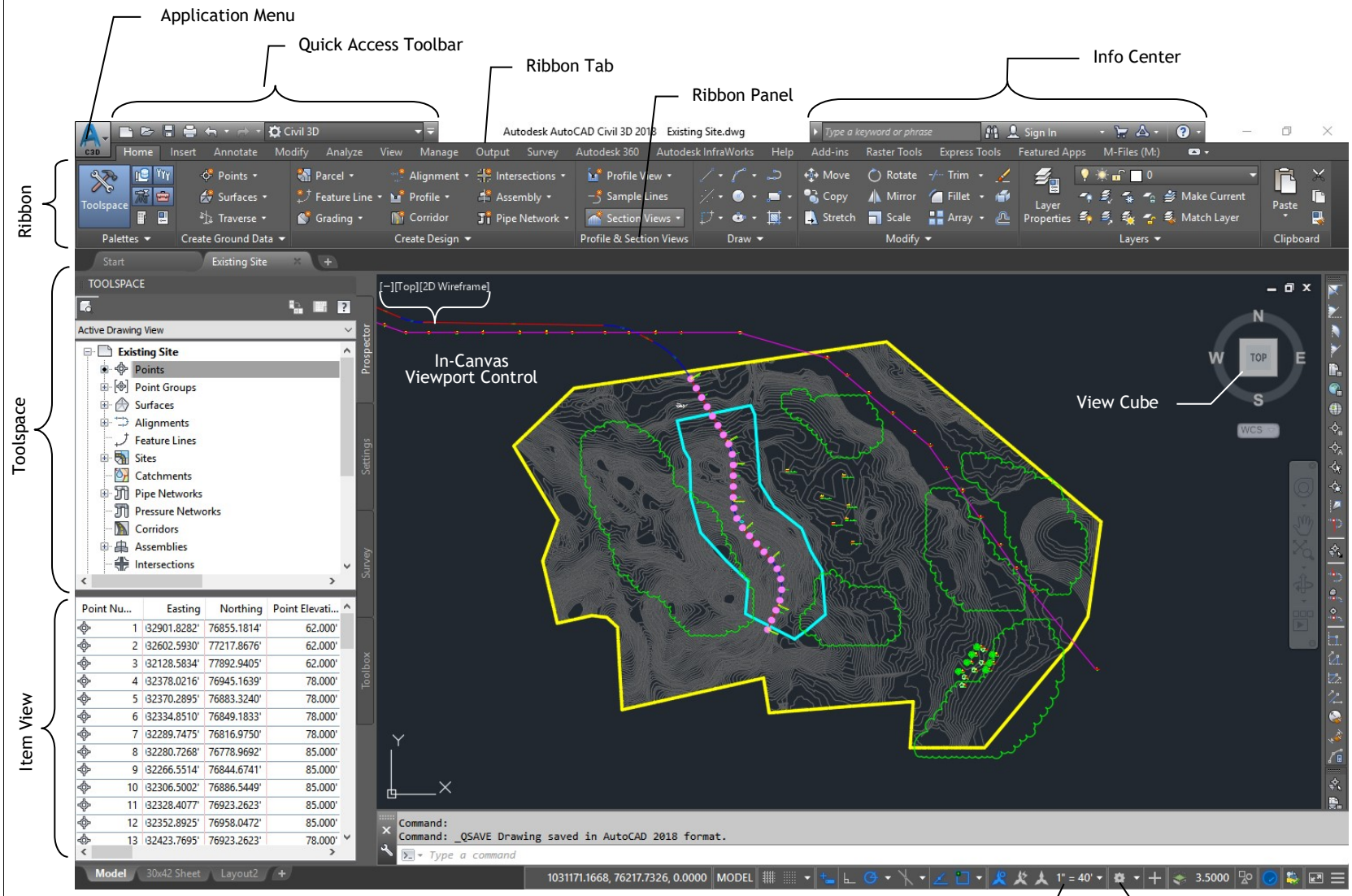


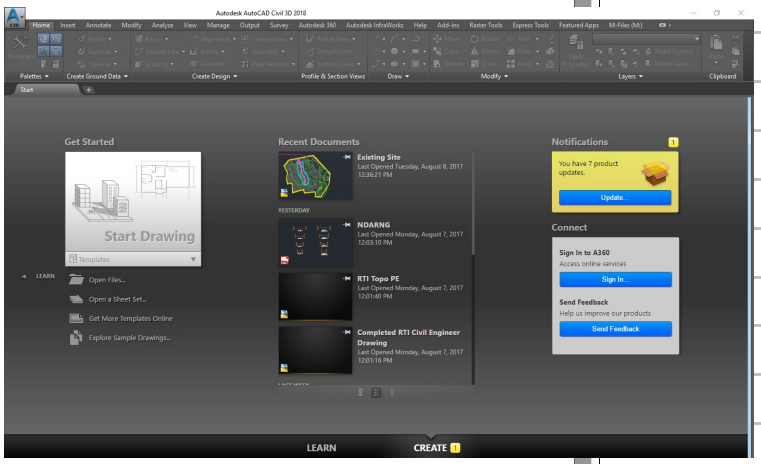
Tip: Display Coordinates

The Coordinates of your cursor are no longer displayed by default in the interface. To turn these on, click on the "Customization" tool at the far bottom right of your Civil 3D interface and choose "Coordinates" at the top of the list.

CONCEPT

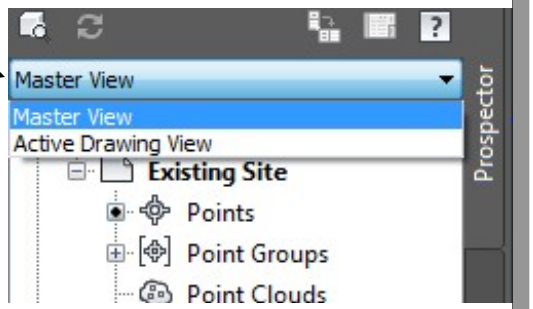
Start Screen

- Access to Learning Resources:
  - Access “What’s New” Tutorials
  - Getting Started Videos



Interface

- Similar to AutoCAD 2018: Familiar Environment
- Multi-document enabled
- Menus and Toolbars based on ease-of-use and workflow
- Application Menu:
  - Command Search
  - Drawing Previews
- Info Center:
  - Help Search and User Documentation Access
  - Communication Center (Update Notification)
- Ribbon:
  - Tabs and Panels Arranged According to Workflow
  - Includes AutoCAD & Civil 3D Tools
  - "Sticky" Panels Can Be Detached from Ribbon
  - Context Sensitive (Changes with Element/Object Selection)
- Toolspace:
  - Prospector Tab (Object Creation & Access, Data Shortcuts, and Templates Access)
  - Settings Tab (Style Creation & Access, Drawing Settings)
  - Drawing View Drop-Down
  - Item View
- Options:
  - Command ‘OP’
  - Drawing Display Options Controlled by AutoCAD Profiles
- Customized User Interface:
  - Command ‘CUI’
  - Controls Tool Bars and Menu Placement
- View Cube:
  - 3D Navigation Tool
- Quick View DWG and Layouts:
  - Multiple File and Layout Preview



NOTES

CONCEPT

Civil 3D 2018 Intelligence

- Civil 3D provides powerful tools in a dynamic and intelligent environment that streamlines the design process and increases productivity.

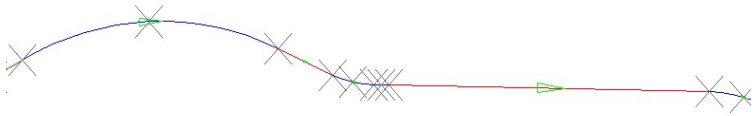
Intelligent Object-Based Environment

- Intelligent AECC objects instead of basic AutoCAD entities

Example: A series of connected AutoCAD lines and arcs (AutoCAD) →

VS.

An intelligent Alignment (Civil 3D) →



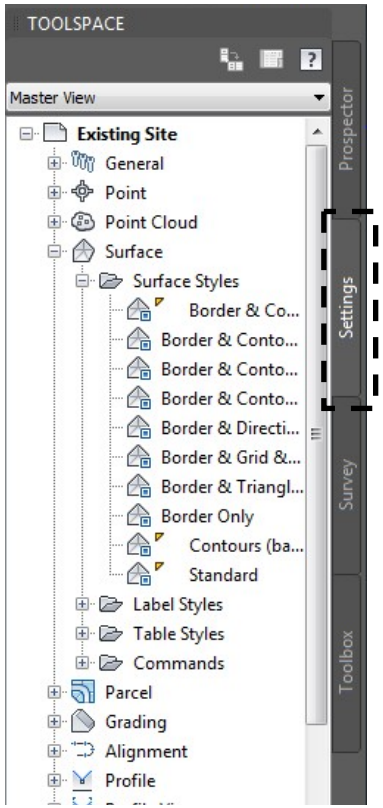
Intelligent Objects

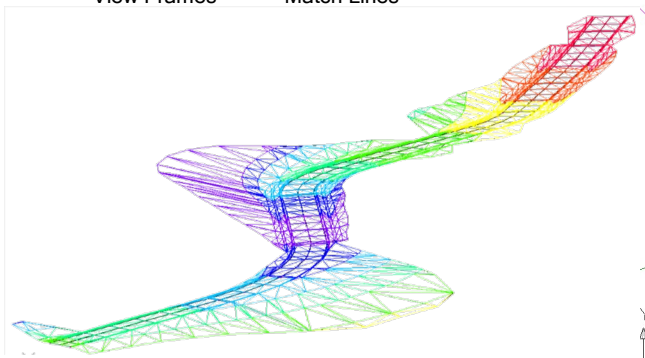
- Are the Building Blocks of Civil 3D Design
- Maintain Dynamic Relationships to Each Other
  - Objects react to changes in other related objects
  - Parcels subtended by alignments will automatically subdivide into two parcels
  - Profiles based on Alignments (surface profiles) will update as Alignment is edited
  - Surfaces automatically rebuild when points or breaklines are added/edited
- Deletion of Objects is Permanent
- Types of Intelligent Objects Include:

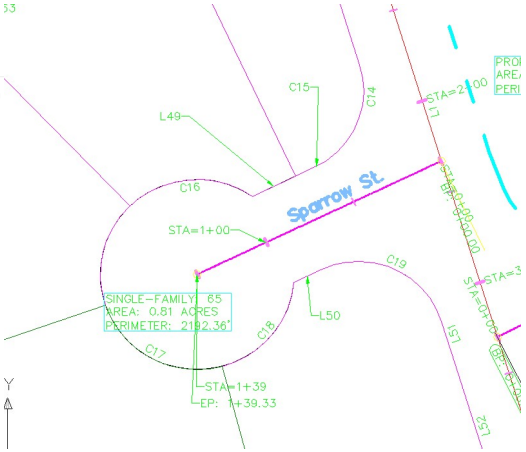
Points	Point Groups
Surfaces	Alignments
Feature Lines	Grading Groups
Parcels	Pipe Networks
Corridors	Profiles
Profile Views	Sample Lines
Sections	Section Views
Assemblies	Subassemblies
View Frames	Match Lines

Styles

- Similar to 'Styles' in MS Office, i.e. a predefined group of display settings (layer, color, linetype, size, etc.) that can be applied to objects at any time
- Controls the Display of Object Components
- Created and Accessed through the Settings Tab on Toolspace
- Include Object Styles, Label Styles, Table Styles
- Associated to Objects through Object Properties





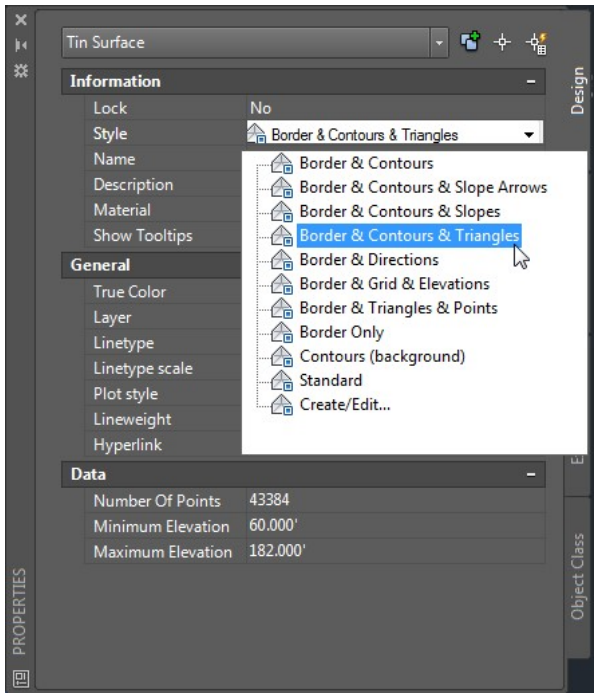


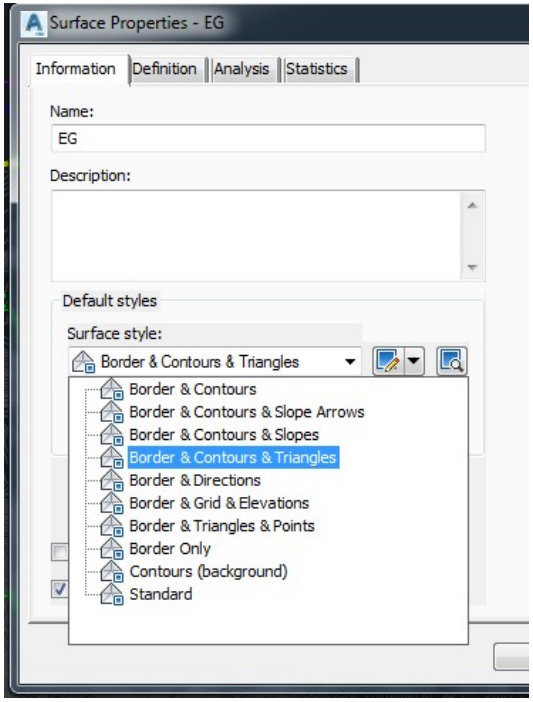
EXERCISE

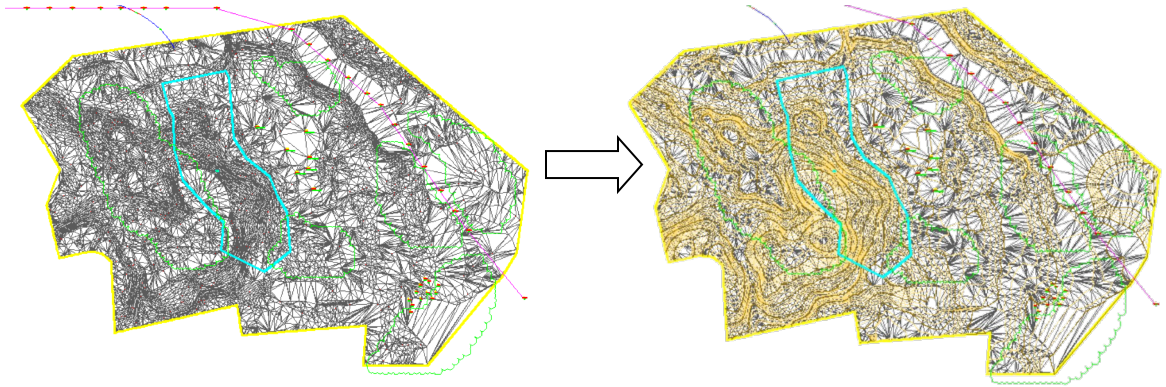
1. **Open *"..\Introduction\Existing Site.dwg"***

2. **Change Surface Style to "Border & Contours & Triangles"**
   a. Select the Surface and choose "Properties" from the right-click menu or the TIN Surface contextual tab
   b. Change the "Style" to "Border & Contours & Triangles"

   ⇒ *This can also be accomplished in the "Surface Properties" dialog, as shown here:*







NOTES

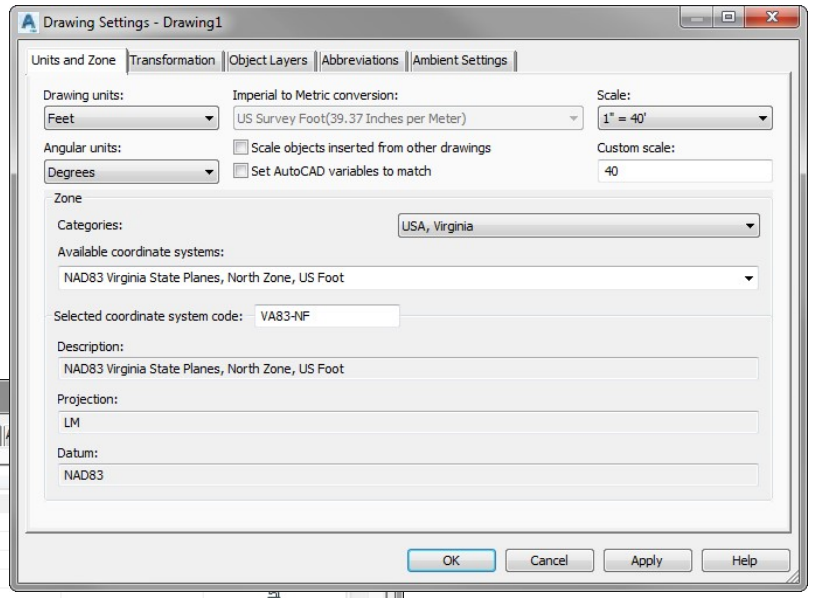
CONCEPT

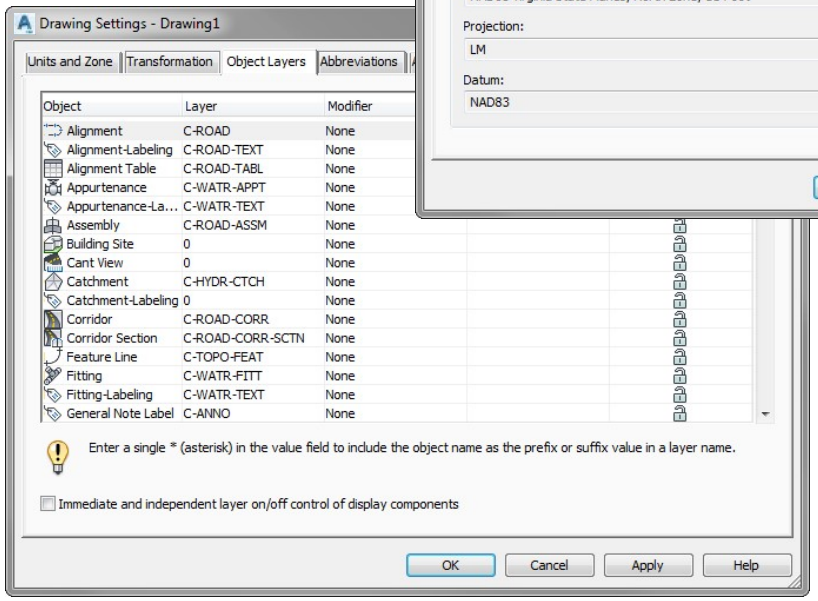
File Formats

- Civil 3D recognizes AutoCAD file formats including .dwg, .dwt, .dws
  - .dwg: Design File Format
  - .dwt: Template File Format containing standard Styles and drawing settings (Standard Templates provided with software)
  - .dws: Standards File Format (a template that contains standard element samples)
- DWG Format compatibility
  - 2013 DWG format usable by AutoCAD 2013, 2014, 2015, 2016 and 2018
  - 2013 Civil 3D DWG format usable by Civil 3D 2013, 2014, 2015, and 2016
  - Prior to 2013, files are not backwards compatible
  - 2018 introduces new Civil 3D Object Versions, so these drawings with intelligent objects are not backwards compatible to any prior version.

Drawing Creation

- A new project design file can be created from an existing template and will automatically appear in Prospector
  - Rick-click a template file in Prospector and choose Create New Drawing or
  - Go to Application Menu > New and choose a Template or New Drawing Icon
- Drawing setting can be modified through the Settings Tab
  - Right-click drawing file name and choose “Edit Drawing Settings”
  - Drawing Settings include:
    - ◊ Units and Zone
    - ◊ Transformation
    - ◊ Object Layers
    - ◊ Abbreviations
    - ◊ Ambient Settings





Exercise

1. **Create New Drawing**
   a. Use the + to create a new drawing tab using the "_AutoCAD Civil 3D (Imperial) NCS.dwt"
2. **Change Drawing Settings as follows:**
   a. On the "Settings" tab of the Toolspace, right-click on the drawing name and choose "Edit Drawing Settings"
   b. Units and Zone

Drawing Units:	Feet	Scale: 1" = 100'	
Set AutoCAD Variables to Match:	Checked	Zone: USA, Virginia	
Coordinate System:	NAD83 Virginia State Planes, North Zone, US Foot		

   c. Object Layers

Alignment:	C-ROAD (-* Suffix)	Alignment Labels:	C-ROAD-LABL
Assembly:	C-CORR-ASSM	Corridor:	C-CORR
Parcel:	C-PRCL	Parcel Segment:	C-PRCL-LINE
Parcel Table:	C-PRCL-TABL	Profile:	C-ROAD-PROF (-* Suffix)
Subassembly:	C-CORR-ASSM		

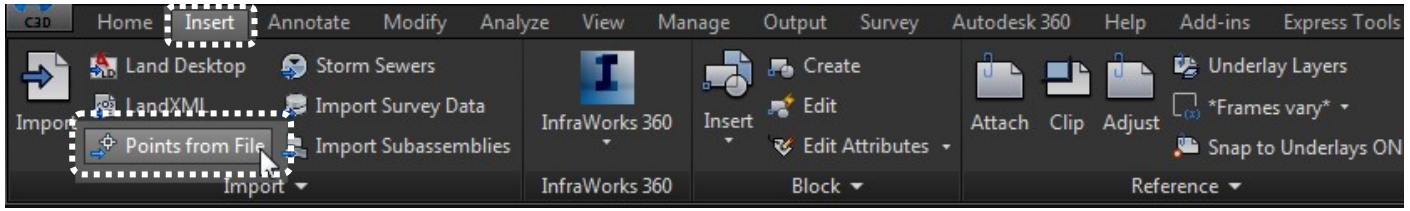
   d. Abbreviations (Leave default settings)
   e. Ambient Settings> General

Plotted Unit Display Type:	Decimal
Show Event Viewer:	No
Show Tooltips:	Yes

   Examine other settings and options
3. **Save as new template file (C:\Civil 3D Projects\Civil 3D Class template.dwt)**
4. **Save again as "Points and Surfaces.dwg" under the same folder**

NOTES

CONCEPT

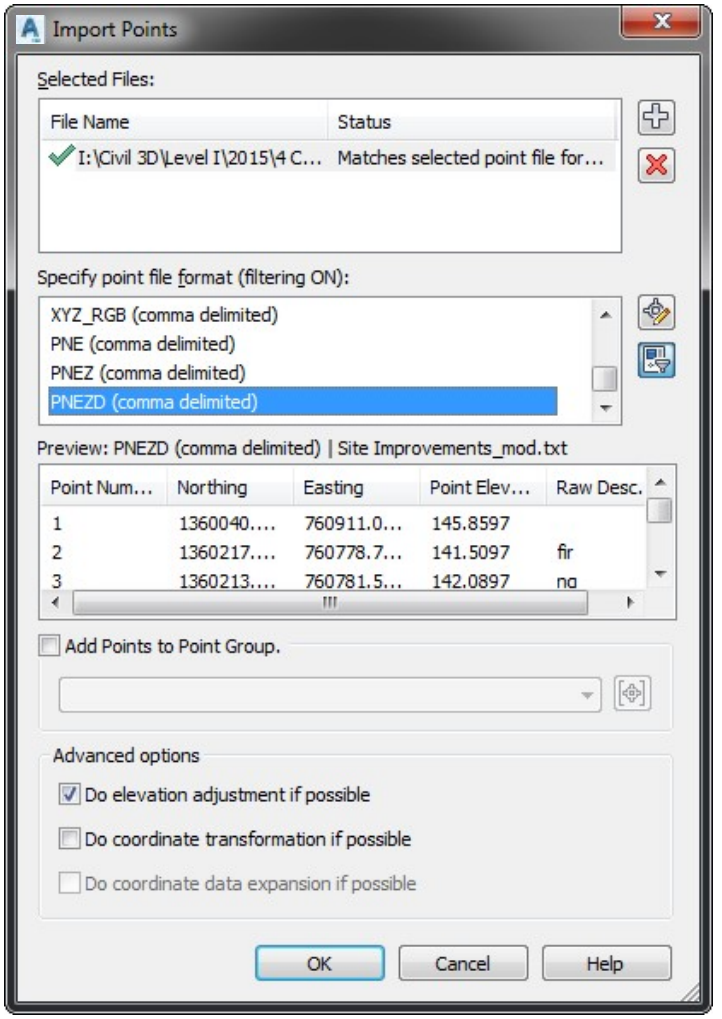


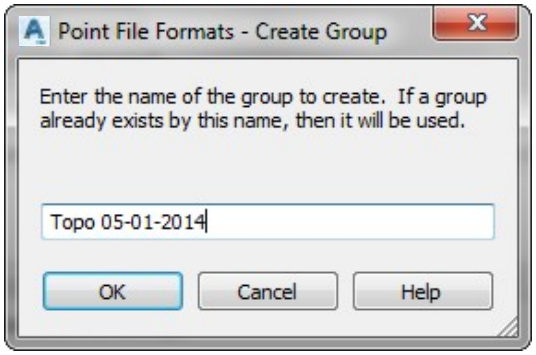
Point Import Capabilities

- Import options controlled by Point Settings and Point Command Settings
- 16 standard text file formats provided (comma and space delimited)
- Can create your own file formats and store in drawing templates
- Automatically add all Points to one Point Group or create new Point Group on the fly
- Perform Elevation Adjustment
- Perform Coordinate Transformation

Point Import Tools

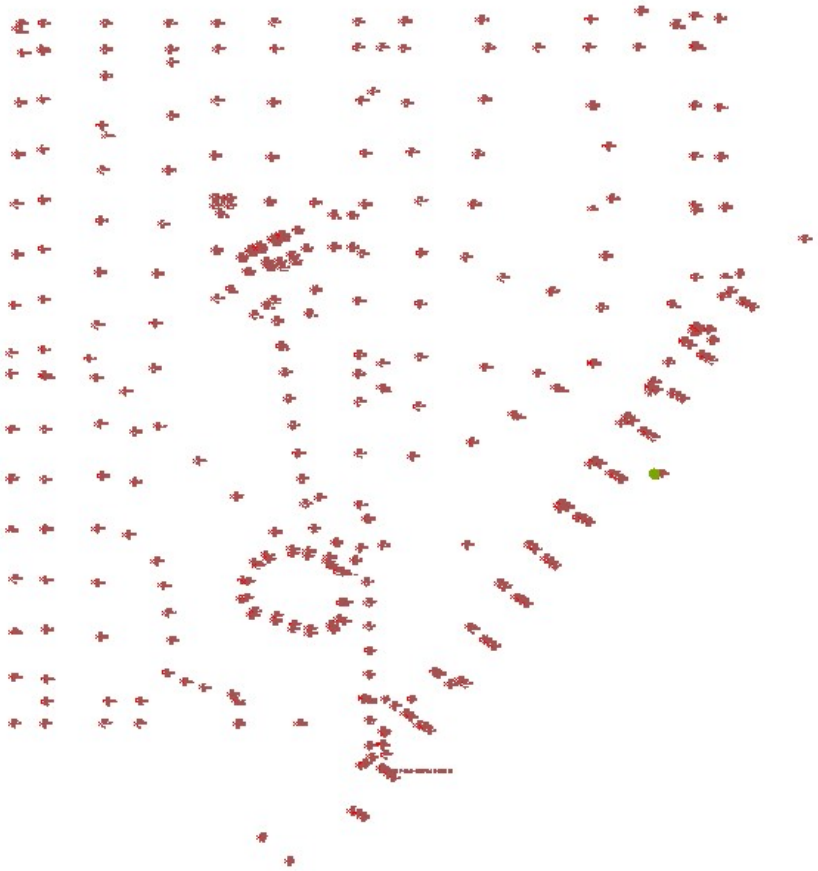
- Found on 'Insert' Tab> 'Import' Panel> 'Points from File' Tool
- Select Point File format
- Choose Source File(s) to import
- Perform Coordinate Transformation





Exercise

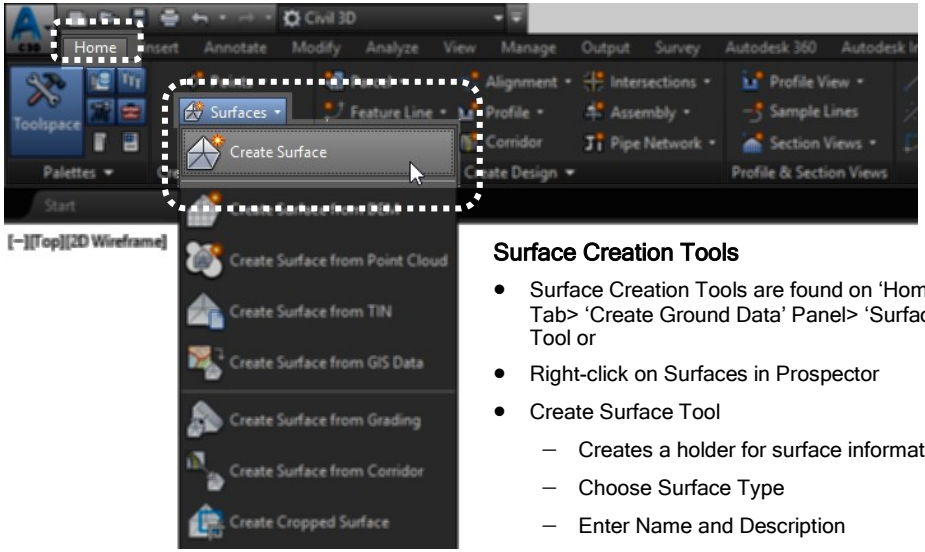
1. **Import Point File *"..\Points\Site Improvements_mod.txt"***
   a. "Insert" tab > "Import Panel" > "Points from File"
   b. Use the  button to browse to the file listed above
   c. Select the PNEZD (comma delimited) file format
   d. Put a check in the "Add Points to Point Group" box, then use the  button to create a new Point Group called "Topo Survey [today's date]"
2. **Examine Results**
   a. Zoom Extents in drawing
   b. Examine the Points in the Prospector "Item View"
   c. Zoom to and Pan to Points
   d. Manipulate labels
3. **Save the Drawing**



NOTES

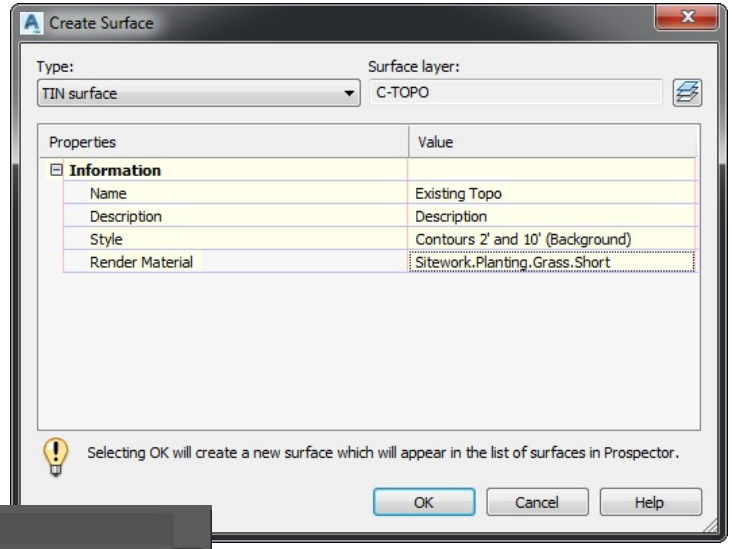
Digital Terrain Modeling: Creating Surfaces

CONCEPT



Surface Creation Tools

- Surface Creation Tools are found on 'Home' Tab> 'Create Ground Data' Panel> 'Surfaces' Tool or
- Right-click on Surfaces in Prospector
- Create Surface Tool
  - Creates a holder for surface information
  - Choose Surface Type
  - Enter Name and Description
  - Set desired Style and Material
- Additional Surface Creation Options:
  - Create Surface from DEM, TIN, or GIS Data (ex. Shapefiles)

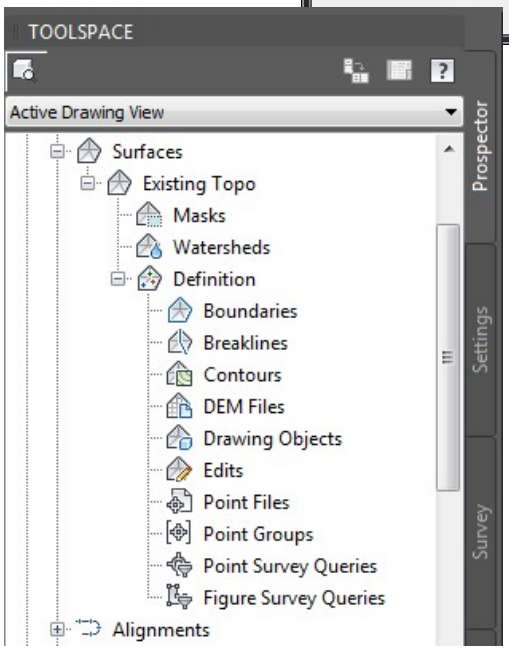


Add data to Surface

- Under Surface "Definition" in Prospector
- Data that can be added includes:
  - Boundaries (Outer, Show, Hide)
  - Breaklines
  - Contours
  - DEM Files
  - Drawing Objects
  - Edits (TIN deletions, Paste Surface, etc…)
  - Point Files
  - Point Groups

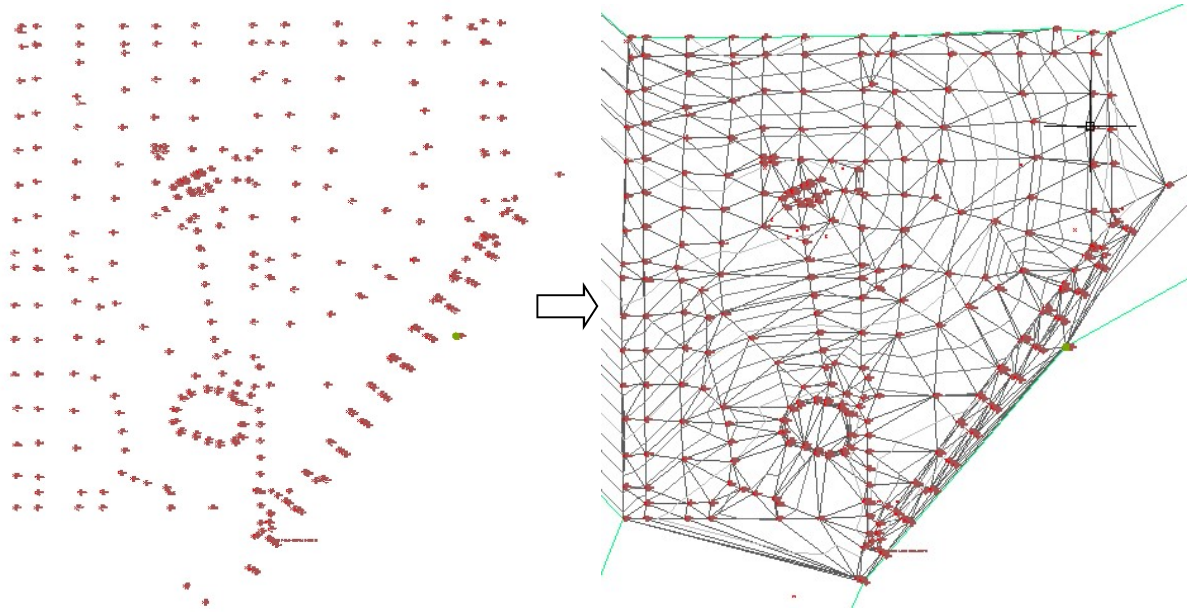
Examine Surface for Errors

- View in Object Viewer
  - Right-click on Surface and choose "Object Viewer"
  - Use multiple View Styles
- Note any spikes, holes, etc...



Exercise

1. **Continue in *"Points and Surfaces.dwg"***
2. **Create New Surface**
   a. "Home" tab > "Create Ground Data" Panel > "Surfaces" > "Create Surface"
   b. Name: Existing Topo
   c. Description: From Contours and Points
   d. Style: Contours and Triangles
   e. Material: Grass - Short
   f. Hit OK
3. **Add Data**
   a. Prospector > expand "Existing Topo" > "Definition" > right-click on "Point Groups
   b. Choose "Topo [today's date]" and hit "OK"
4. **Examine in the Object Viewer**
   a. Look for spikes, holes, etc…
5. **Edit Point Group**
   a. Prospector > expand "Point Groups" > right-click on "Topo Survey [todays' date]" and choose "Properties"
   b. In the "Exclude" tab check "With elevations matching"
   c. Type "<5" and hit OK
   d. Rebuild the Surface (right-click on "Existing Topo" and hit "Rebuild")
6. **Save and close the Drawing**



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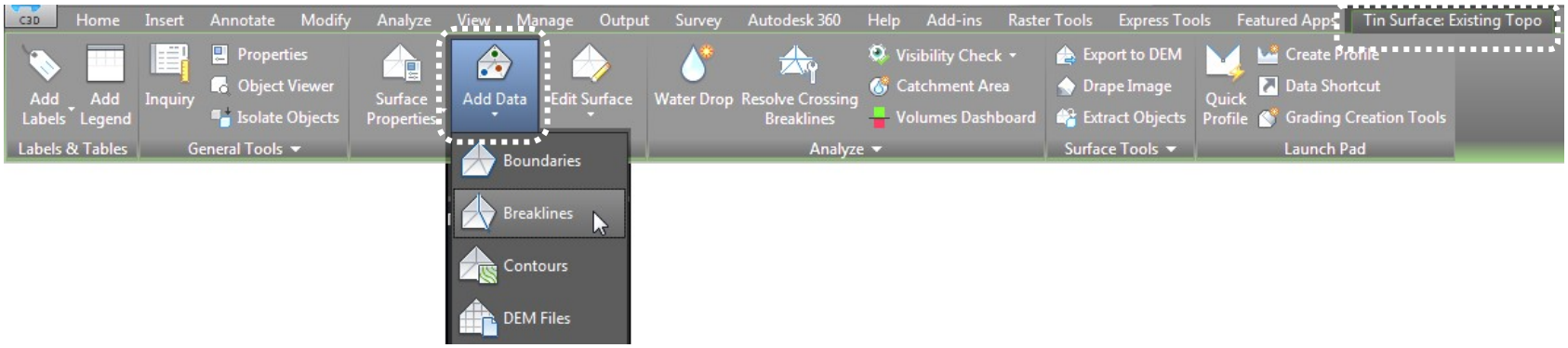


Breaklines

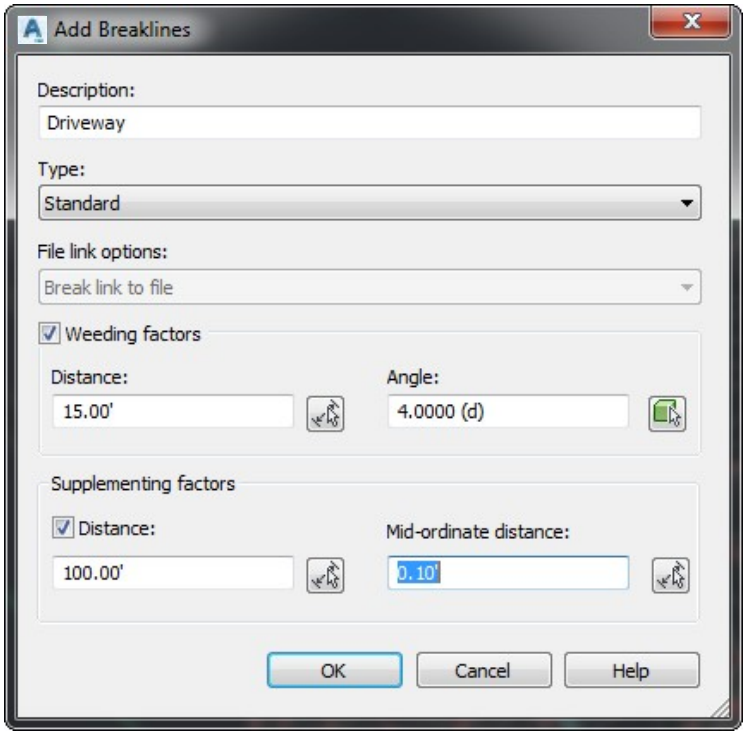
- GIS Definition - A linear feature that defines and controls the surface behavior of a TIN in terms of smoothness and continuity.
- Represent known features in surface (elevation breaks, edges of pavement features, stream banks, etc…)
- Control creation of triangles and contours
  - Triangles can't cross breaklines - creates linear features in TIN

Breakline Types

- **Standard** - Defined by selection of 3D lines, grading features (covered in another class), or 3D Polylines
- **Proximity** - Defined by selection of polyline or other object inside the surface extents. The Z value for the vertices in these breaklines is determined from the closest corresponding TIN point.
- **Wall** - Defined by selecting grading features, 3D lines, 3D Polylines or points and specifying an offset side and elevation difference. Treated as a Standard Breakline
- **Non-destructive** - Defined by selecting grading features and other AutoCAD objects. These breaklines are applied to the surface for guidance in triangle creation, but they still maintain the integrity of the original surface.

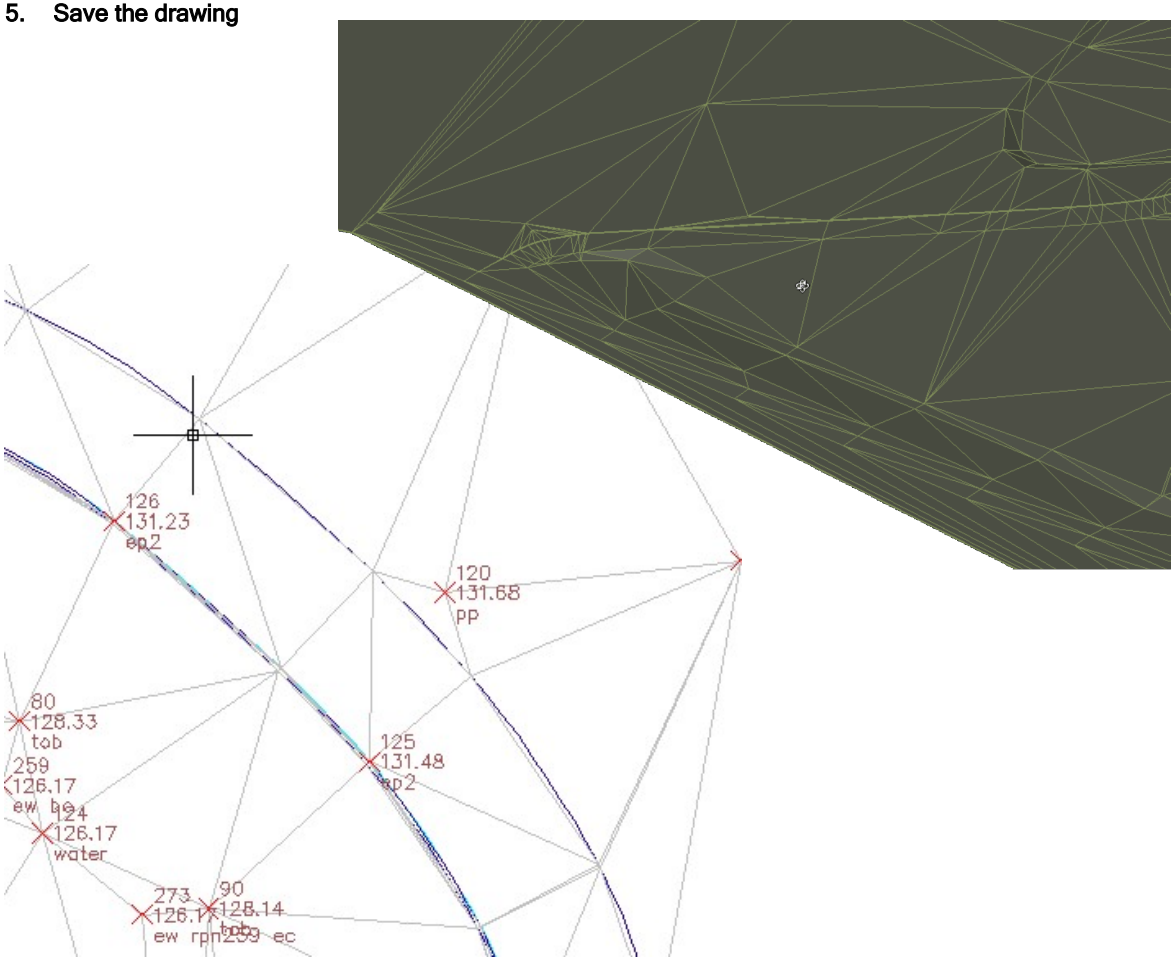
Adding Breaklines

- Draw 'dummy' features to represent breaklines
- Select Surface to get 'Surface' Tab> 'Modify' Panel> 'Add Data' Tools or
- Under Surface "Definition" in Prospector (right-click)
- Provide Description, Type, and Mid-ordinate distance
- Select Features



Exercise

1. **Open *"..\Surfaces\Create Surface—Add Breaklines.dwg"***
2. **Add Driveway Breaklines**
   a. Prospector > expand "Existing Topo" > "Definition" > right-click on "Breaklines" and choose "Add"
   b. Description: "Driveway"
   c. Type: Standard
   d. Weeding: Off
   e. Supplementing Factors: Off
   f. Mid-ordinate Distance: 0.08
   g. Hit OK and choose the 4 Feature Lines that represent the driveway
3. **Repeat Step 2 to add the Road Edges (Description = "Existing Road")**
4. **Examine the Surface in the Object Viewer**
5. **Save the drawing**



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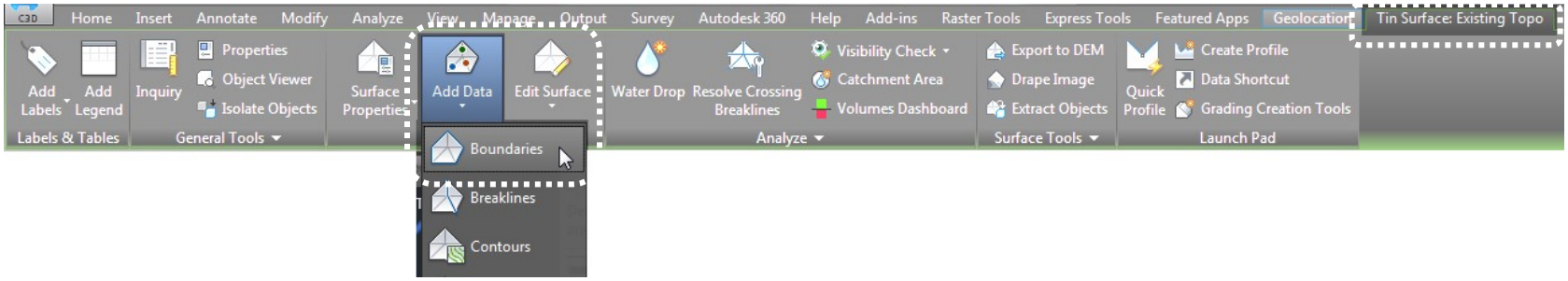
CONCEPT



Boundaries

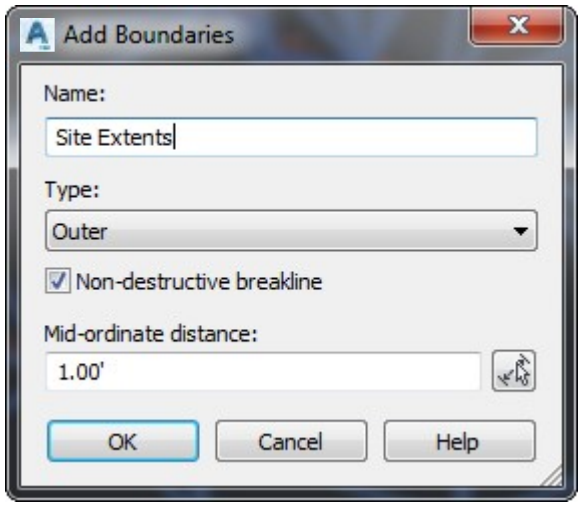
- Consist of closed polyline/polygon that controls the visibility of triangles and contours in a surface
- Used often to represent survey extents

Boundary Types

- **Outer** - Defines the outside boundary of a surface. Any surface elements (triangles, contours) outside of the boundary are not shown.
- **Hide** - Defines an inner boundary of a surface. Any surface elements (triangles, contours) inside the boundary are not shown.
- **Show** - Defines an inner boundary of a surface, inside of which surface elements (triangles, contours) are shown. Useful for creating islands inside of hide boundaries.
- **Data Clip** - Defines a region of a surface where new data added to the surface will be used.
  - For example, if you want to add LIDAR data to only one area of a surface, you create a data clip boundary, then add the whole set of LIDAR data. Only the LIDAR data that falls inside the Data Clip boundary will actually be added to the surface

Adding Boundaries

- Draw closed polyline/polygon to represent Boundary
- Select Surface to get 'Surface' Tab> 'Modify' Panel> 'Add Data' Tools or
- Under Surface "Definition" in Prospector (right-click)
- Provide Name, Type, Breakline behavior and Mid-ordinate distance
- Select Features (closed polyline/polygon)

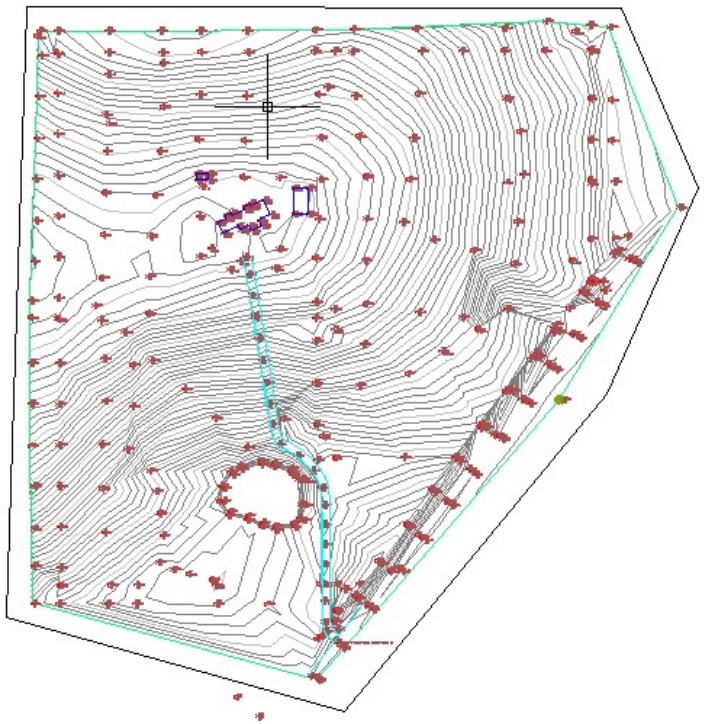


Quick Note
Outer Boundaries are a form of "Show" boundary. These will show everything inside of them and override any internal "Hide" boundaries you have.

The order in which boundaries are added is important. Always add the outer boundary first.

Exercise

1. **Continue in *"Create Surface–Add Breaklines.dwg"***
2. **Use the AutoCAD POLYLINE command to create a closed polyline around the site (as shown below)**
3. **Add this polyline as the Outer Boundary**
   a. Prospector > expand "Surfaces" > "Existing Topo" > "Definition" > right-click on "Boundaries" > "Add"
   b. Name: Site Extents
   c. Type: Outer
   d. Non-destructive Breakline: Unchecked
   e. Hit OK and choose the polyline
4. **Add Hide boundaries for the Buildings**
   a. Repeat Step 3 with the following options:
   b. Name: Buildings
   c. Type: Hide
   d. Non-destructive Breakline: Checked
   e. Hit OK and choose the 3 blue building polylines
5. **Repeat Step 4 to add the EW for the Pond (Green line) as a Hide Boundary**
   a. Name: Pond
   b. Type: Hide
   c. Non-destructive Breakline: Checked
   d. Hit OK and choose the green EW line
6. **Rebuild the Surface (if necessary)**
7. **Examine in the Object Viewer**
8. **Save and close the Drawing**

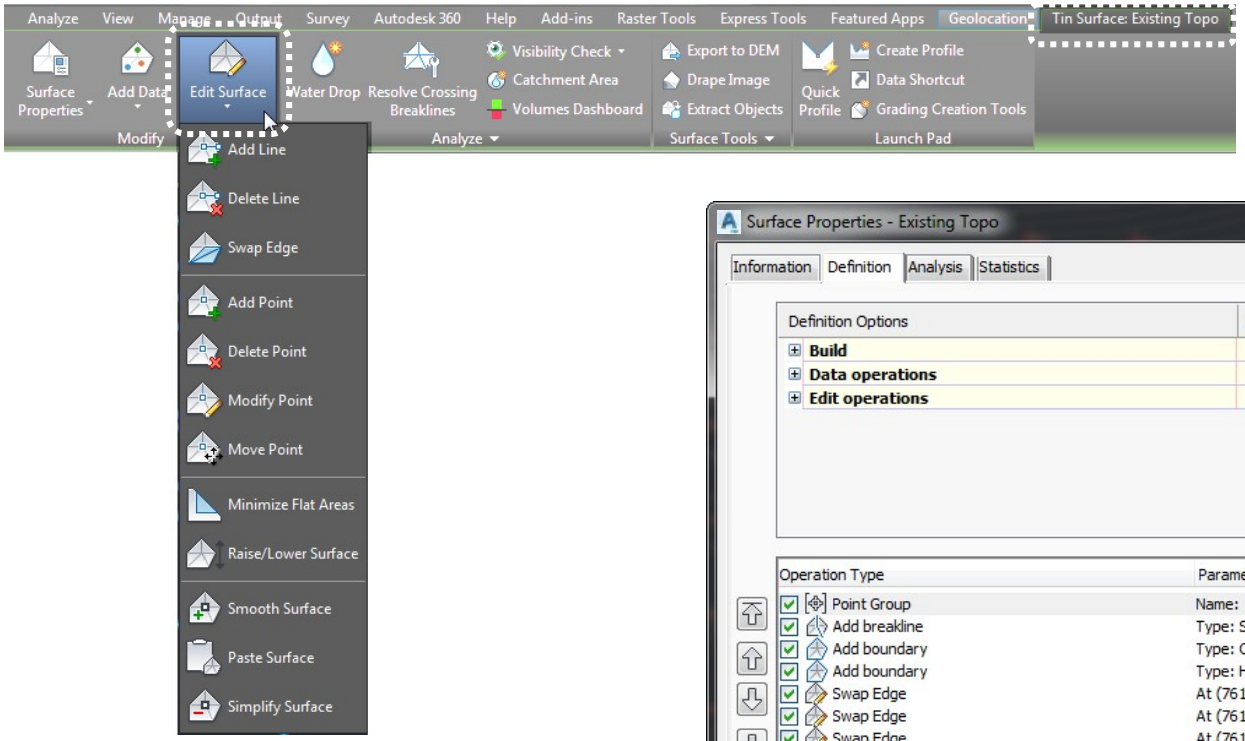


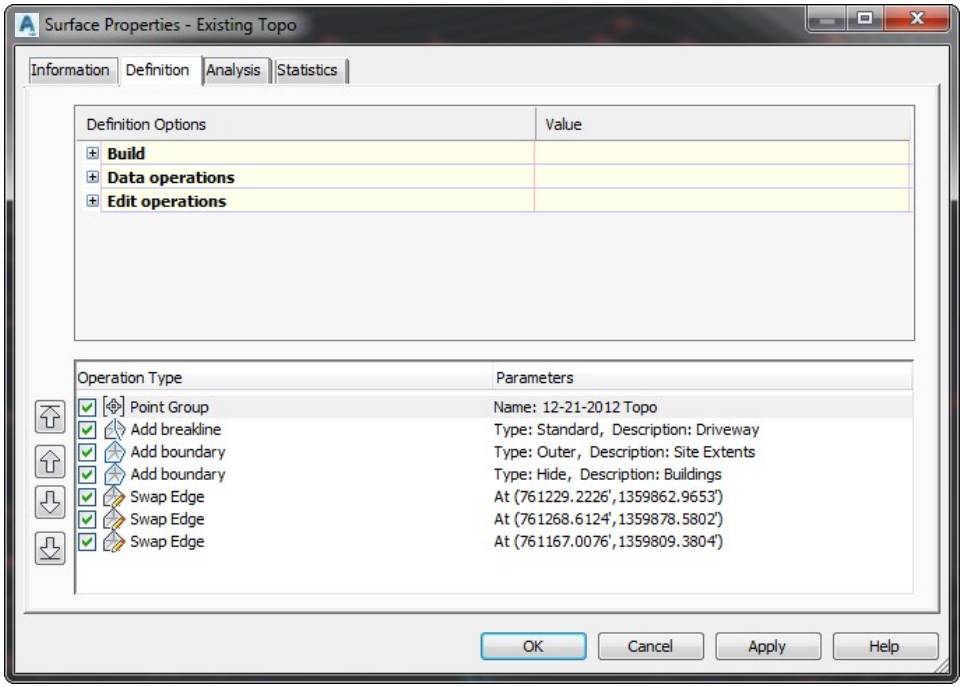
NOTES

CONCEPT

Surface Editing Functions

- Select Surface to get 'Surface' Tab> 'Modify' Panel> 'Edit Surface' Tools or
- Prospector under the Surface 'Definition' right-click on 'Edits' to show all Options
- TIN Edits
  - Add Line
  - Delete Line
  - Swap Edge
- Surface Point Edits
  - Add Point
  - Delete Point
  - Modify Point
  - Move Point
- Surface Object Edits
  - Minimize Flat Faces (Triangles)
  - Raise/Lower Surface
  - Smooth Surface
  - Paste Surface (covered in later class)



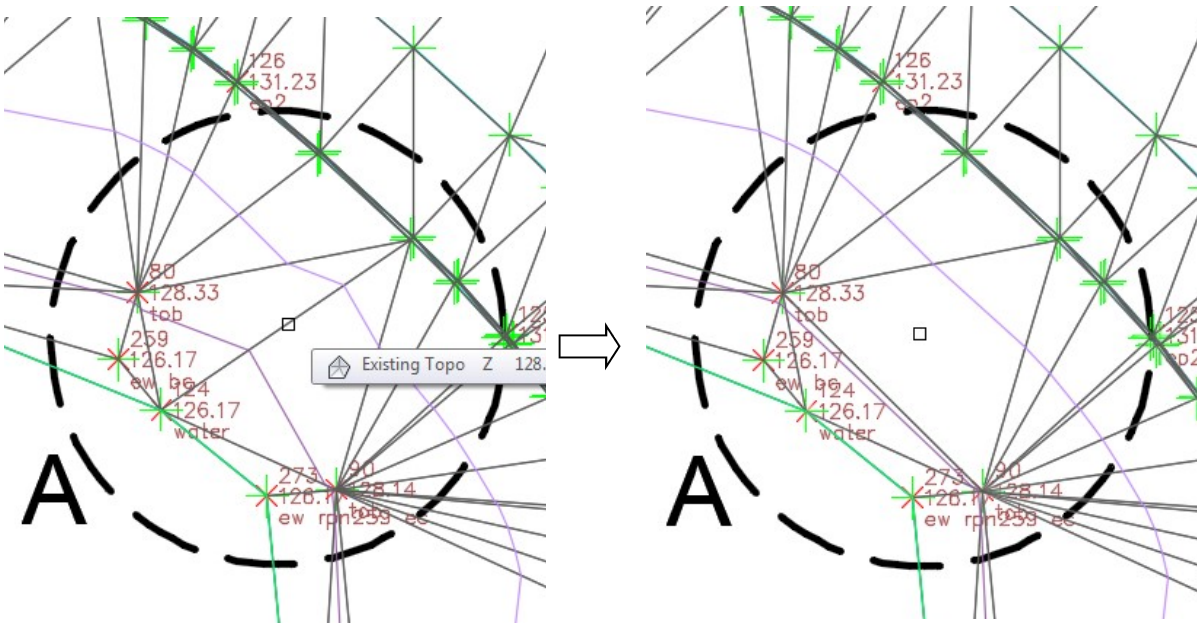


Surface Properties

- Change Surface Build options ('Definition' Tab)
  - Exclude elevations less than or greater than certain values
  - Minimum and Maximum triangle length
- All Edits tracked, accessed, and re-ordered in Surface Properties and in Prospector
  - Turn on/off
  - Delete

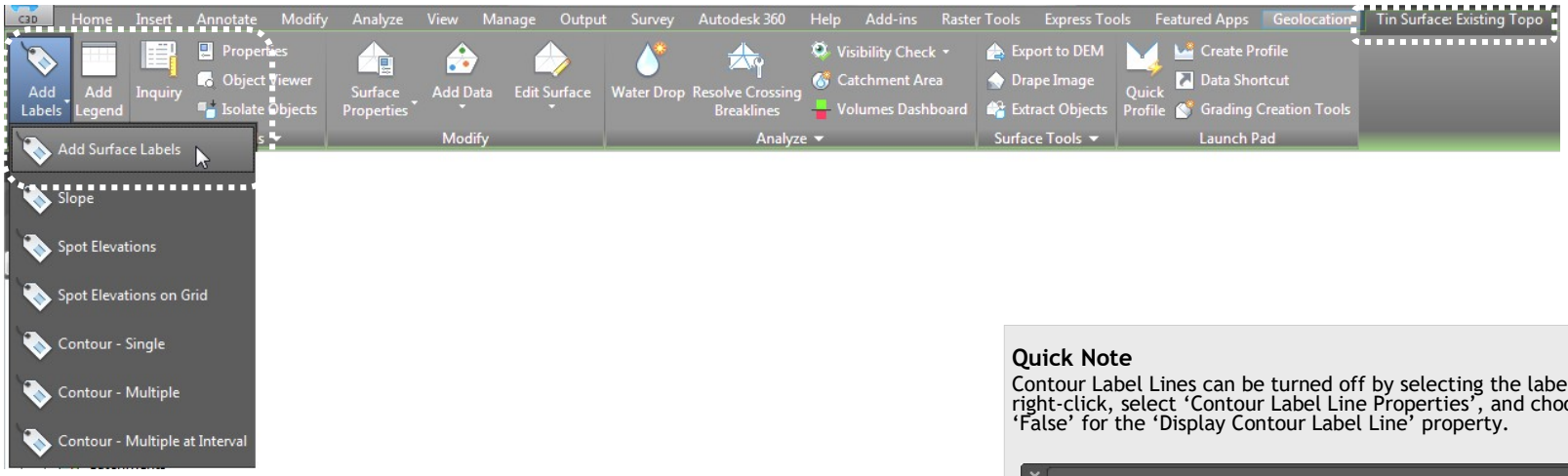
Exercise

1. **Open *"..\Surfaces\Edit Surface—TIN Editing.dwg"***
2. **Prepare Surface for Editing**
   a. Use the Properties Palette to change the Surface Style to "CADD–TIN Editing"
   b. Zoom in to the area between the pond and locate the white circle labeled "A"
3. **Swap Edges**
   a. Prospector > expand "Surfaces" > "Existing Topo" > "Definition" > right-click on "Edits" and choose "Swap Edge"
   b. Select the edge that starts near the letter A and goes diagonally NE towards the road to swap. Notice the change to the contours
4. **Move Point**
   a. Pan to the NW and locate the white circle labeled "B"
   b. Prospector > expand "Surfaces" > "Existing Topo" > "Definition" > right-click on "Edits" and choose "Move Point"
   c. Select the TIN point near the center of circle "B" and move it slightly to the North. Again, notice the change to the contours
5. **Delete Point**
   a. Zoom and Pan to the South end of the driveway and locate the circle labeled "C"
   b. Prospector > expand "Surfaces" > "Existing Topo" > "Definition" > right-click on "Edits" and choose "Delete Point"
   c. Select the TIN point near the center of circle "C" that corresponds to the "fir" COGO Point. Notice that the TIN Point is removed and the contours change but the COGO Point is not changed.
6. **Save the Drawing**



NOTES

CONCEPT



Surface Labels

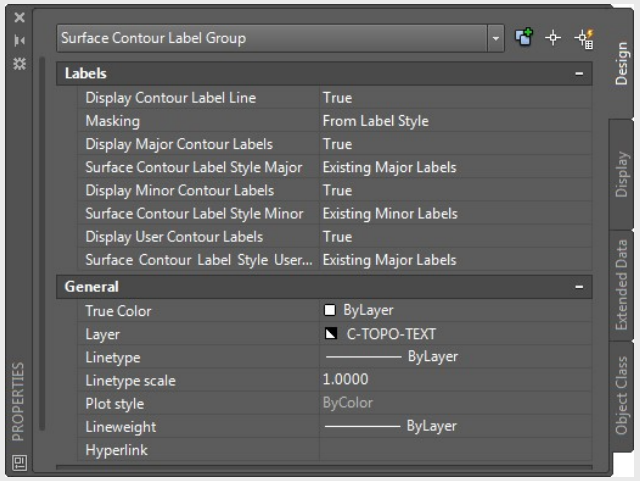
- Select Surface to get ‘Surface’ Tab> ‘Labels & Tables’ Panel> ‘Add Labels’ Tools or
- ‘Annotate’ Tab> ‘Labels & Tables’ Panel> ‘Add Labels’ Tools> ‘Surface’ or
- Prospector right-click on the surface> ‘Add Label’
- Display based on Label Styles
- Label Types
  - Slope
  - Spot Elevation (automatic Point creation)
  - Contours

Contour Labels

- Commands accessed from Surface menu
- Display based on Label Styles
- Select Label creation method
  - Single Label Line
  - Multiple Labels Line
  - Create from Objects
  - Multiple Labels Line at Interval
  - Label Major
  - Label Minor
  - User-Defined Contours
- Select locations inside the Surface
- Contour Label Lines can be adjusted with a right-click and selecting ‘Contour Label Line Properties

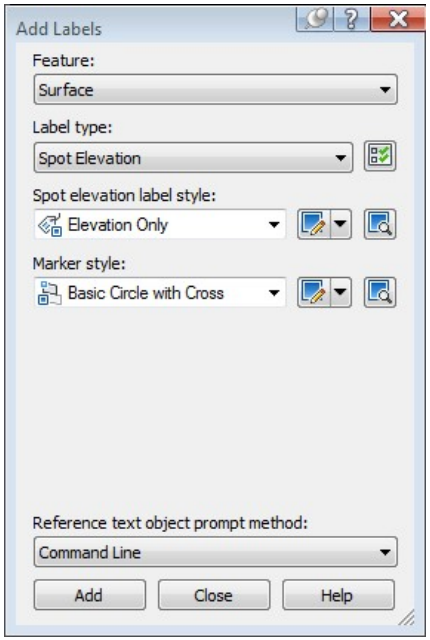
Quick Note

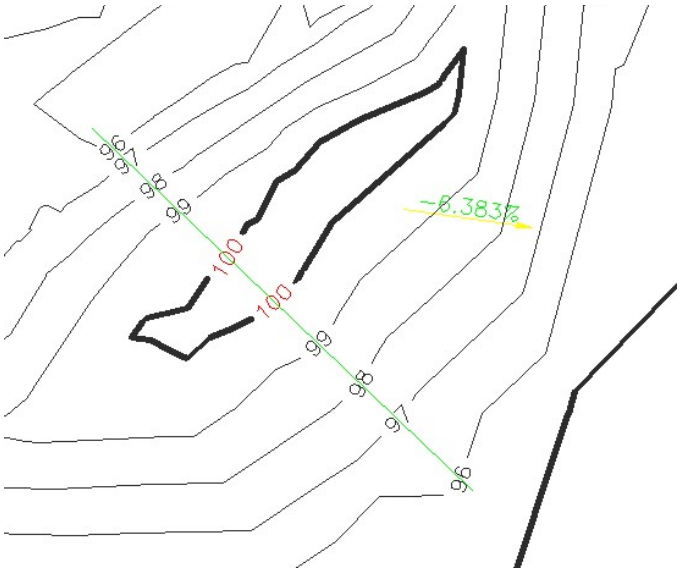
Contour Label Lines can be turned off by selecting the labels, right-click, select ‘Contour Label Line Properties’, and choose ‘False’ for the ‘Display Contour Label Line’ property.



Exercise

1. **Continue in "*Edit Surface–TIN Editing.dwg*"**
2. **Add Slope Labels**
   a. "Annotate" Ribbon tab > "Add Labels" > "Surface" > "Add Surface Labels"
   b. Label Type: Slope
   c. Slope Label Style: Percent
   d. Hit "Add"
   e. Use the "One Point" option and pick a location on the Surface
   f. Hit "Add" again and use the "Two Point" option to place a two-point slope label somewhere on the Surface
3. **Add Spot Elevation Labels**
   a. In the "Add Labels" dialog, set Label Type to "Spot Elevation"
   b. Leave the defaults for styles
   c. Hit "Add"
   d. Select a location on the Surface to place the Spot Elevation Label
4. **Prepare Drawing for Contour Labeling**
   a. Use the Properties Palette to change the Surface Style to "Contours 1' and 5' (Background)"
5. **Add Contour Labels**
   a. In the "Add Labels" dialog, set Label Type to "Contour–Single"
   b. Leave the defaults for styles
   c. Hit "Add"
   d. Select a location on a contour to place a single contour label Spot Elevation Label
   e. Back in the "Add Labels" dialog, change the "Label Type" to "Contour–Multiple" and hit "Add".
   f. Pick multiple locations to define a polyline (contour label line) that crosses multiple contours.
   g. Close the "Add Labels" dialog
6. **Use the instructions in the Quick Note on the previous page to hide the Contour Label Line**
7. **Select one of the Contour Labels and use the grips to edit the placement**
8. **Save the Drawing**



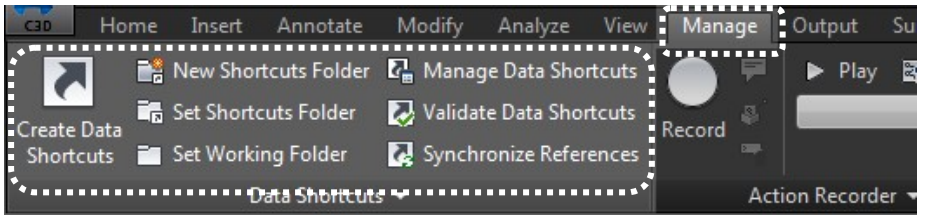


NOTES

CONCEPT

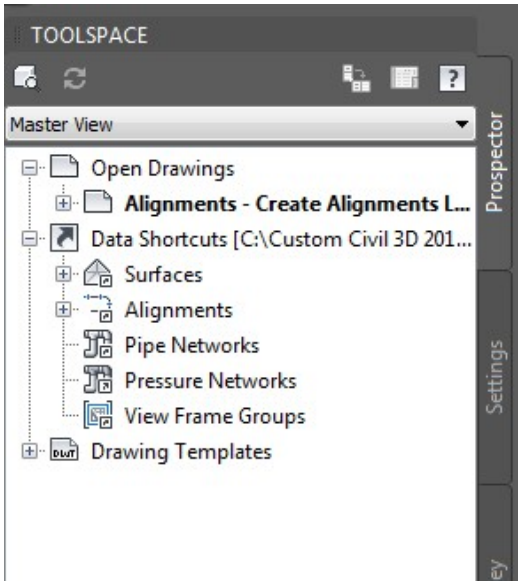
Data Sharing With Data Shortcuts

- Ability to Share Objects between drawings without the need for a database
- Sharable Objects Include:
  - Surfaces
  - Alignments
  - Profiles
  - Corridors
  - Pipe Networks (Gravity and Pressure)
  - View Frame Groups
- Links to Objects created from one drawing to another
  - References generated as separate XML files
- Referenced Objects can be used in Destination Drawing
  - Change Display and Labels through Styles
  - Use intelligence
  - Geometry can only be edited in original drawing



Working with Data Shortcuts

- 'Manage' Tab> 'Data Shortcuts' Panel
- All Data Shortcuts stored in a Data Shortcuts Folder
  - Project Templates can be used for automatic folder generation
  - XML files as well as Drawings can be stored
- Can have multiple Data Shortcut Folders
- Can convert Data Shortcuts to Vault
  - Import into Vault
  - Automatically converted to Vault References



Creating Data Shortcuts

- Create New Folder
  - 'Manage' Tab> 'Data Shortcuts' Panel> 'New Data Shortcuts Folder'
  - Select Project Template (optional)
  - Current Data Shortcuts folder will be automatically set to newly created folder
- Create Data Shortcuts
  - Create shortcuts for data in the current drawing
  - 'Manage' Tab> 'Data Shortcuts' Panel> 'Create Data Shortcuts'
  - Choose objects to share
  - Shortcuts will appear in Prospector
- Original Drawing that holds the object is called the "Source Drawing"

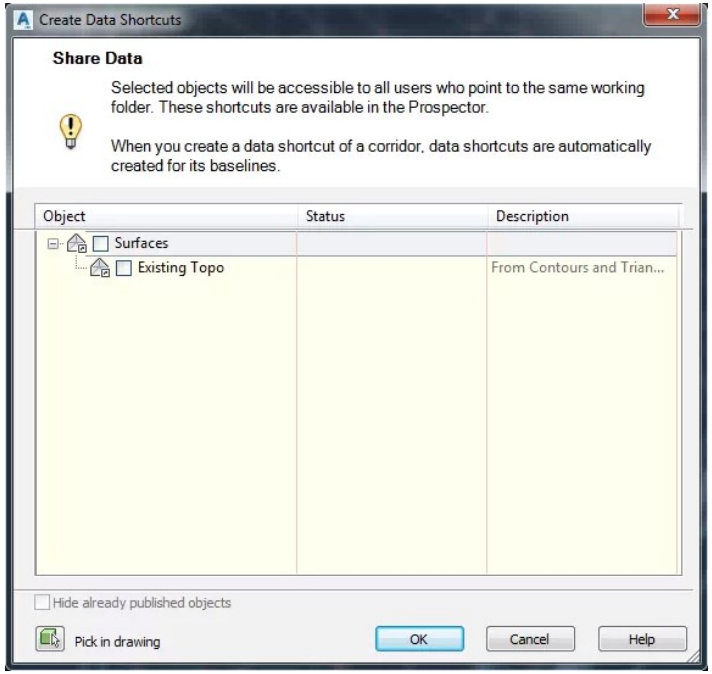
Creating Reference Objects

- Access Destination drawing
  - Open another drawing or Create a New Drawing
  - Destination drawing sometimes referred to as the "Consumer Drawing"
- Add Reference copy to Destination drawing
  - Make sure the correct Data Shortcut Folder is set
  - Right-click on Data Shortcut Object in Prospector and choose "Create Reference"
  - Provide a name, starting Object Styles, and other information for object in the destination drawing.

Quick Note
If the drawing is new, it must be saved before reference objects can be added

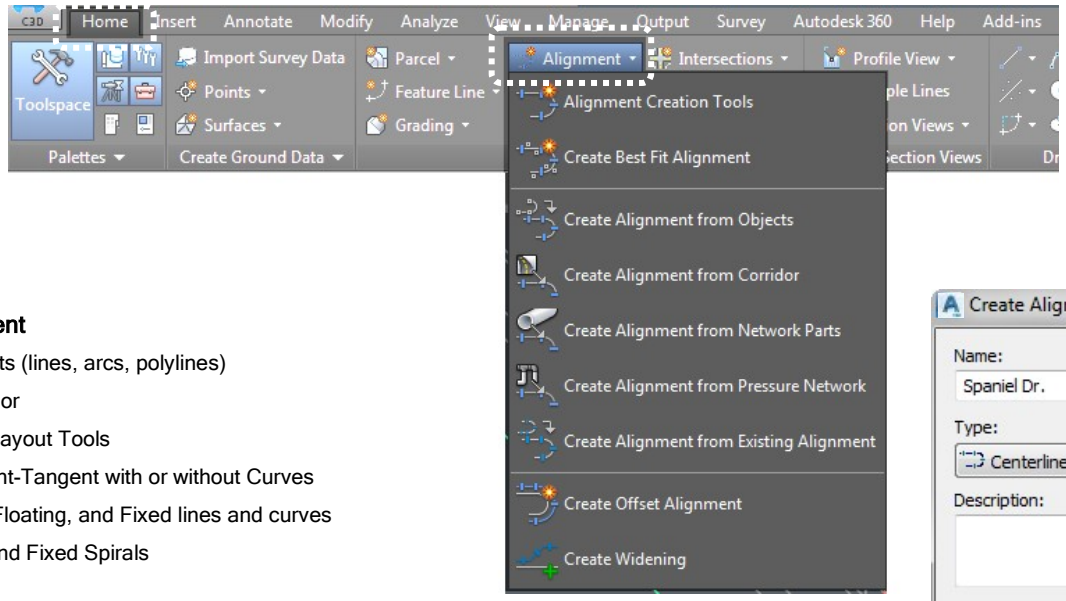
EXERCISE

1. **Continue in "*Edit Surface–TIN Editing.dwg*"**
2. **Set Working Folder to *C:\Civil 3D Projects\Civil 3D 2018 Level I\Data Management***
   a. "Manage" Ribbon tab > "Data Shortcuts" Panel > "Set Working Folder"
   b. Browse to the path listed above
   c. Hit "OK"
3. **Create New Data Shortcuts Project Folder**
   a. "Manage" Ribbon tab > "Data Shortcuts" Panel > "New Shortcuts Folder"
   b. Name: "<YYYY-MM>_Hunter's Ridge" (use current month and year)
   c. Leave the other defaults and hit "OK"
4. **Create Data Shortcuts**
   a. Save the drawing
   b. Prospector > scroll down to "Data Shortcuts…", right-click and choose "Create Data Shortcuts"
   c. Put a check in the box for "Existing Topo" and hit "OK"
5. **Create New Drawing by selecting the New Tab "+"**
   a. Save the new drawing as C:\Civil 3D Projects\Civil 3D 2018 Level I\Road Design.dwg"
6. **Create Reference to the Surface in the New Drawing**
   a. Prospector > expand "Data Shortcuts…" > "Surfaces" > right-click on "Existing Topo" and choose "Create reference"
   b. In the dialog that appears, set the Style to "Contours 2' and 10' (Background)" and hit "OK"
7. **Examine the Prospector to see the new Surface Reference in the drawing**
8. **Use Zoom > Extents to see the Surface**
9. **Save the Drawing**



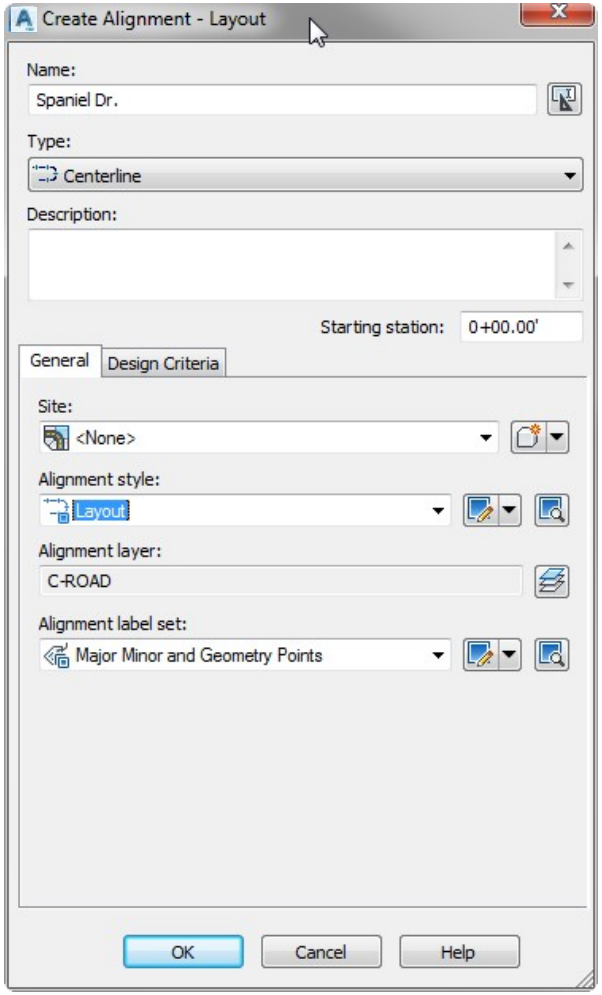
NOTES

CONCEPT



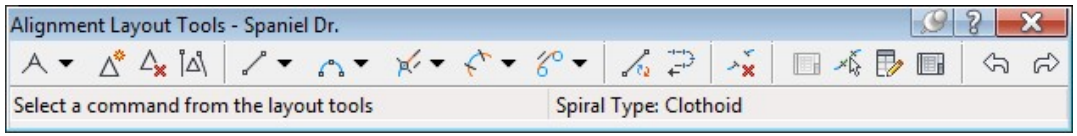
Create Alignment

- From Objects (lines, arcs, polylines)
- From Corridor
- Alignment Layout Tools
  - Tangent-Tangent with or without Curves
  - Free, Floating, and Fixed lines and curves
  - Free and Fixed Spirals
  - Add PI
- Must specify Alignment Type, Site, Alignment Style, Layer, and Label Set
- Alignment Types include Centerline, Offset, Curb Return, or Miscellaneous
- Can use Design Criteria to aid in the design process
  - Pre-defined AASHTO Tables for Minimum Radius, Transition Length, and Superelevation
  - Can build custom tables



Object Intelligence

- Labels created on the fly
- Layers created on the fly
- Any Parcels that are split by Alignments on the same Site will automatically be subdivided.

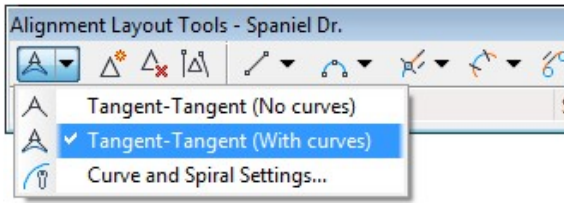


Quick Note

This symbol indicates that a design criteria requirement has not been met. Place your mouse over the symbol for more information.

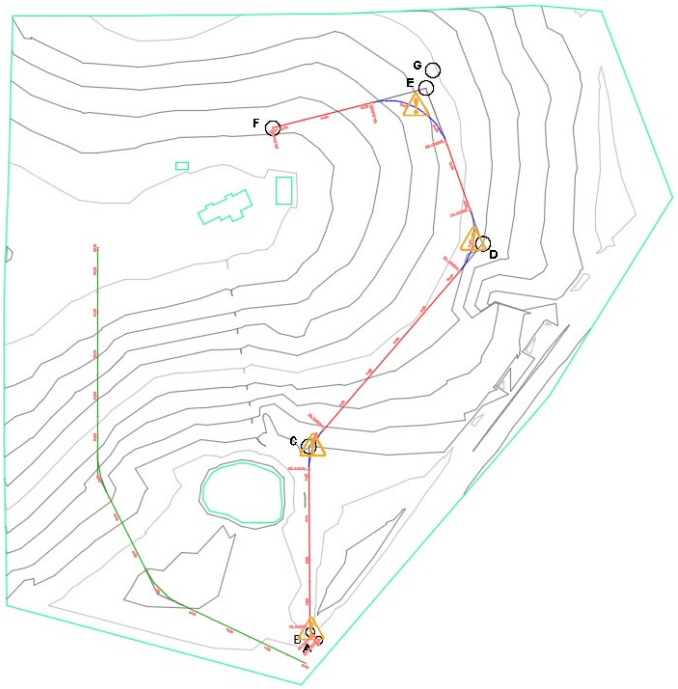
Exercise

1. **Continue in *"Road Design.dwg"***
2. **Insert *"..\Alignments\Alignments—Alignment Creation.dwg"* as a block at 0,0,0 and Explode**
3. **Create Alignment from Objects**
   a. "Home" Ribbon tab > "Create Design" Panel > "Alignment" > "Create Alignment from Objects"
   b. Select the red polyline on the west side of the site and hit <ENTER>
   c. Make sure the direction is south to north and hit <ENTER>
   d. Name: Retriever Road
   e. Type: Centerline
   f. Alignment Style: Proposed
   g. Alignment Label Set: Major and Minor Only
   h. Add curves between tangents: R = 200'
   i. Erase existing entities: Checked
   j. Hit OK



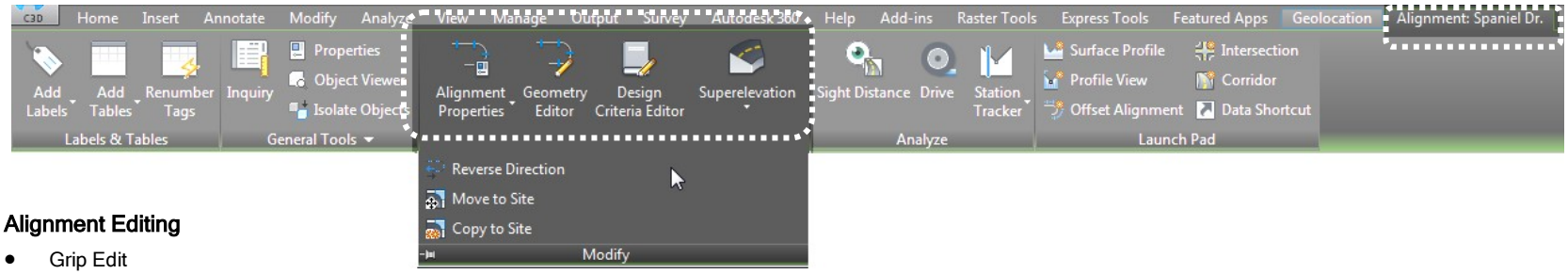
4. **Create Alignment by Layout**
   a. "Home" Ribbon tab > "Create Design" Panel > "Alignment" > "Alignment Creation Tools"
   b. Name: Spaniel Drive
   c. Type: Centerline
   d. Alignment Style: Layout
   e. Alignment Label Set: Major Minor & Geometry Points
   f. On the "Design Criteria Tab", set the "Starting Design Speed" to 25 mph and check the box next to "Use criteria-based design"
   g. Hit OK
5. **Draw Alignment**
   a. In the *Alignment Layout Tools* toolbar, select the down-arrow of the first button and choose "Curve and Spiral Settings"
   b. Make sure "Curve" is checked and set the default radius to 250', then hit OK
   c. Click on the down-arrow of the first button again and choose "Tangent-Tangent (With curves)
   d. Use the *center* snap to snap to each of the circles in order from A to F, then hit <ENTER>
   e. Close the *Alignment Layout Tools* toolbar
6. **Save the Drawing**

Note: Most Design warnings will be fixed in the next exercise



NOTES

CONCEPT



Alignment Editing

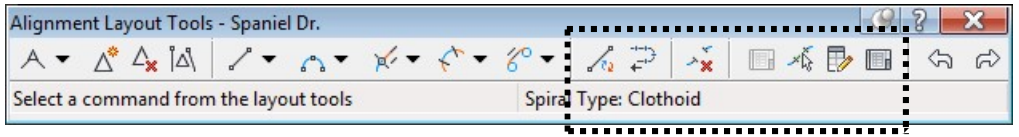
- Grip Edit
  - Shift Entities
  - Move/Drag Labels
- Select Modify Tab> Design Panel> Alignment Tools or
- Select the Alignment on screen to activate Alignment Tab on the Ribbon
  - 'Geometry Editor' to invoke Alignment Layout Tools
    - Insert/Delete PI
    - Tabular Edit
      - Values in Black can be edited
      - Values in Grey are fixed
    - Sub-entity Edit
      - Edit one Sub-entity at a time
      - Same rules as tabular edit
  - 'Design Criteria Editor'

Object Intelligence

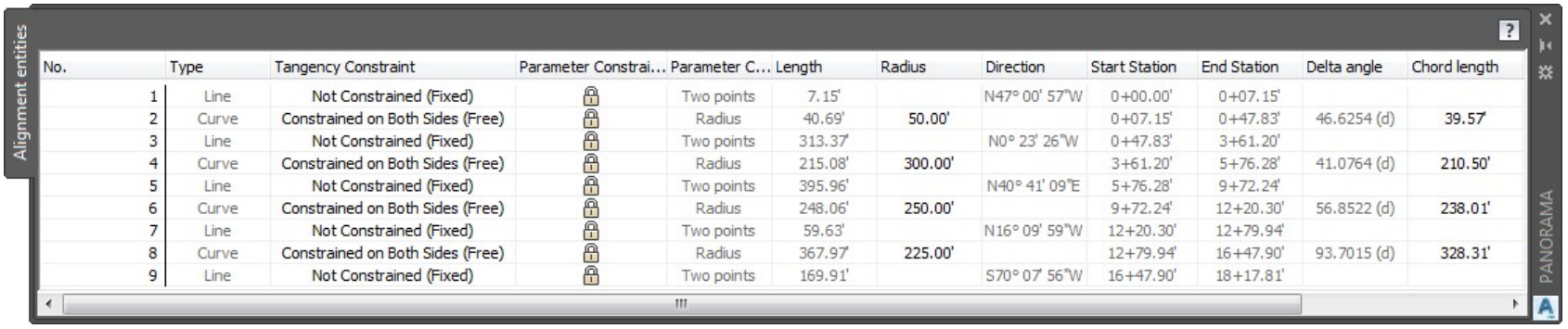
- Alignment geometry updated when tabular changes are made
- All labels update automatically
- All tangents update automatically as curves are edited.

Quick Note

This symbol indicates that a design criteria requirement has not been met. Place your mouse over the symbol for more information.



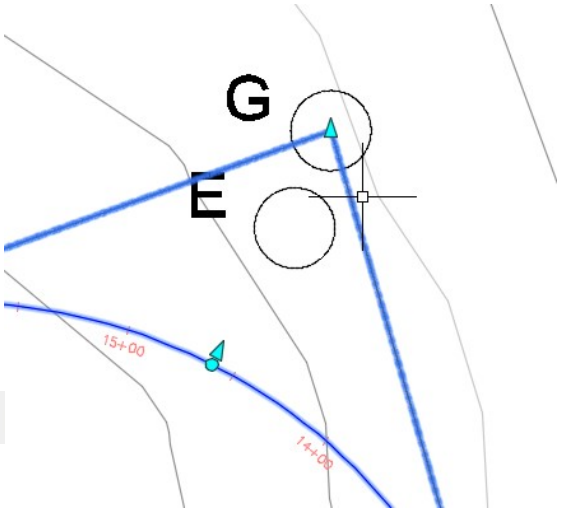
Alignment Editing Tools

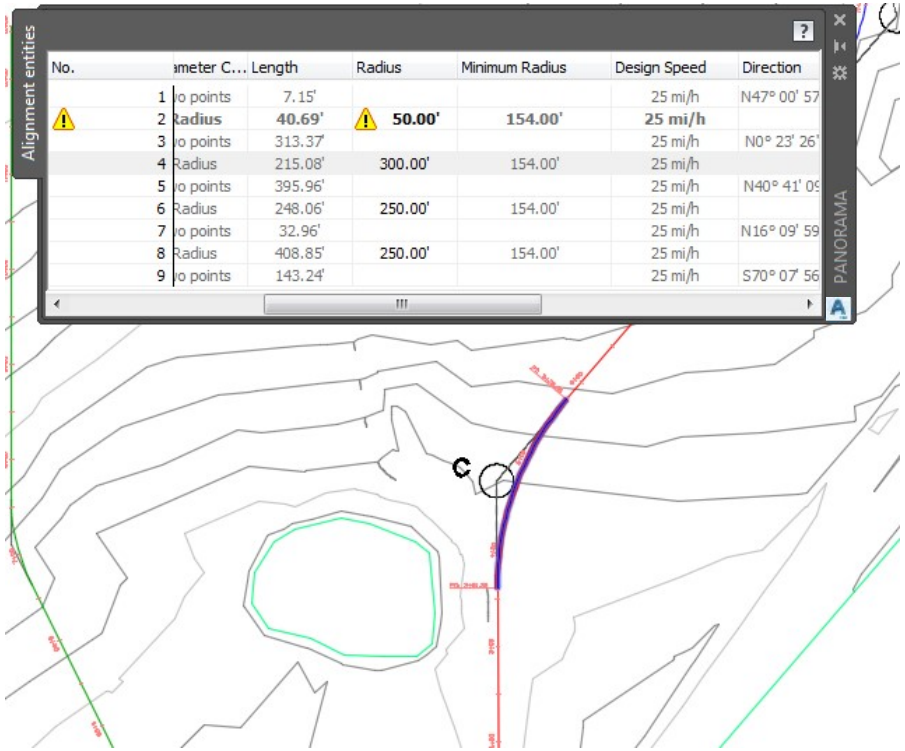


No.	Type	Tangency Constraint	Parameter Constrai...	Parameter C...	Length	Radius	Direction	Start Station	End Station	Delta angle	Chord length
1	Line	Not Constrained (Fixed)		Two points	7.15'		N47° 00' 57"W	0+00.00'	0+07.15'		
2	Curve	Constrained on Both Sides (Free)		Radius	40.69'	50.00'		0+07.15'	0+47.83'	46.6254 (d)	39.57'
3	Line	Not Constrained (Fixed)		Two points	313.37'		N0° 23' 26"W	0+47.83'	3+61.20'		
4	Curve	Constrained on Both Sides (Free)		Radius	215.08'	300.00'		3+61.20'	5+76.28'	41.0764 (d)	210.50'
5	Line	Not Constrained (Fixed)		Two points	395.96'		N40° 41' 09"E	5+76.28'	9+72.24'		
6	Curve	Constrained on Both Sides (Free)		Radius	248.06'	250.00'		9+72.24'	12+20.30'	56.8522 (d)	238.01'
7	Line	Not Constrained (Fixed)		Two points	59.63'		N16° 09' 59"W	12+20.30'	12+79.94'		
8	Curve	Constrained on Both Sides (Free)		Radius	367.97'	225.00'		12+79.94'	16+47.90'	93.7015 (d)	328.31'
9	Line	Not Constrained (Fixed)		Two points	169.91'		S70° 07' 56"W	16+47.90'	18+17.81'		

Exercise

1. **Continue in *"Road Design.dwg"***
2. **Grip Edit the Alignment**
   a. Select the SPANIEL DR. Alignment to display the grips
   b. Zoom into the area near circles E and G
   c. Select the grip for the PI inside of circle E and move it to the center of circle G. Notice that the curve remains tangent to the lines and the labels updated automatically.
3. **Edit Alignment Through Tabular Editor**
   a. With the Alignment still selected, go to the "Alignment" contextual tab and on the "Modify" Panel, choose "Geometry Editor"
   b. When the *Alignment Layout Tools* toolbar appears, select the "Alignment Grid View" button 
   c. Change the radius of the first curve to 50'
   d. Change the radius of the second curve to 300'
   e. Change the radius of the third curve to 250'
   f. Change the radius of the last (4th) curve to 225'
4. **Save the Drawing**





NOTES

CONCEPT

Alignment Styles

- Control display properties of Alignments
  - Visibility of elements (lines, curves, spirals, PIs, etc…)
  - Grip Edit behavior
- Create one for each Alignment type
- Civil 3D templates contain pre-made styles

Alignment Label Styles

- Controls individual element labels (Geometry Points, Segments, Curves, Stations, etc…)
- Control display properties of Alignment Label Elements
  - Text Style, Orientation
  - Label visibility
  - Linetype, Lineweight
  - Content and layout of text
  - Text height, color, justification
  - Dragged state of label (leader creation, arrowhead, etc…)
- Create one for each label type/setup you need
- Civil 3D templates contain pre-made styles

Alignment Label Style Sets

- Collections of Label Styles
- Allows multiple Labels to be assigned to Alignments easily
- Can save and import Label Sets into Alignment Properties
- Civil 3D templates contain pre-made Label Style Sets

Alignment Table Styles

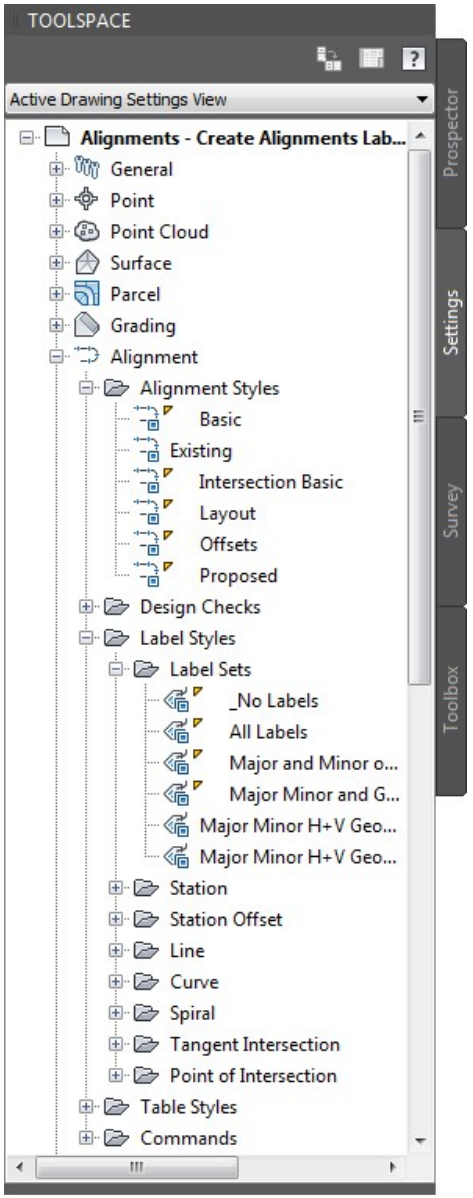
- Controls tables for Lines, Curves, Spirals, and Segments
- Control content and display properties of Alignment Tables
  - Text Style for titles, cells, etc...
  - Column content
  - Cell Formatting (Text wrap, Sort)
  - Visibility of elements
- Create one for each Table type/setup you need
- Civil 3D templates contain pre-made styles

Create/Edit Styles - Multiple Commands

- Alignment right-click menu (drawing or Prospector)
- Alignment Properties dialog (right-click from drawing or Prospector)
- Settings Tab (right-click)
- Create New or Copy Existing and rename

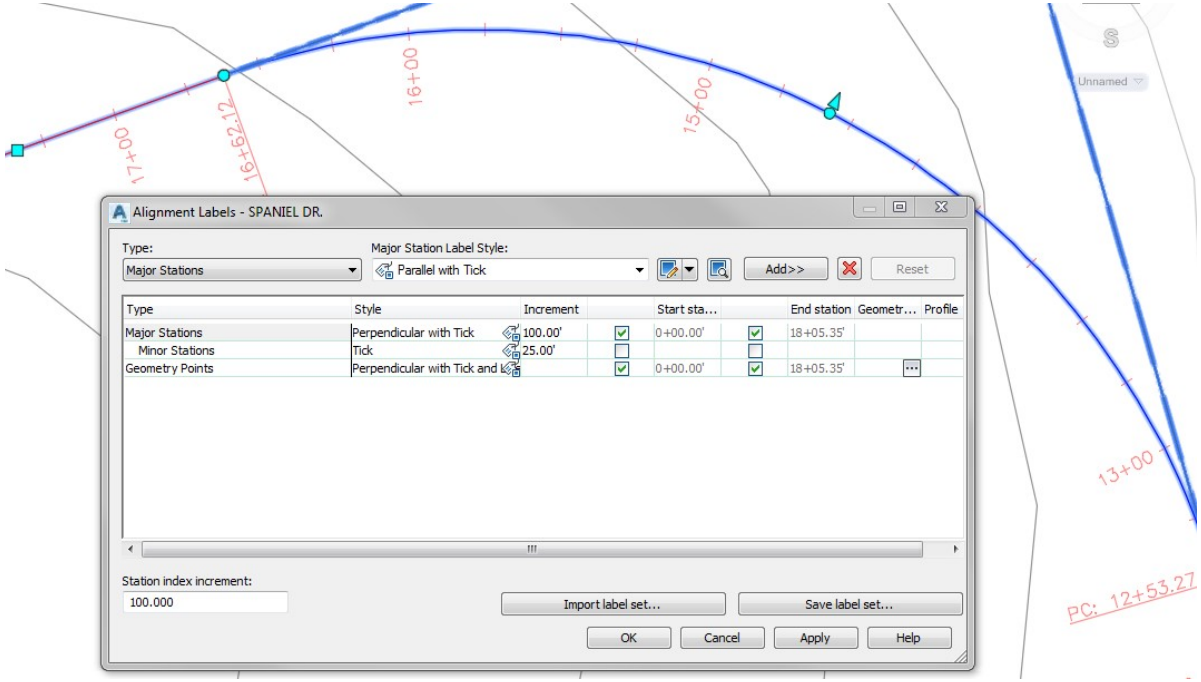
Apply Alignment Styles

- Alignment Styles are applied through Alignment Properties
- Can change Styles using Prospector Item View
- Change Label Styles
  - Right-click on Alignment in drawing or prospector, hit “Edit Label Style”
  - Also from Alignment Properties dialog
  - Change settings inside the Style



Exercise

1. **Continue in *"Road Design.dwg"***
2. **Change the Style of SPANIEL DR.**
   a. Select the Alignment and open the Properties Palette
   b. Change the "Style" to "Proposed"
   c. Hit <ESC> and close the Properties Palette
3. **Edit the Settings for the Labels on SPANIEL DR.**
   a. Select the Alignment, right-click and choose "Edit Alignment Labels"
   b. Change the Style of the Major Stations to "Perpendicular with Tick"
   c. Hit Apply and review the changes in the drawing
4. **Create a New Label Set**
   a. Hit "Save label set…"
   b. On the "Information" tab, change the name to "CADD Class–Major Minor & Geo Pt 25"
   c. Hit OK, then hit OK again to close both of the dialog boxes
5. **Apply the new Label Set to RETRIEVER RD.**
   a. Select the Alignment, right-click and choose "Edit Alignment Labels"
   b. In the dialog, hit "Import Label Set" and choose the set that was created in the previous step.
   c. Hit OK, then OK again to apply the changes and close the dialog boxes
   d. Hit <ESC> to deselect the Alignment
6. **Save the Drawing**



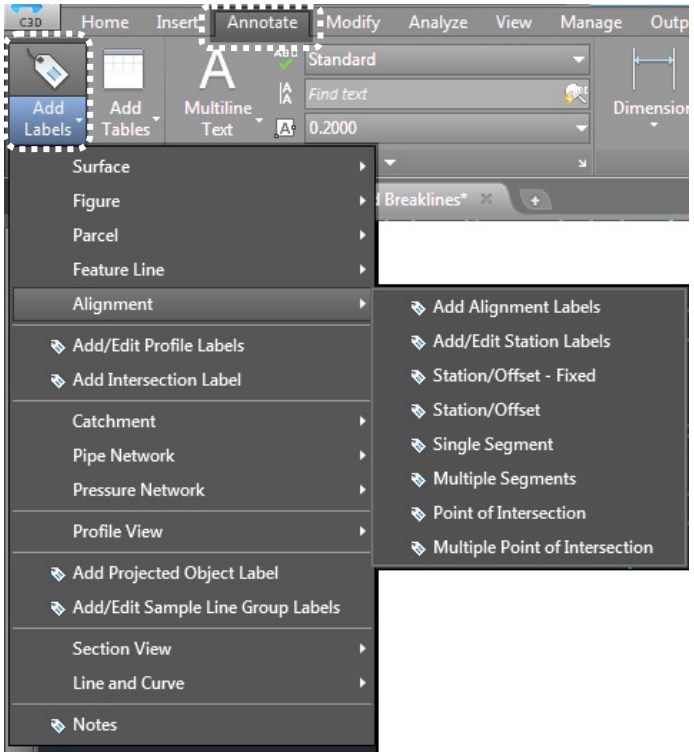
NOTES

CONCEPT

Alignment Labels

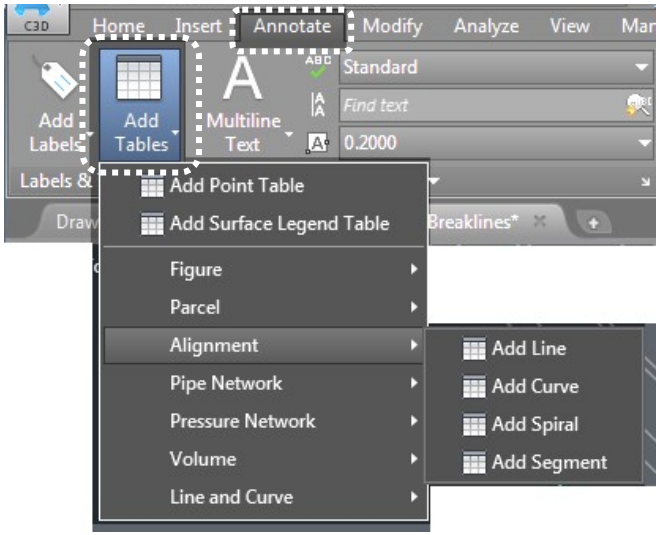
- Can add Labels independent of Label Style/Set assigned to Alignment
- 'Annotate' Tab> 'Labels & Tables' Panel> 'Add Labels' Tools> 'Alignment'
- Display based on Label Styles
- Label Types
  - Station Offset - Fixed Point
  - Station Offset
  - Single Segment
  - Multiple Segment
  - Tangent Intersection
  - Multiple Tangent Intersection
- Pick Alignment
- Select locations along the Alignment

Quick Note
Alignment segments must be labeled in order for them to appear in a table.



Alignment Tables

- Each segment has a Tag
  - Used as index in Table
- Annotate' Tab> 'Labels & Tables' Panel> 'Add Tables' Tools> 'Alignment'
- Display based on Table Styles
- Table types
  - Line
  - Curve
  - Spiral
  - Segment (All 3 above)
- Select Segments individually or by Style
  - If by Style, can automatically add new segments created with that Style
- Can set options for splitting the Table
- Set reactivity mode (Static or Dynamic)

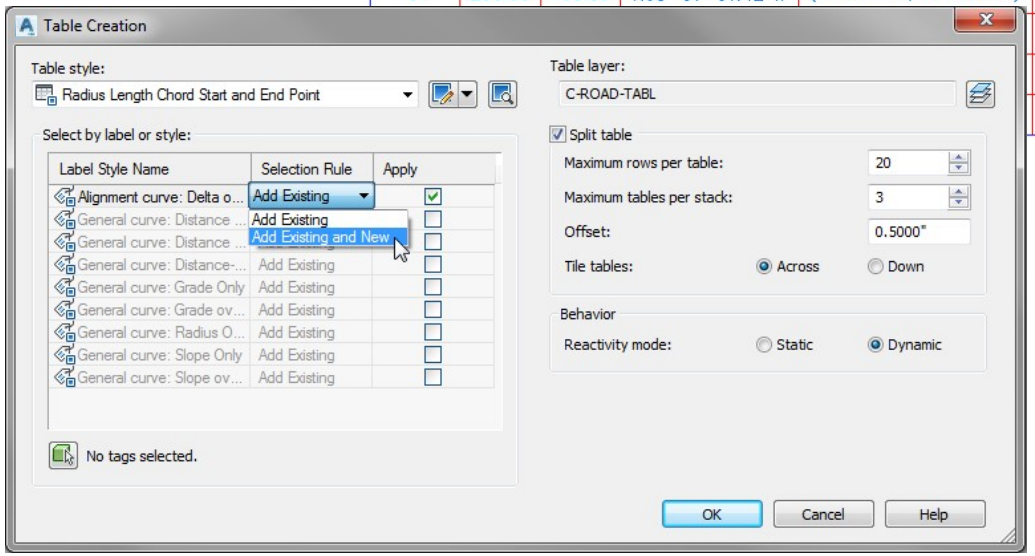


Exercise

1. **Continue in *"Road Design.dwg"***
2. **Add Segment Labels to the Alignments**
   a. "Annotate" Ribbon tab > "Add Labels" > "Alignment" > "Add Alignment Labels"
   b. Label Type: Single Segment
   c. Leave the defaults for Styles
   d. Hit "Add"
   e. Click anywhere on one of the line segments of SPANIEL DR.
   f. Click anywhere along one of the curve segments of SPANIEL DR.
   g. Change the "Label Type" to "Multiple Segment" and hit "Add"
   h. Click anywhere along RETRIEVER RD.
   i. Close the "Add Labels" dialog box
3. **Create a Curve Table**
   a. "Annotate" Ribbon tab > "Add Tables" > "Alignment" > "Add Curve"
   b. Under "Select by label or Style", change the "Section Rule" on the first row to "Add Existing and New" and put a check in the box under "Apply"
   c. Leave the remaining defaults and hit OK.
   d. Click somewhere outside of the site, near the NE corner to place the table
4. **Add Another Curve Label and Update the Table**
   a. Repeat #2, steps a–f above to place a label on another curve along SPANIEL DR., then close the dialog box.
   b. To update the table, type "REA" at the command line and hit <ENTER>
5. **Save the Drawing**

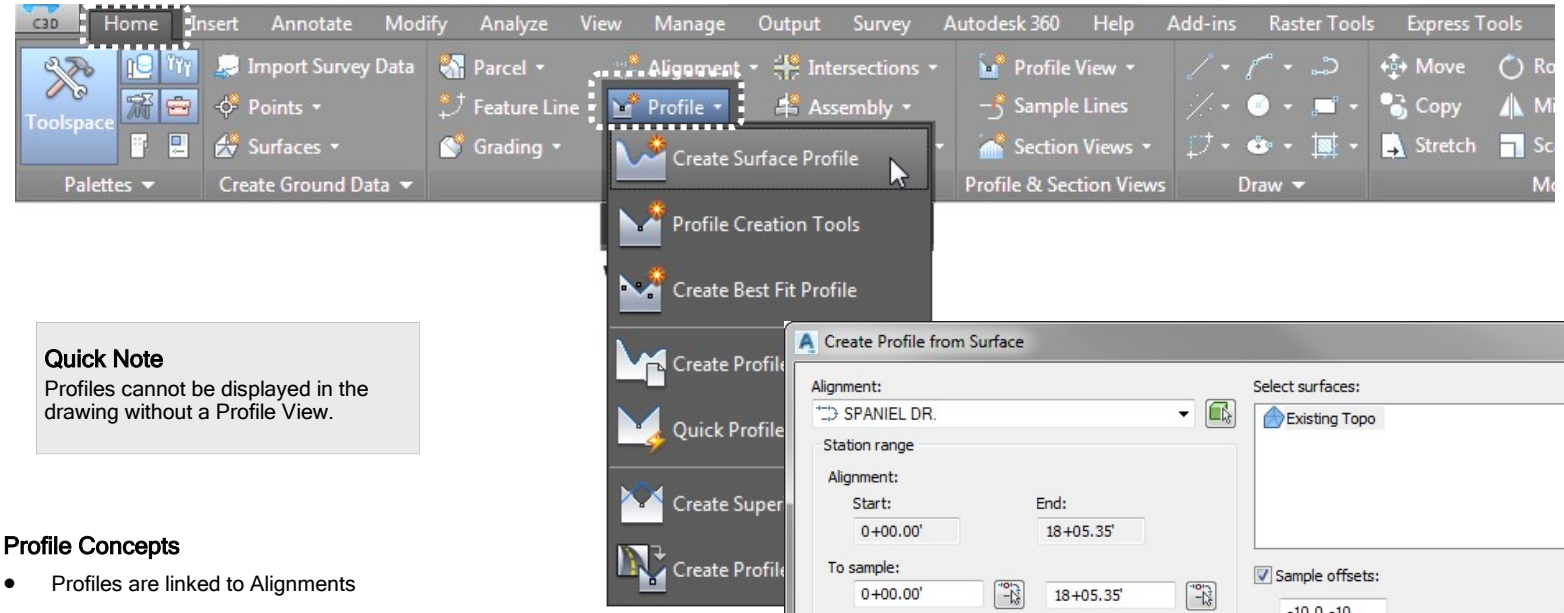
Curve Table: Alignments

Curve #	Radius	Length	Chord Direction	Start Point	End Point
C1	250.00	408.85	N63° 01' 01.42"W	(761823.40,1359881.46)	(761498.33,1360046.97)
					(761055.09,1358938.65)
					(760941.86,1359212.23)
					(761498.33,1360046.97)

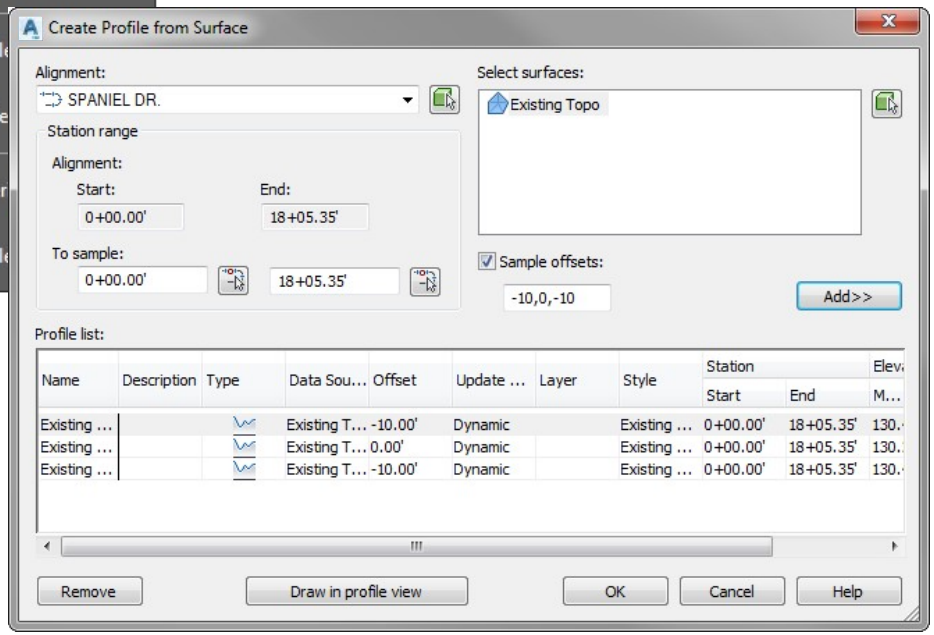


NOTES

CONCEPT



Quick Note
Profiles cannot be displayed in the drawing without a Profile View.

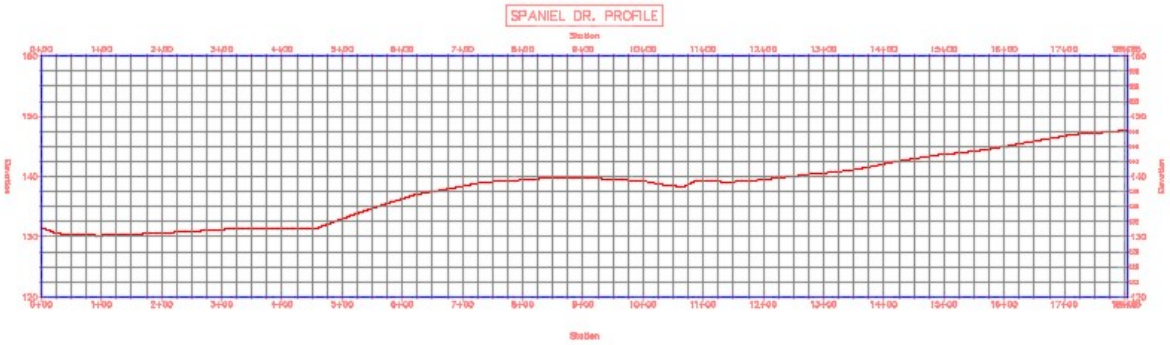


Profile Concepts

- Profiles are linked to Alignments
- Profiles reside in Profile Views
  - Separate Objects
  - Profiles and Profile Views each have Styles
- Create Profile from File, from Surface, or using the Profile Layout Tools

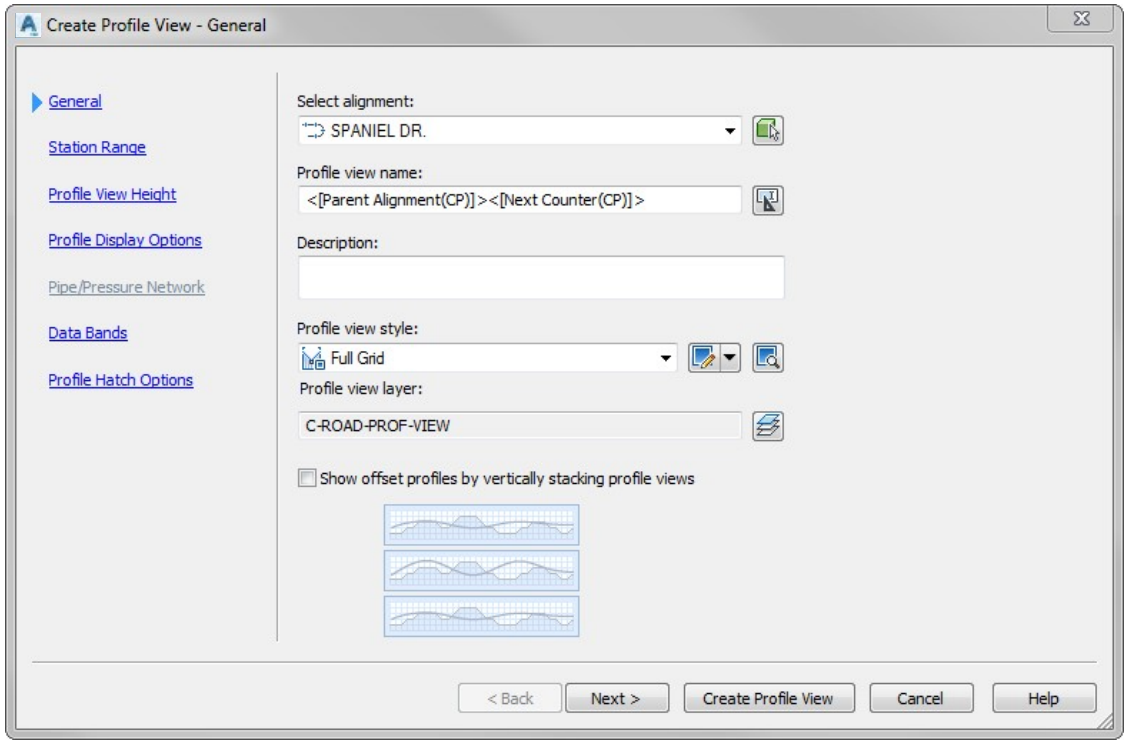
Create Profiles from Surface

- 'Home' Tab> 'Create Design' Panel> 'Profile'> 'Create Surface Profile'
- Generate Profile Definition
  - Select Alignment
  - Select Surface
  - Set station range
  - Add to list of defined profiles for the alignment
  - Choose style, offset, layer, etc…
- Place Profile in Profile View
  - All profiles are displayed in Profile Views
  - Available from the Create Profile from Surface dialog or in the Profiles menu
  - Select Alignment, Profile, station range, styles, band sets, etc…



EXERCISE

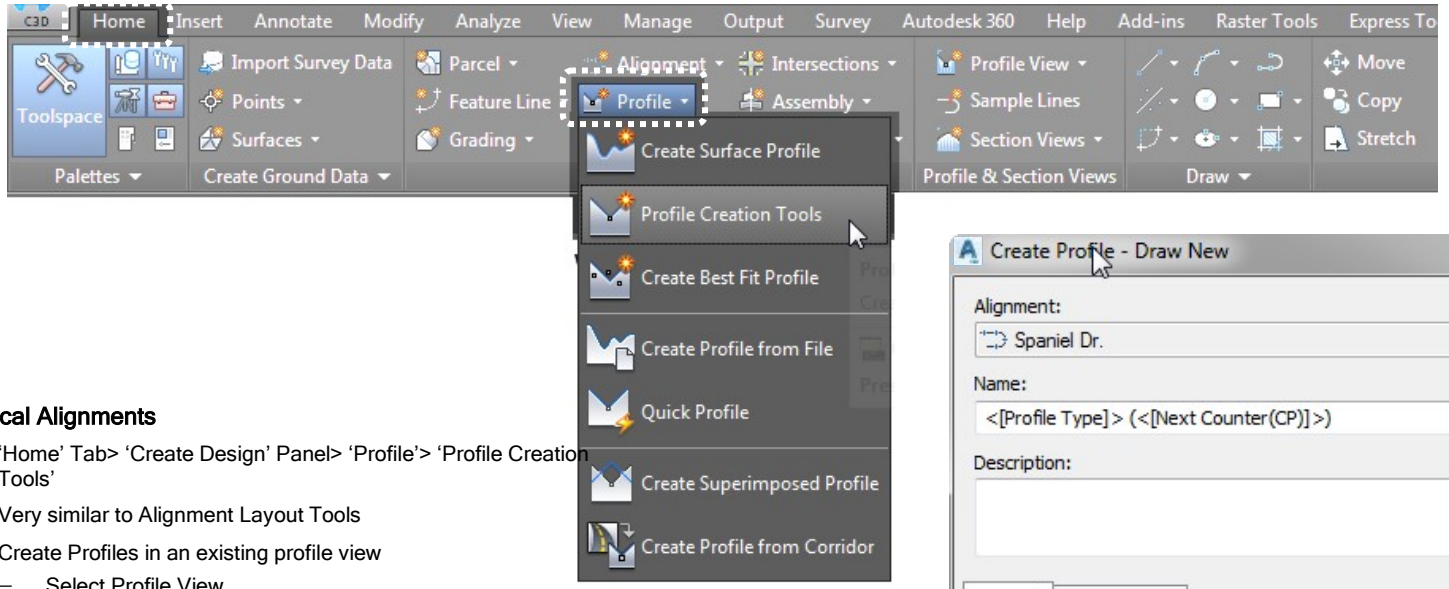
1. **Continue in *"Road Design.dwg"***
2. **Sample Surface Profile for SPANIEL DR.**
   a. "Home" Ribbon tab > "Create Design" Panel > "Profile" > "Create Surface Profile"
   b. Alignment: SPANIEL DR.
   c. Surface: Existing Topo
   d. Sample Offsets: Checked, enter -10,0,10 in the box
   e. Hit ADD>>
   f. Do not close the dialog
3. **Draw in Profile View**
   a. Hit "Draw in Profile View"
   b. Set the "Profile View Style" to "Full Grid" and hit "Next >"
   c. Leave the defaults for Station range and hit "Next >"
   d. Leave the defaults for Profile View Height and hit "Next >"
   e. Uncheck both of the offset Profiles (leave only the middle one checked)
   f. Confirm that the "Labels" column is set to "_No Labels" and hit "Next >"
   g. Set the Band Set to "_No Bands" and hit "Create Profile View"
   h. Select a location to the East of the site to place the Profile View
4. **Save the Drawing**



NOTES

Profiles: Design Profiles (Vertical Alignments)

CONCEPT

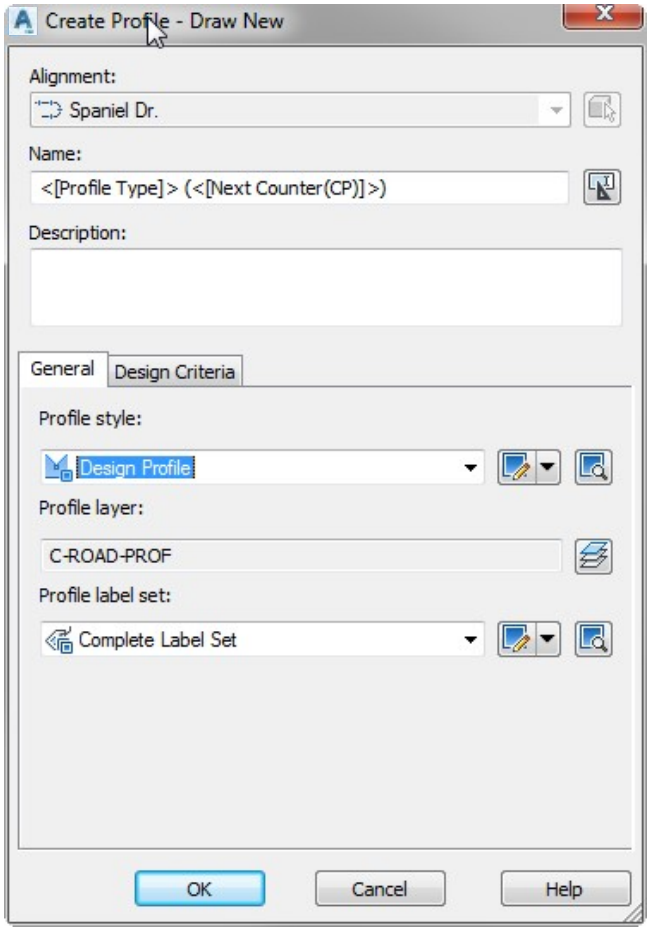


Vertical Alignments

- 'Home' Tab> 'Create Design' Panel> 'Profile'> 'Profile Creation Tools'
- Very similar to Alignment Layout Tools
- Create Profiles in an existing profile view
  - Select Profile View
  - Select Alignment
  - Provide a Name
  - Select the style
  - Select the Label Set
- Creation Tools
  - Tangent-Tangent with or without Curves
  - Fixed Lines
  - Add 3 different curve types
  - Tabular PVI and Curve generation
- Can use Design Criteria to aid in the design process
  - Pre-defined AASHTO Tables for Minimum K
  - Can build custom tables

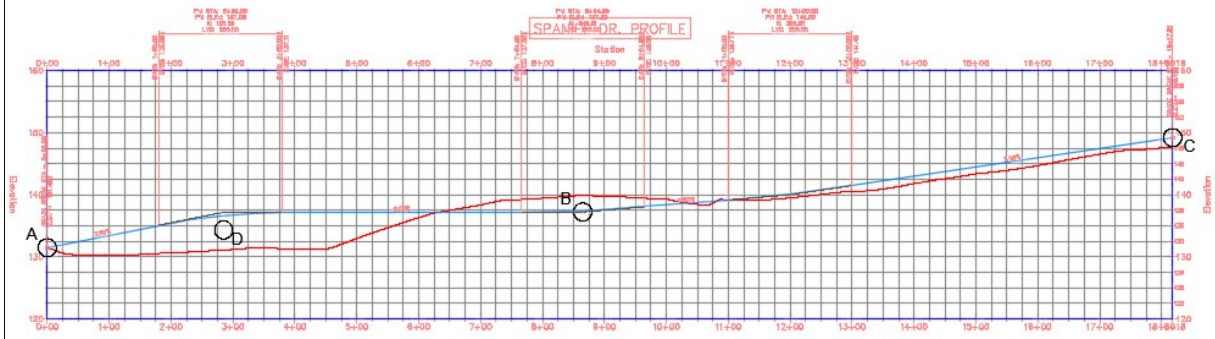
Object Intelligence

- Labels are automatically generated
- Layers can be automatically created



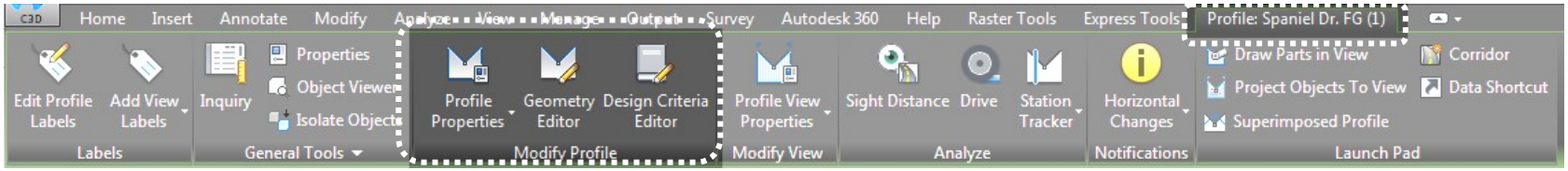
EXERCISE

1. **Continue in *"Road Design.dwg"***
2. **Insert *"..\Profiles\Profile Creation Guides.dwg"* as a block, choose Explode, insert using the bottom left corner of the profile**
3. **Initiate Creation Command**
   a. "Home" Ribbon tab > "Create Design" Panel > "Profile" > "Profile Creation Tools"
   b. Select the SPANIEL DRIVE Profile View
   c. Alignment: SPANIEL DR.
   d. Name: SPANIEL DR. FG
   e. Profile Style: Design Style
   f. Profile Label Set: Complete Label Set
   g. Hit OK
4. **Set Curve Parameters**
   a. On the *Profile Layout Tools* toolbar, choose the arrow next to the first button and select "Curve Settings"
   b. Make sure the "Select Curve Type" is set to "Parabolic"
   c. Set the Length to 200' for both Crest curves and Sag curves and hit OK.
5. **Create the Profile Geometry**
   a. On the *Profile Layout Tools* toolbar, choose the arrow next to the first button and select "Draw Tangents with Curves"
   b. Use a "Center" OSNAP to snap to the center of Circle A to set the first PVI
   c. Use the "Profile Grade Station" Transparent Command to set the next PVI at a grade of 2% at station 2+80.
   d. Hit <ESC> once.
   e. Use a "Center" OSNAP to snap to the center of Circle B to set the third PVI
   f. Use the "Profile Station Elevation" Transparent Command to set the next PVI at station 12+00, elevation 140'
   g. Hit <ESC> once.
   h. Use a "Center" OSNAP to snap to the center of Circle C to set the final PVI.
   i. Hit <ENTER> to end the command
6. **Close the *Profile Creation Tools* toolbar.**
7. **Save the Drawing**



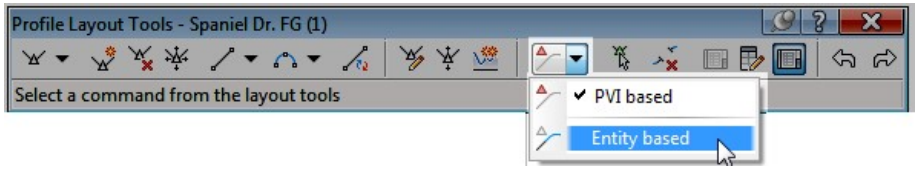
NOTES

CONCEPT



Profile Editing

- Grip Edit
  - Shift Entities
  - Move, Drag Labels
- Insert/Delete PI
- Tabular Edit
  - Edit Curve information
  - Edit PVI station, elevation, grade in, grade out.
  - Grid View can be PVI- or Entity-based
  - Values in Black can be edited
  - Values in Grey are fixed
- Sub-entity Edit
  - Edit one Sub-entity at a time
  - Same rules as tabular edit



Quick Note

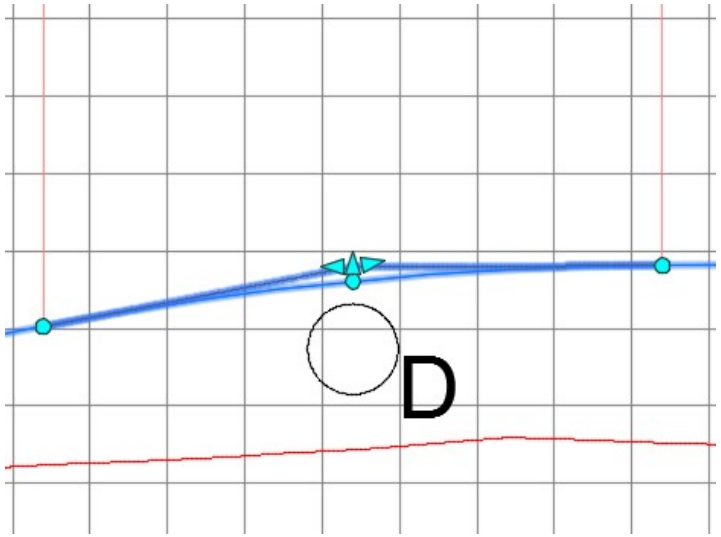
This symbol indicates that a design criteria requirement has not been met. Place your mouse over the symbol for more information.

Object Intelligence

- Profile geometry updated when tabular changes are made
- All labels update automatically
- All tangents update automatically as curves are edited.

EXERCISE

1. **Continue in *"Road Design.dwg"***
2. **Grip edit a PVI**
   a. Select the blue Profile line to display the grips
   b. Use the center (upright) triangle on the second PVI to shift the PVI to the center of Circle D. Notice that the labels update their position and information automatically.
3. **Edit the Profile Through Tabular Editor**
   a. With the Profile still selected, go to the "Profile" contextual tab and on the "Modify" Panel, choose "Geometry Editor"
   b. When the *Profile Layout Tools* toolbar appears, select the "Profile Grid View" button 
   c. Change the "Grade Out" from PVI 3 to 1%
   d. Change the "Profile Curve Length" of the curve at PVI 3 to 250'
   e. Change the "Grade Out" from PVI 4 to 1.5%
3. **Close the "Profile Entities Panorama" and the *Profile Layout Tools* toolbar.**
4. **Save the Drawing**



Profile Entities

No.	PVI Station	PVI Elevation	Grade In	Grade Out	A (Grade Change)	Profile Curve Type	Profile Curve Lengt
1	0+00.00'	131.48'		1.00%			
2	2+84.89'	134.33'	1.00%	0.50%	0.50%	Crest	200.00'
3	8+64.95'	137.23'	0.50%	1.00%	0.50%	Sag	250.00'
4	12+00.00'	140.58'	1.00%	1.50%	0.50%	Sag	200.00'
5	18+17.81'	149.85'	1.50%				

PANORAMA

NOTES

CONCEPT

Profile Styles

- Control display properties of Profiles
  - Visibility of elements (lines, curves, spirals, PIs, etc…)
  - 3D Chain Visualization
- Create one for each Profile type
- Civil 3D templates contain pre-made styles

Create/Edit Styles - Multiple Commands

- Profile right-click menu (drawing or Prospector)
- Profile Properties dialog (right-click from drawing or Prospector)
- Settings Tab (right-click)
- Create New or Copy Existing and rename

Profile Label Styles

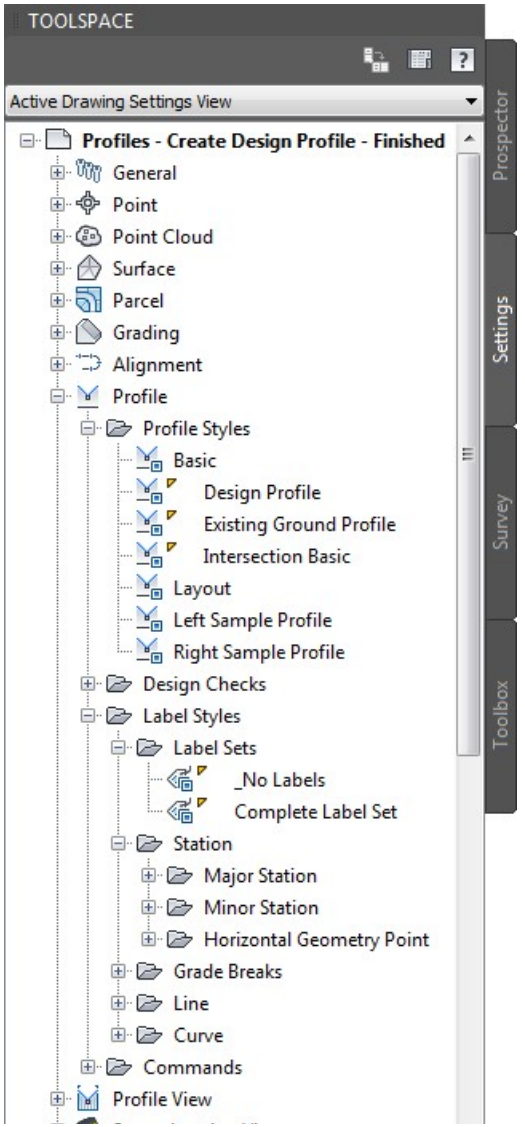
- Controls individual element labels (Geometry Points, Lines, Curves, Stations, etc…)
- Control display properties of Profile Label Elements
  - Text Style, Orientation
  - Label visibility
  - Linetype, Lineweight
  - Content and layout of text
  - Text height, color, justification
  - Dragged state of label (leader creation, arrowhead, etc…)
- Create one for each label type/setup you need
- Civil 3D templates contain pre-made styles

Profile Label Style Sets

- Collections of Label Styles
- Allows multiple Labels to be assigned to Profiles easily
- Can save and import Label Sets into Profile Properties
- Civil 3D templates contain pre-made Label Style Sets

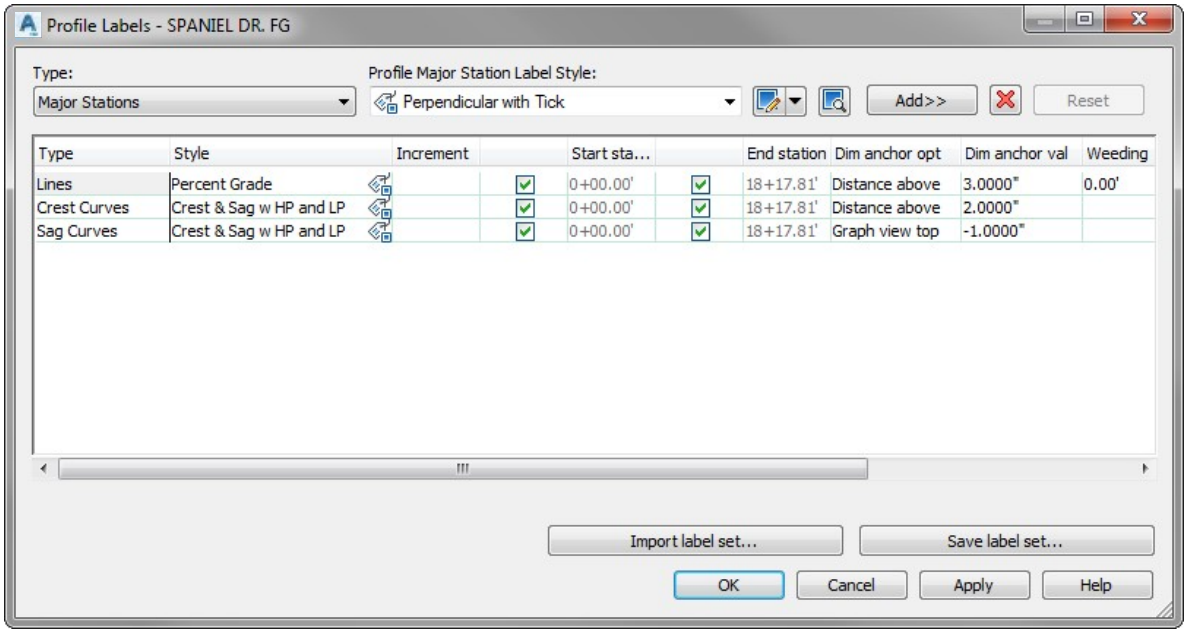
Apply Profile Styles

- Profile Styles are applied through Profile Properties
- Can change Styles using Prospector Item View
- Change Label Styles
  - Right-click on Profile in drawing or prospector, hit “Edit Label Style”
  - Also from Profile Properties dialog
  - Change settings inside the Style



Exercise

1. **Continue in *"Road Design.dwg"***
2. **Change the Style of SPANIEL DR. FG**
   a. Select the Profile and open the Properties Palette
   b. Change the "Style" to "Layout". Review the changes in the drawing
   c. Repeat steps a–b to change the Profile Style back to "Design Style"
   d. Hit <ESC> and close the Properties Palette
3. **Edit the Settings for the Labels on SPANIEL DR.**
   a. Select the Profile, right-click and choose "Edit Labels"
   b. Select the "Grade Breaks" line and hit the "X" button to remove them 
   c. Change the "Dim Anchor Opt" for Crest Curves to "Distance Above"
   d. Change the "Dim Anchor val" for Crest Curves to 2.0"
   e. Change the "Dim Anchor val" for Sag Curves to -1.0"
   f. Hit Apply and review the changes in the drawing
4. **Create a New Label Set**
   a. Hit "Save label set…"
   b. On the "Information" tab, change the name to "CADD - Lines and Curves"
   c. Hit OK, then hit OK again to close both of the dialog boxes
5. **Save the Drawing**



NOTES

CONCEPT

Profile View Styles

- Controls Visibility of Profile View components
  - Grid
  - Title
  - Axes and Axis Labels

Profile Label Bands

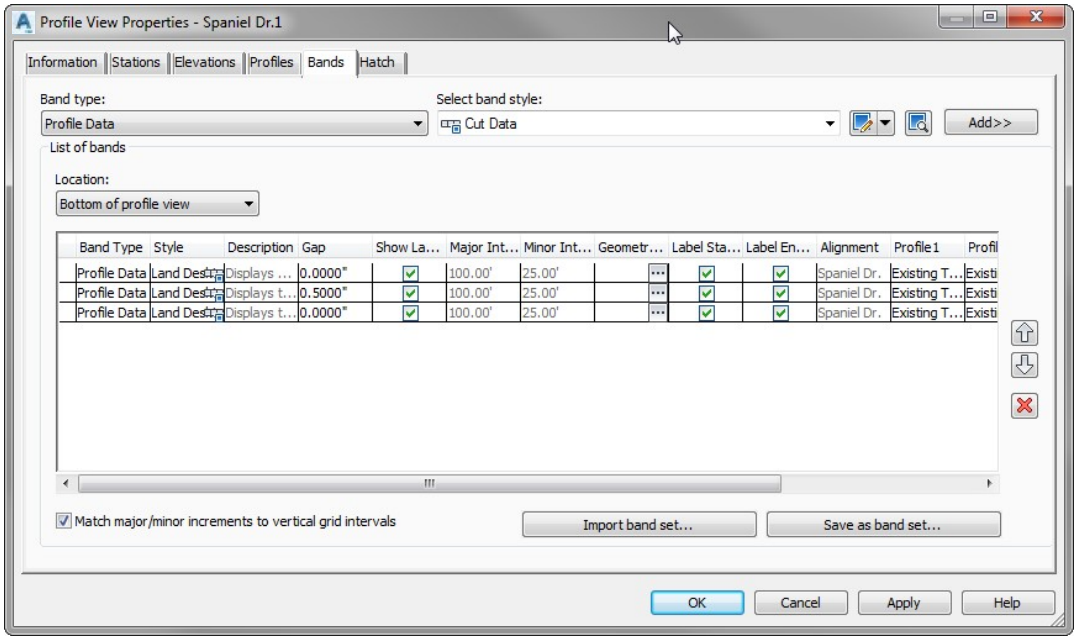
- Rows of data/information about the Profiles in a Profile View
  - Profile Information - Stations, Elevations, etc.
  - Vertical Geometry
  - Horizontal Geometry
  - Superelevation Information
  - Sectional Information (covered later)
  - Pipe Network Information (covered later)
- Shown at the bottom or top of a Profile View
- Applied through the Profile View Creation dialog or the Profile View Properties dialog.

Profile Band Styles

- Controls individual elements in Band (Boundaries, Text, etc…)
- Control display properties of Band Elements
  - Text Style, Orientation
  - Label visibility
  - Boundary Linetype, Lineweight
  - Content and layout of text
  - Text height, color, justification
  - Create one for each Band type/setup you need
  - Civil 3D templates contain pre-made styles

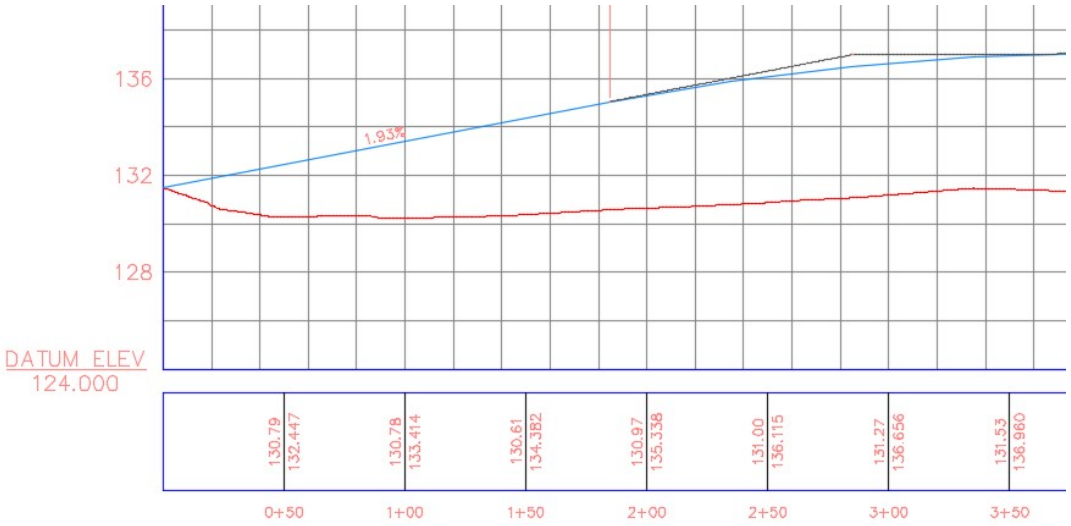
Profile Band Sets

- Allows multiple Bands to be assigned to Profile Views easily
- Can save and import Band Sets into Profile View Properties
- Civil 3D template contains pre-made Band Sets



EXERCISE

1. **Continue in *"Road Design.dwg"***
2. **Turn off the C-ANNO layer**
3. **Change the Style of SPANIEL DR. PROFILE**
   a. Select the Profile View and open the Properties Palette
   b. Change the "Style" to "Profile View". Review the changes in the drawing
   c. Change the "Style" to "Land Desktop Profile View". Review the changes in the drawing
4. **Apply Band Set to the Profile View**
   a. Right-click on Profile View and choose "Profile View Properties"
   b. In the "Bands" tab, hit "Import Band Set…"
   c. Choose "Cut and Fill" and hit OK
   d. Change "Profile1" for both of the Bands to "Existing Topo–(Surface)"
   e. Change "Profile2" for both of the Bands to "SPANIEL DR. FG"
   f. Change the "Location" (top left) to "Top of Profile View"
   g. Change the "Profile2" for this band to "SPANIEL DR. FG"
   h. Hit OK
5. **Apply a different Band Set to the Profile View**
   a. Right-click on Profile View and choose "Profile View Properties"
   b. In the "Bands" tab, hit "Import Band Set…"
   c. Choose "EG-FG Elevations and Stations" and hit OK
   d. Change the "Gap" for the remaining band to 0.25"
   e. Change "Profile1" to "Existing Topo–(Surface)"
   f. Change "Profile2" to "SPANIEL DR. FG"
   g. At the bottom left corner, uncheck "Match major/minor increments to vertical grid intervals"
   h. Change the major interval to 50' and the minor interval to 25'
   i. Hit OK
6. **Save the Drawing**



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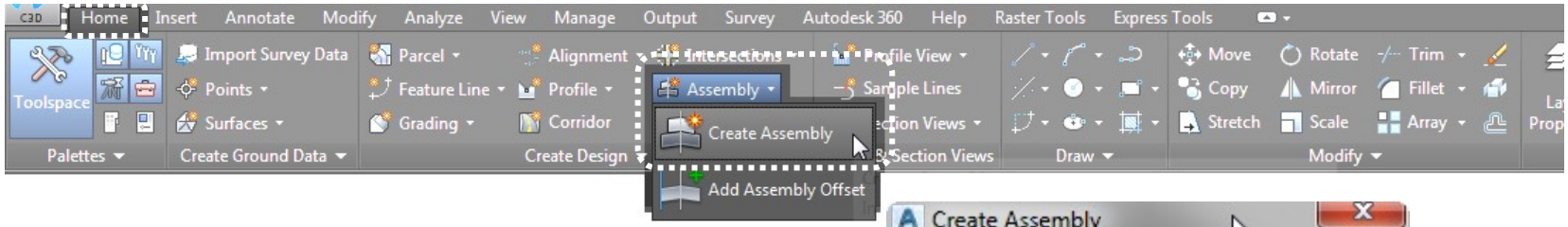
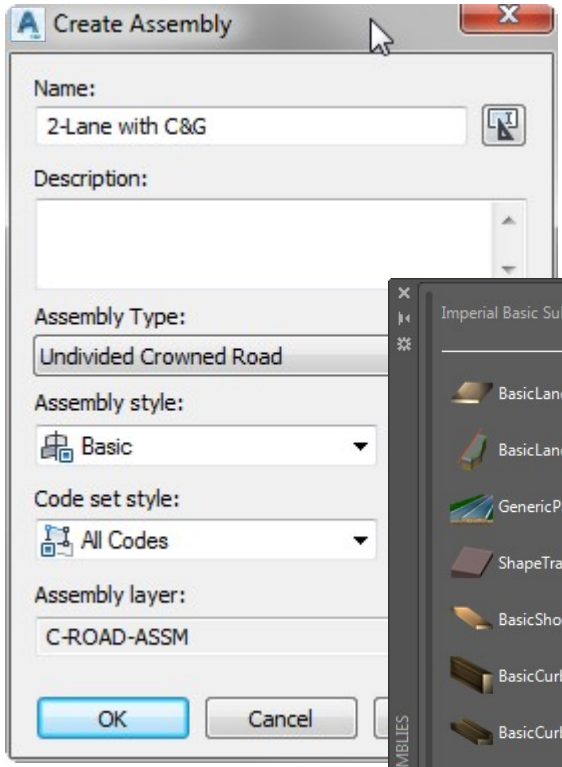
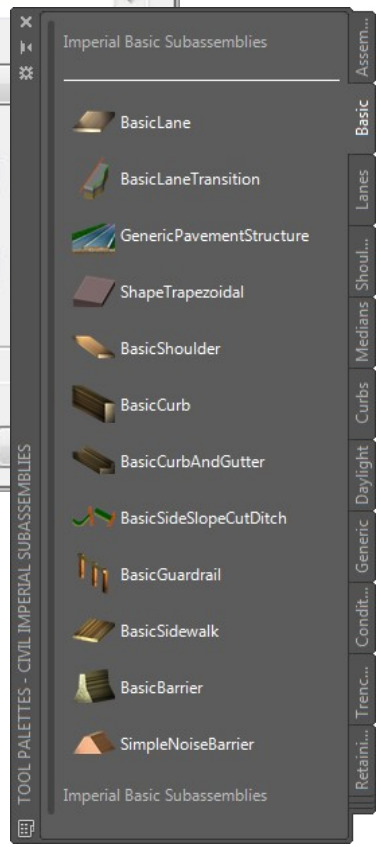
CONCEPT







Assemblies

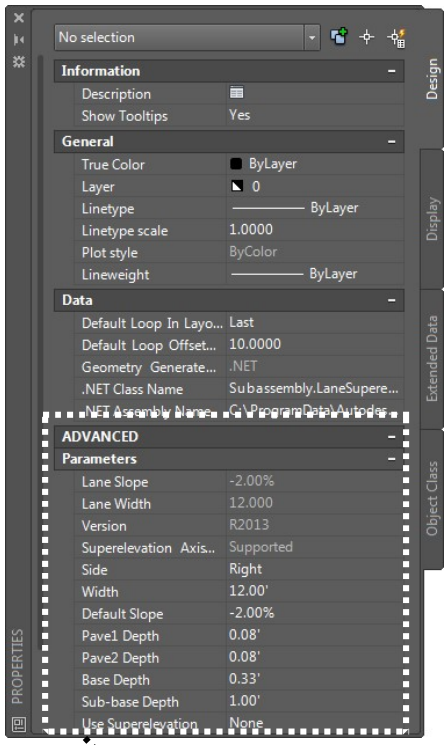
- Similar to Civil Design "Templates"
- Used as base-line for generating cross-sectional definition of corridors
- Used to manage collection of Subassemblies
- 'Home' Tab> 'Create Design' Panel> 'Assembly'> 'Create Assembly'
  - Provide a name
  - Select Style
  - Select Code Set
  - Select location for Assembly baseline

Subassemblies

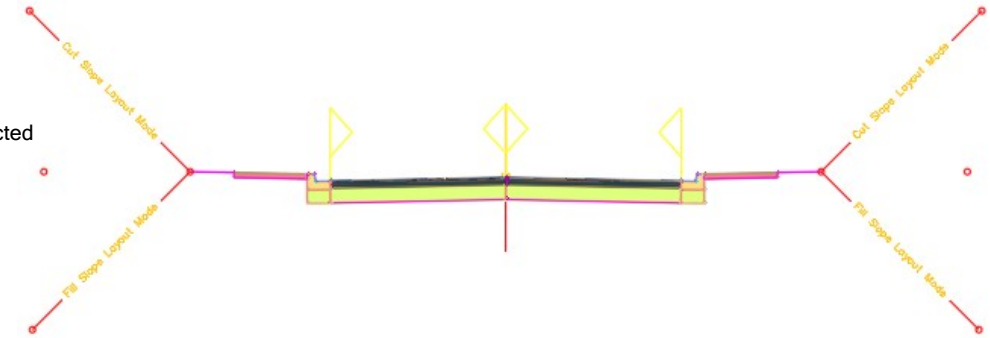
- Used as basic building blocks of the cross-sectional definition of corridors
- Standard collection of Subassemblies can be found in the Catalog
  - 'Modify' Tab> 'Design' Panel> Subassembly Icon (next to 'Assembly')
    'Subassembly' Tab> 'Launch Pad' Panel> 'Catalog'
- Often-used Subassemblies easily transferred to Tool Palette for quick access
  - 'Home' Tab> 'Palettes' Panel> 'Tool Palettes' Icon
- Subassemblies attached to the Assembly base point to created cross-sectional definition
- Can create custom Subassemblies
- To Attach Subassemblies
  - Select Subassembly from Catalog and transfer to Tool Palette
  - Click on Subassembly in Tool Palette
  - Set properties and click on attachment point in Assembly
  - Attach Subassemblies to each other through Codes
- Build each half of Assembly separately by selecting the "Side" property appropriately
- Use intelligent Copy to, Move to, and Mirror commands
  - Select Subassemblies, then Right-click and choose command

EXERCISE

1. **Continue in *"Road Design.dwg"***
2. **Create a typical road section design using an Assembly**
   a. "Home" Ribbon tab > "Create Design" Panel> "Assembly"> "Create Assembly"
   b. Name: 2-Lane with C&G and SW
   c. Assembly Type: Undivided Crowned Road
   d. Leave the other defaults and hit "OK"
   e. Click any empty spot in the drawing to place the Assembly
3. **Open the Tool Palettes**
4. **Add a Lane Subassembly**
   a. On the "Lanes" tab of the Tool Palette, choose "LaneSuperelevationAOR"
   b. Width: 12'
   c. Default Slope -2%
   d. In the drawing, click on the center attachment point on the Right
5. **Add a Curb & Gutter**
   a. On the "Curbs" tab of the Tool Palette, choose "UrbanCurbGutterGeneral"
   b. Subbase Extension: 0.00'
   c. Dimension B: 12"
   d. Dimension D: 6"
   e. Dimension E: 7"
   f. Dimension F: 6"
   g. Attach to Top Edge of Pavement on the Right
6. **Add a Sidewalk**
   a. On the "Curbs" tab of the Tool Palette, choose "UrbanSidewalk"
   b. Sidewalk Width: 5'
   c. Outside Boulevard Width: 3'
   d. Attach to top Back of Curb on the Right
7. **Add Daylight**
   a. On the "Basic" tab, choose "BasicSideSlopeCutDitch"
   b. Cut Slope: 3:1
   c. Fill Slope: 4:1
   d. Attach to right edge of grass strip/boulevard
8. **Mirror to complete symmetrical Assembly**
   a. Close the Tool Palettes
   b. Select each of the subassemblies on the right side until all are selected
   c. Right-click and choose "Mirror"
   d. Choose main center attachment point as mirror Marker
9. **Save the drawing**



Specific Subassembly Properties



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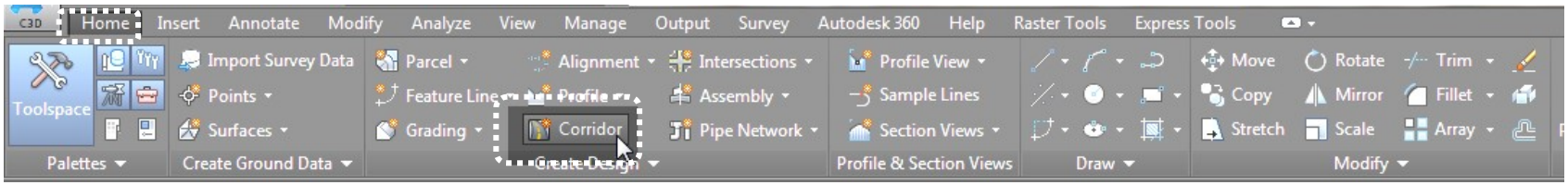


Corridor Definition

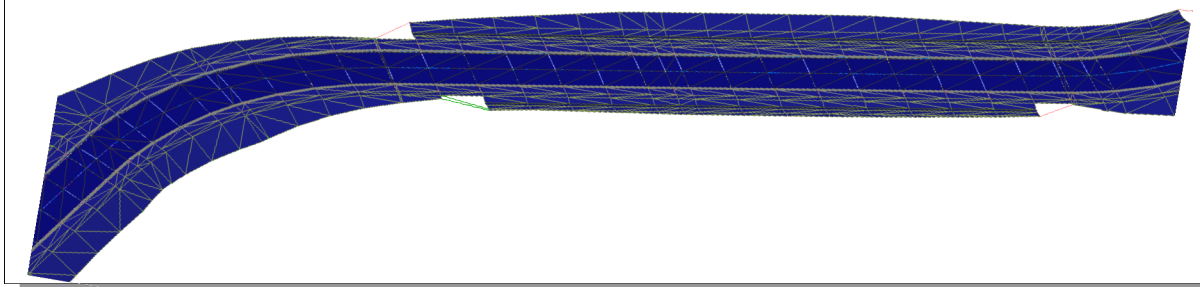
- Used to create a 3D model of anything that has a horizontal, vertical, and cross-sectional definition
  - Highways and Roads
  - Railroads
  - Ditches
  - Culverts
  - Etc…
- Corridor requires 3 pieces of information to build
  - Horizontal Alignment
  - Profile (Usually Design Profile/Vertical Alignment)
  - *******OR******* ***Feature Line***
  - Assembly (Cross-section)

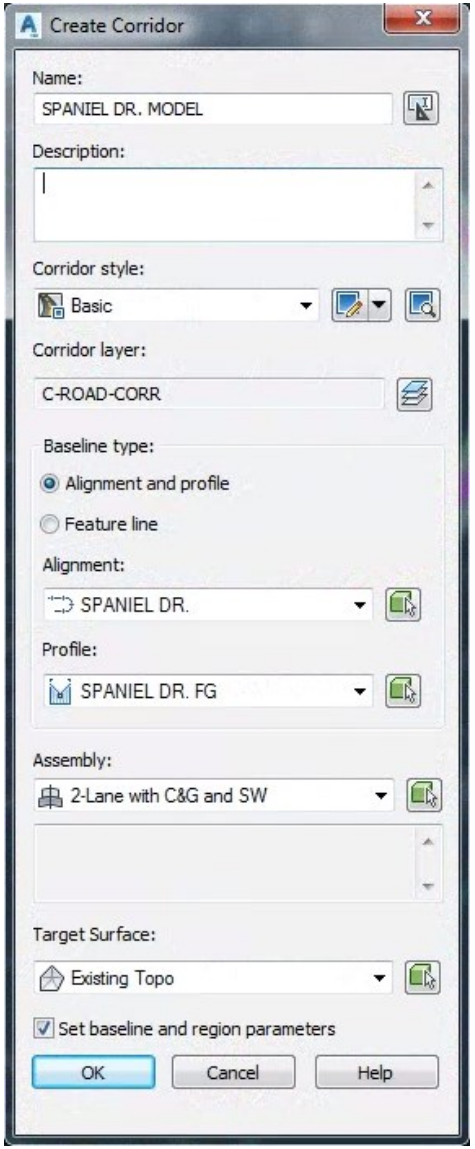
Quick Notes

- As of Civil 3D 2017, a Feature Line can be used to create a Corridor in place of the Alignment/ Profile combination

Create Corridor

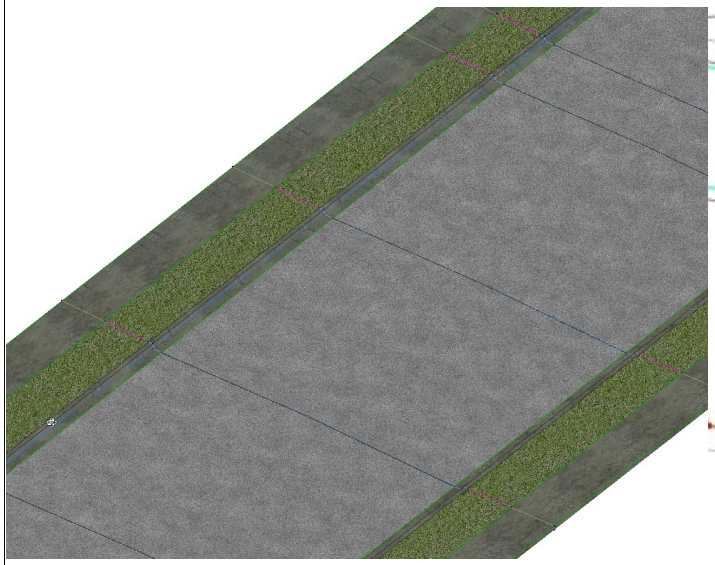
- 'Home' Tab> 'Create Design' Panel> 'Corridor'
  - Corridor based on single alignment and profile
- Provide a name and description
- Select Alignment (or press enter for dialog)
- Select Profile (or press enter for dialog)
- Select Assembly (or press enter for dialog)
- Logical Name Mapping used to set target alignments, profiles, or surfaces.





EXERCISE

1. **Continue in *"Road Design.dwg"***
2. **Create corridor model from Spaniel Dr.**
   a. "Home" Ribbon tab > "Create Design" Panel> "Corridor"
   b. Name: SPANIEL DR. MODEL
   c. Alignment: Spaniel Dr.
   d. Profile: Spaniel Dr. FG
   e. Assembly: 2-Lane with C&G and SW
   f. Target Mapping Surface: Existing Topo
   g. "Set baseline and region parameters": Unchecked
   h. Hit OK
3. **View Corridor in the Object Viewer**
   a. Zoom/Pan back to the Plan view of the site
   b. Select the model, then right-click and choose "Object Viewer"
   c. Use the left mouse button to click and drag and rotate the model
   d. Zoom in to a small area and set the "Visual Style" (top left of the window) to "Realistic". Examine the results
   e. Change the Visual Style to "Shaded with Edges"
4. **Close the Object Viewer**
5. **Save the Drawing**



NOTES

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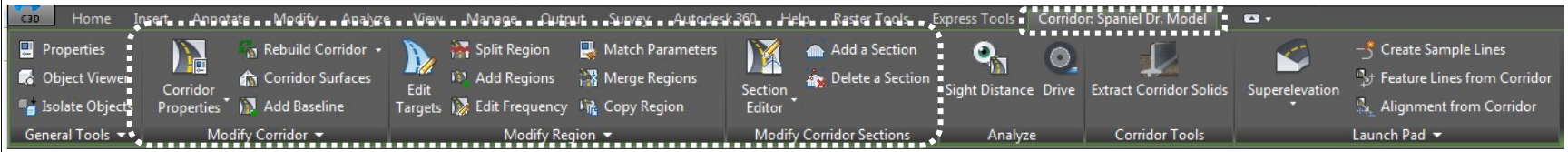


Change Base Objects

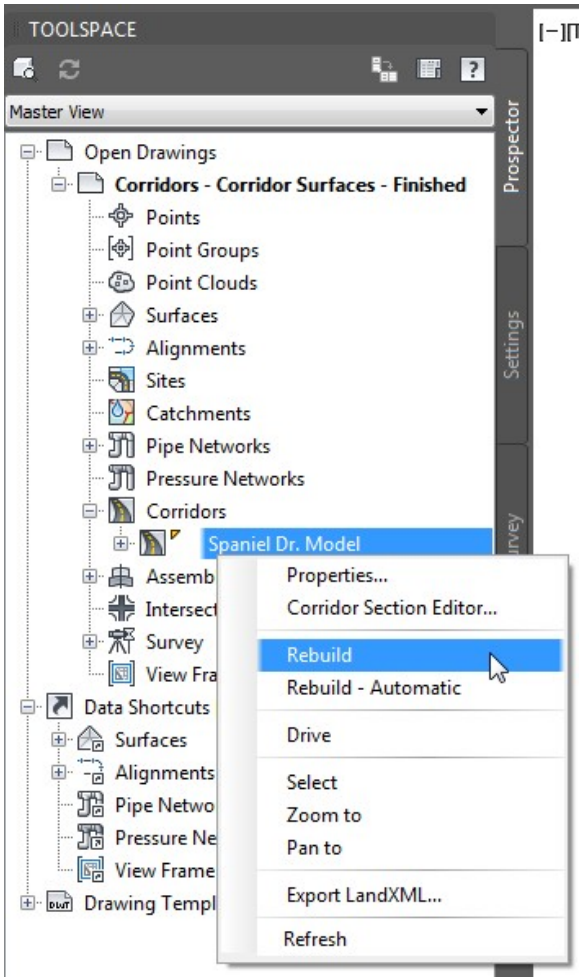
- Any change to objects in definition will be detected by Corridor and will automatically update (if setting is selected)
  - Edit Alignment
  - Edit Profile
  - Edit Assembly
- Can set to “Rebuild - Automatic” from the Prospector

Change Definition

- Done in “Corridor Properties” dialog
  - ‘Corridor’ Tab> ‘Modify’ Panel> ‘Corridor Properties’
  - Right-click on Corridor name in Prospector and choose “Properties”
  - Right-click on Corridor in drawing and choose “Corridor Properties”
- Change which objects are used in creation
- Add Additional Baselines (CL Alignments)
- Add Regions along Baselines
  - Right-click on Baseline and hit “Add Region”
  - Use different Assemblies along one Baseline
  - Assign different Alignments and/or Profiles to Assembly along Baseline
- Change sampling frequency
  - Interval along lines, curves where the Assembly is applied

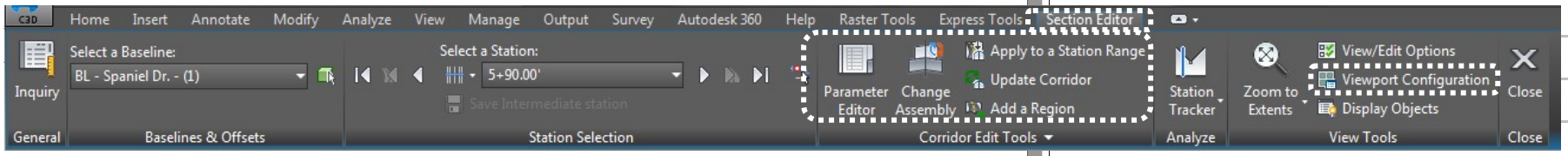
Edit Individual Sections

- Override settings at individual Sections or Section ranges
  - Change Subassembly settings, values, and targets.
  - Add additional Assemblies and Subassemblies
  - View Sections without generating Section Views
- Three ways to access this functionality
  - ‘Corridor’ Tab> ‘Modify’ Panel> ‘Corridor Section Editor’
  - Right-click on Corridor name in Prospector and choose “View/Edit Corridor Sections”
  - Right-click on Corridor in drawing and choose “View/Edit Corridor Sections”



EXERCISE

1. **Continue in *"Road Design.dwg"***
2. **Set the Corridor to Automatically Update**
   a. Prospector > expand "Corridors" > right-click on "SPANIEL DR. MODEL" and choose "Rebuild- Automatic"
3. **Edit Assembly**
   a. Zoom to the Assembly, select the right lane, right-click, and choose "Subassembly Properties"
   b. Change the "Width" to 10'
   c. Repeat steps a. and b. to change the width of the left lane
4. **Change the Frequency**
   a. Select the model in the plan view and from the context tab, choose "Edit Frequency"
   b. Move the cursor over the Corridor until a blue outline appears and left-click to select that region
   c. Along Curves : "By curvature"
   d. Mid-ordinate distance to define…" 0.1'
   e. Along Vertical Curves: 10'
   f. Hit "OK" again to rebuild the corridor
5. **Open and Configure the Section Editor**
   a. With the Corridor still selected, choose "Section Editor" from the context tab
   b. From the *Section Editor*, choose ""Viewport Configuration"
   c. Viewport 1: Section
   d. Viewport 2: Plan
   e. Viewport 3: Profile
   f. Hit OK
6. **Change the Fill Slope on the left side of the road near the pond**
   a. Use station slider to advance to Station 2+75 and click on "Parameter Editor"
   b. Expand "Left" > expand "BasicSideSlopeDitch"', locate "Fill Slope"
   c. In the "Value" column 2:1 and hit <TAB>. Notice the change in the Plan View
   d. In the *Station Editor* tab, hit "Apply to a Station Range"
   e. Leave the "Start Station" at 2+75, and for "End Station", enter 4+50
   f. Hit OK
   g. In the *Station Editor* , hit "Update Corridor"
   h. Look at Plan View to see the change
7. **Close the *Section Editor***
8. **Save the Drawing**

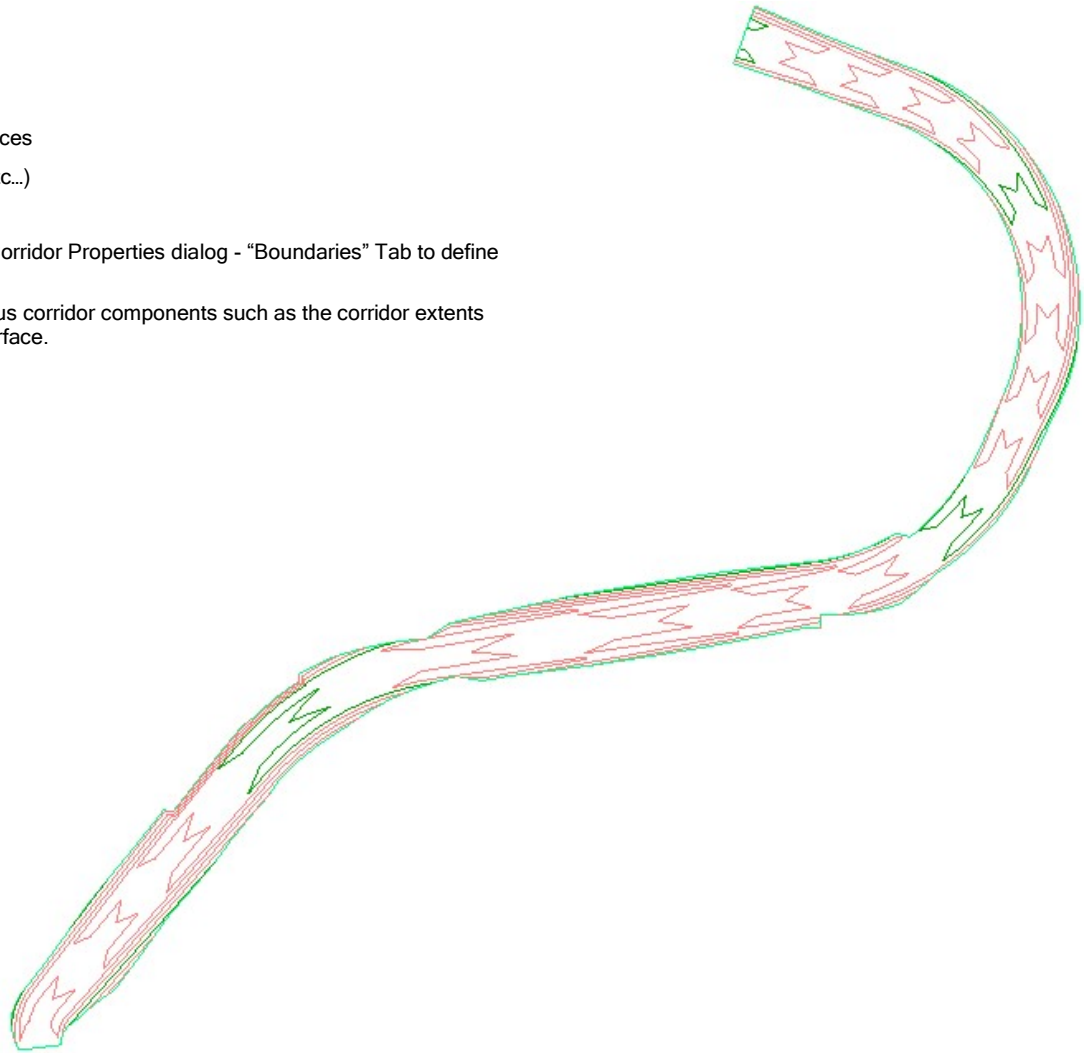


NOTES

CONCEPT

Corridor Surfaces

- Create a Surface from the Corridor
  - 'Corridor' Tab> 'Modify Corridor' Panel> 'Corridor Surfaces
  - Surface Created from Links and Codes (Top, Datum, etc…)
  - Set Surface style (same as regular surface styles)
  - Can add boundaries (Outer, Hide, Render Only) from Corridor Properties dialog - "Boundaries" Tab to define surface extents
    - Boundary can be defined automatically from various corridor components such as the corridor extents (Daylight), which essentially "shrink-wraps" the surface.
  - Perform Volume comparisons
- New Surface automatically created in Prospector
- To create final proposed surfaces
  - Paste Proposed Surface into copy of Existing Surface

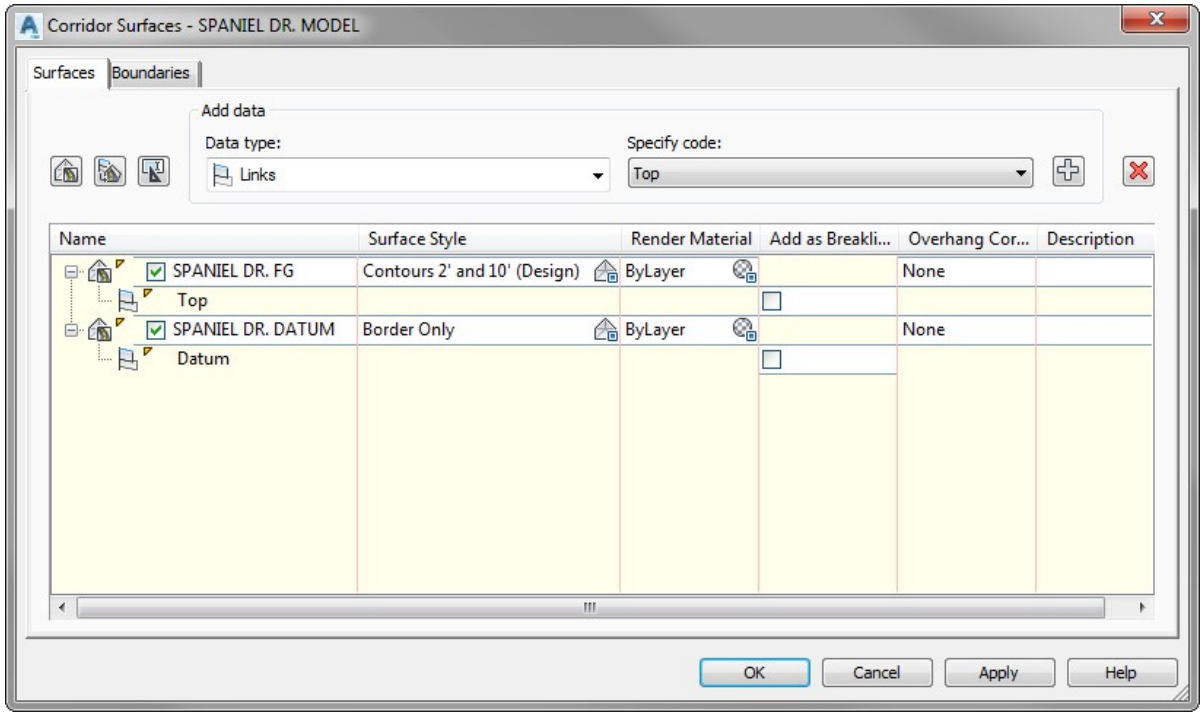


Quick Notes

- Creation of the Corridor Surface is vital for volume comparisons because you can't compare a corridor model to an existing Surface. You must compare a Surface to a Surface to get Volume calculations.
- Datum Surfaces can look strange if the Assembly contains any overhang (Example: Curb and Gutter that has subbase extending past the back of curb.) The way to fix these Surfaces is to set the "Overhang Correction" in the Corridor Surfaces dialog to "Bottom only"

EXERCISE

1. **Continue in *"Road Design.dwg"***
2. **Create FG Top Surface**
   a. Select the Corridor and choose "Corridor Surfaces" from the context tab.
   b. Create a new Surface using the new Surface button, and rename it to "SPANIEL DR. FG" 
   c. With the new Surface selected, set "Specify Code" to "Top" and hit the + button. 
   d. Set the Surface Style to "Contours 1' and 5' (Design)"
   e. Switch to the "Boundaries" tab, select the "SPANIEL DR. FG" Surface, right click, and choose "Corridor extents as boundary"
   f. Hit OK
3. **Create Corridor Datum Surface**
   a. Repeat #2 above using the following parameters to create a new Corridor Surface for the Datum
   b. Name: SPANIEL DR. DATUM
   c. Specify Code: Datum
   d. Style: Border Only
   e. Overhang Correction: Bottom Links
   f. Add Boundary: Corridor Extents as Outer Boundary
   g. Back on the "Surfaces" tab, under "Overhang Correction" for the new Datum Surface, choose ""Bottom Links"
   h. Hit OK



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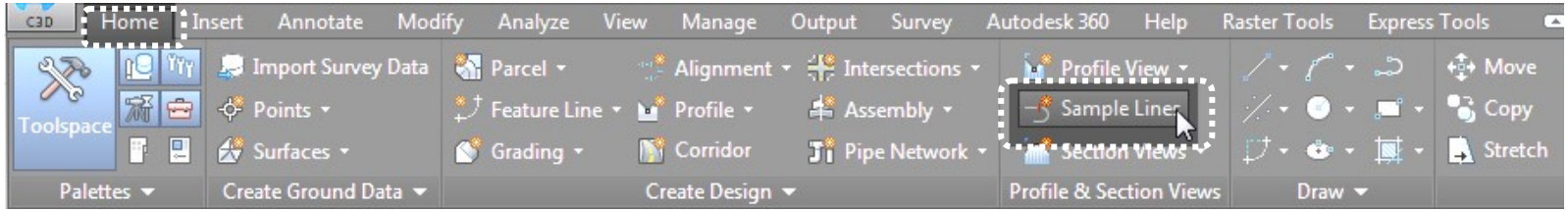
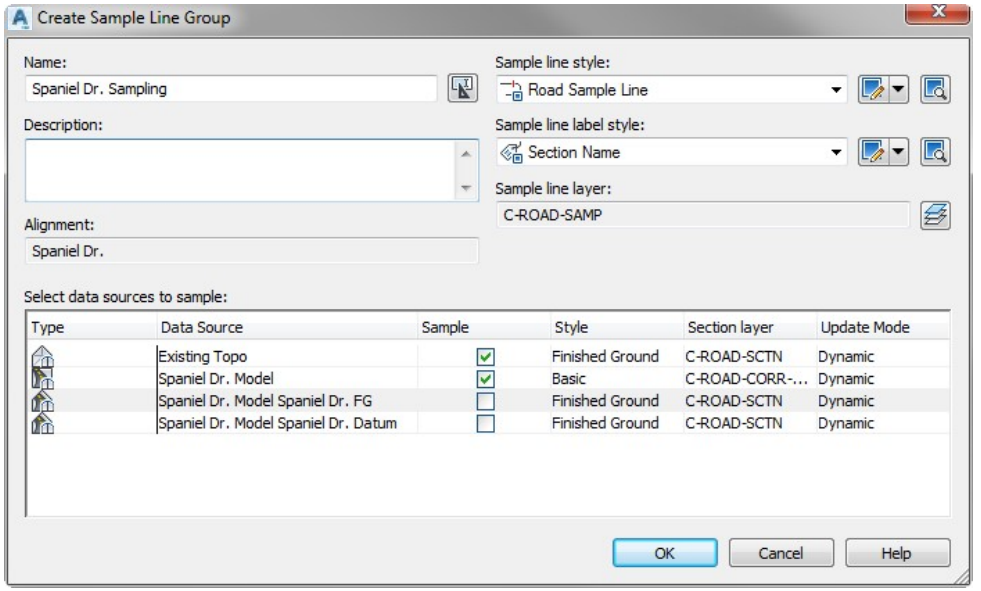


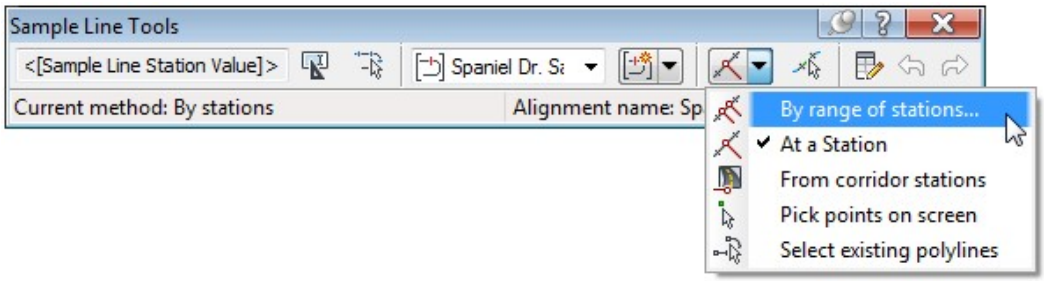
Cross Section Concepts

- Cross Sections reside in Cross Section Views
  - Separate Objects
  - Cross Sections and Cross Section Views each have Styles
- Sections must be sampled in order to be created
- Section (Sample) Lines are organized into Groups

Create Sample Lines

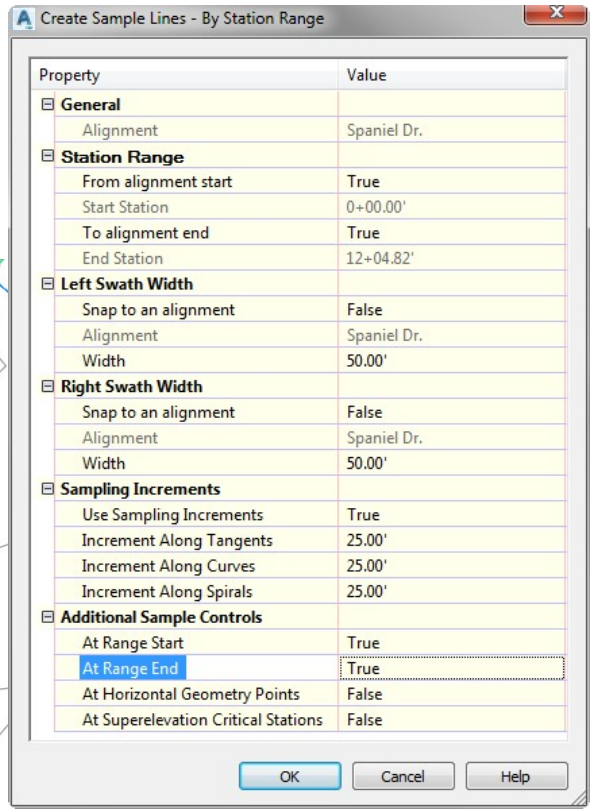
- *Home ▯ Sample Lines*
  - Select Alignment
  - Provide Name
  - Set Sample Line Style and Label Style
  - Choose Surface(s) and Profile(s) to Sample
- Use Tools in Toolbar to Create Sample Lines
  - By Station
  - Pick Points on Screen
  - Pick Existing Polyline
  - By Station Range
  - From Corridor Stations
- Set Sample Width





EXERCISE

1. **Continue in *"Road Design.dwg"***
2. **Create Sample Line Group**
   a. "Home" Ribbon tab > "Profile and Section Views" Panel > "Sample Lines"
   b. Hit <ENTER> to display the list of Alignments, choose SPANIEL DR. and hit "OK"
   c. For the name, enter "SPANIEL DR. SAMPLES"
   d. Under "Select data sources to sample:", deselect the two Corridor surfaces at the bottom of the list and leave on the "Existing Topo" and "SPANIEL DR. MODEL" checked.
   e. Hit OK
3. **Create Sample Lines**
   a. In the *Sample Line Tools* toolbar, select the "Sample Line Creation Methods" button 
   b. Choose "By Range of Stations"
   c. Left and Right Swath Width set to 50'
   d. Increment Along Tangents: 50'
   e. Increment Along Curves: 25'
   f. At Range Start: True
   g. At Range End: True
   h. Hit OK
   i. Hit <ENTER> to end the command
4. **Save the Drawing**



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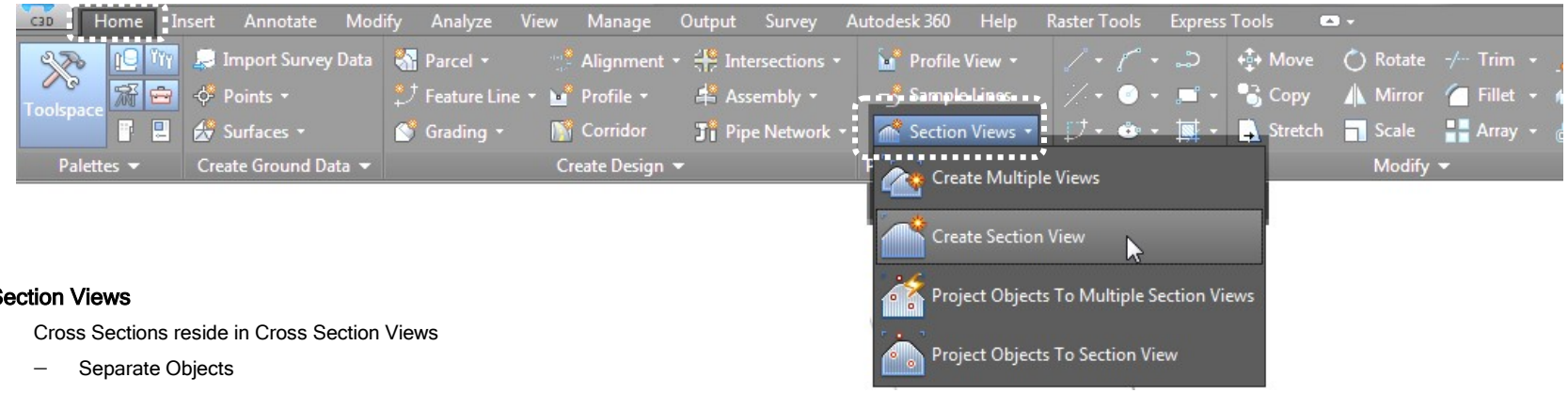
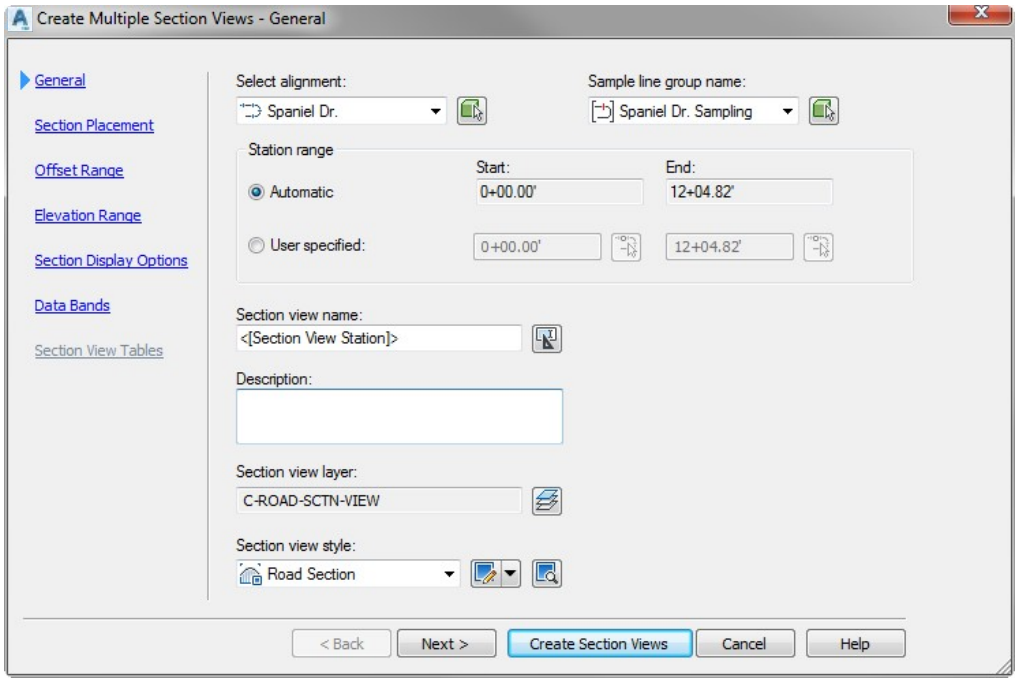


Section Views

- Cross Sections reside in Cross Section Views
  - Separate Objects
  - Cross Sections and Cross Section Views each have Styles
- Section (Sample) Lines are organized into Groups

Create Section View

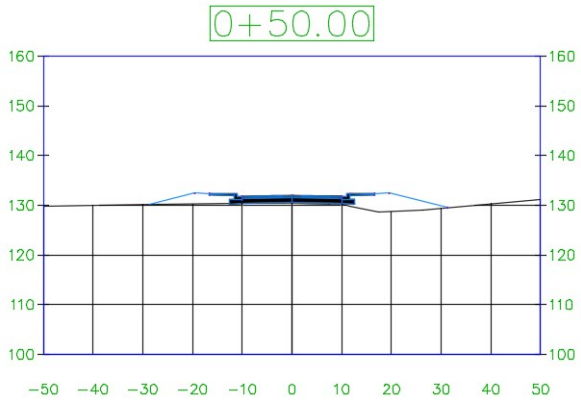
- All Cross Sections are displayed in Cross Section Views
- 'Home' Tab> 'Profile & Section Views' Tab> 'Section Views'
- Wizard walks through necessary steps
- Can Create Multiple Views as well
- Select Alignment, Sample Line Group, Sample Line(s), Style, Band Set, and Sections to draw.



Quick Note
Like Profiles, Sections cannot be displayed in the drawing without a Section View

EXERCISE

1. **Continue in *"Road Design.dwg"***
2. **Create Single Section View**
   a. "Home" Ribbon tab > "Profile and Section Views" Panel > "Section Views" > "Create Section View"
   b. Make sure the Alignment is set to "SPANIEL DR."
   c. From the "Station" drop-down, choose 0+50
   d. Leave the other defaults and hit "Next > "
   e. For "Offset Range", leave the defaults and hit "Next > "
   f. For "Elevation Range", leave the defaults and hit "Next > "
   g. On the "Section Display Options" page, make sure the Style for Existing Topo is set to "Existing Ground"
   h. Also, make sure that the Label Set for both is set to "_No Labels"
   i. Hit "Next > "
   j. On the next page, hit "Create Section View"
   k. Select a location in the drawing for the lower left corner of the Section View.
3. **Turn the C-ANNO layer back on**
4. **Set the Annotation Scale in Model Space to 1" = 20'**
5. **Create Multiple Views**
   a. "Home" Ribbon tab> "Profile & Section Views" Panel > "Section Views'" > "Create Multiple Views"
   b. Make sure the Alignment is set to "SPANIEL DR."
   c. For the Station Range, select "User specified", enter 1+00 for the start station and leave the default for the end station
   d. Hit "Next > "
   e. For Placement Options, select "Production" and hit the browse button 
   f. Leave default for template file name and choose the "ARCH D Section 20 Scale" layout, then hit OK
   g. Hit "Next > "
   h. For "Offset Range", leave the defaults and hit "Next > "
   i. For "Elevation Range", click on "User Specified" and enter 30' for the height.
   j. Select "Follow a Section", choose "SPANIEL DR. MODEL" from the drop-down, and hit "Next > "
   k. On the "Section Display Options" page, make sure the Style for Existing Topo is set to "Existing Ground"
   l. Also, make sure that the Label Set for both is set to "_No Labels"
   m. Hit "Next > "
   n. On the next page, hit "Create Section View"
   o. Select a location in the drawing for the lower left corner of the Section View Group.
6. **Save and close the Drawing**



NOTES

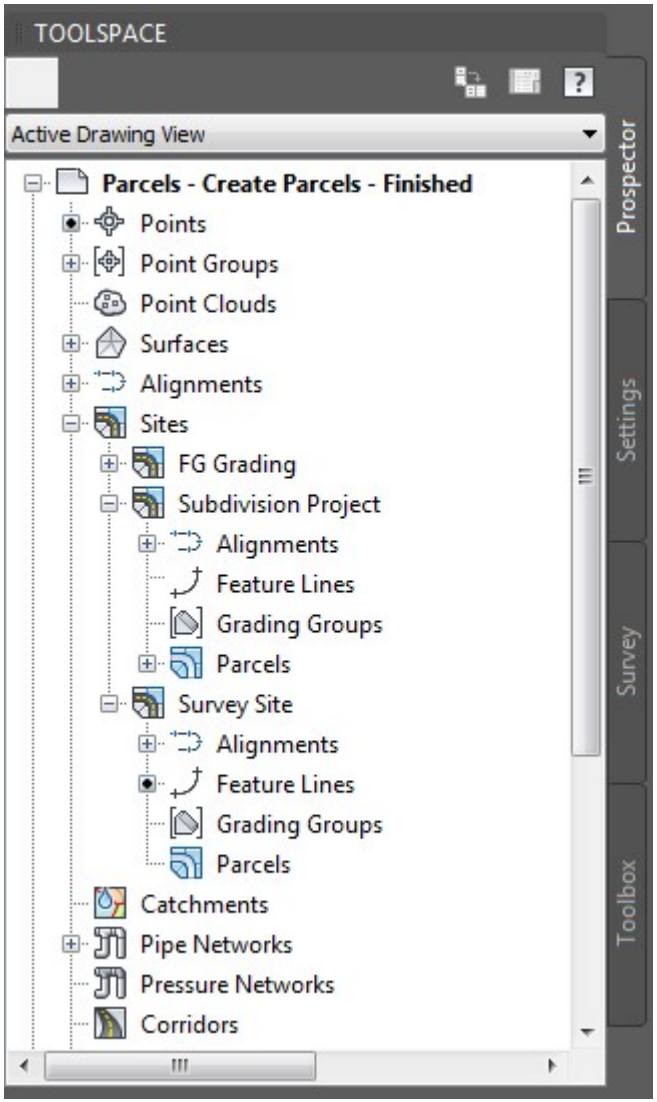
CONCEPT

Topology and Organization

- Parcels, Alignments, Profiles, and Grading can be organized into Sites
- Controls numbering and organization of Parcels and Alignments
- Sites represent separate Topology Levels
  - Different set of relationships (topology) between objects
- Sites are displayed and created in Prospector

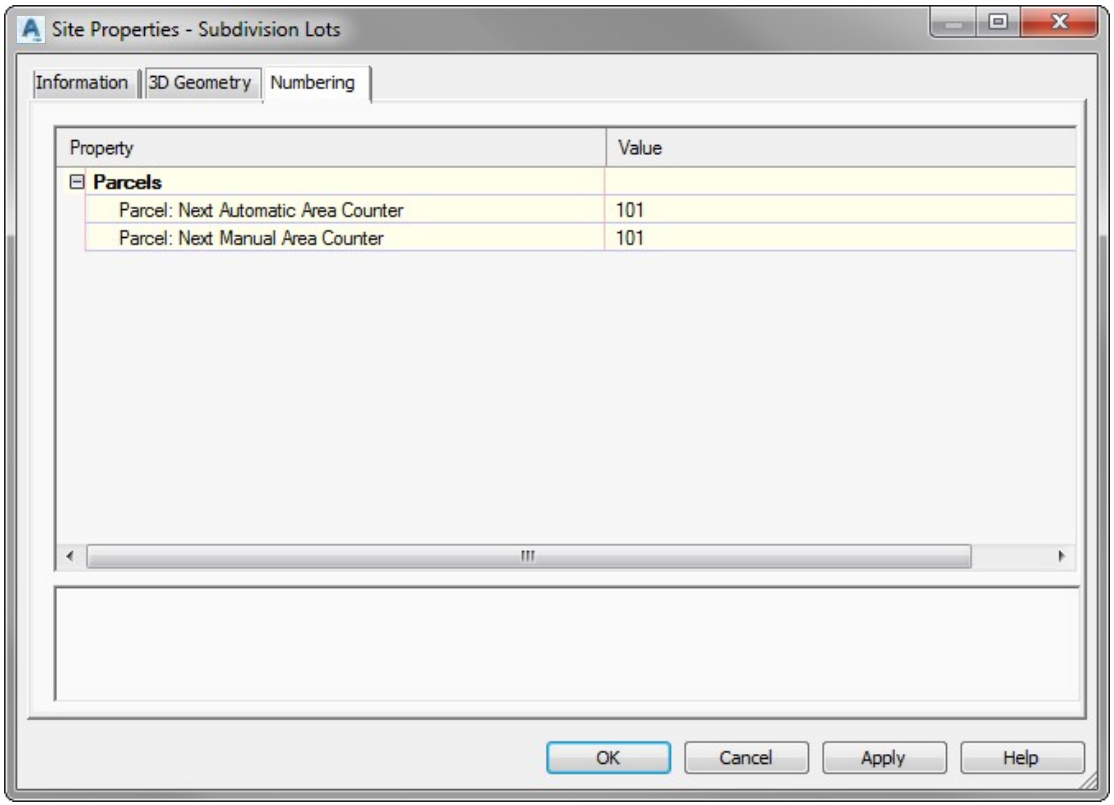
Site Concepts and Rules

- Each Site has a Site Parcel associated with it that represents the extents of all objects within the Site.
- All objects within a Site are dynamically related to each other.
- Objects in one Site are not related to Objects in a different Site.
- While parcels within a Site cannot overlap, Sites can overlap, which in turn allows you to work with overlapping parcels (Ex. property parcels overlapping soil mapping parcels)
- Objects can be moved to a different Site, but the original relationship to the other objects in the original Site is lost.
- Objects within a Site do not have to touch each other.



Exercise

1. Open *"..\Parcels\Road Design—Create Parcels.dwg"*
2. **Create Subdivision Site**
   a. Prospector > right-click on "Sites" and choose "New:
   b. Name: Subdivision Lots
   c. On the "Numbering" tab, set the Value for both counters to 101
3. **Create Grading Site**
   a. Prospector > right-click on "Sites" and choose "New:
   b. Name: FG Grading
   c. On the "Numbering" tab, set the Value for both counters to 1
4. **Create Utilities Site**
   a. Prospector > right-click on "Sites" and choose "New:
   b. Name: Utilities
   c. On the "Numbering" tab, set the Value for both counters to 10001
5. **Save the Drawing**

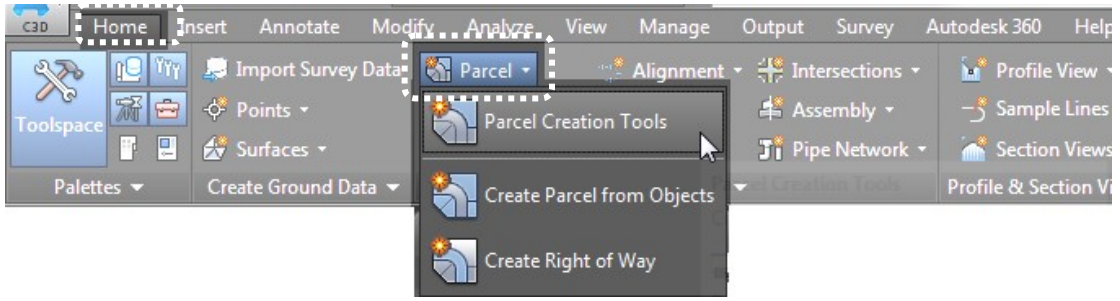


NOTES

CONCEPT

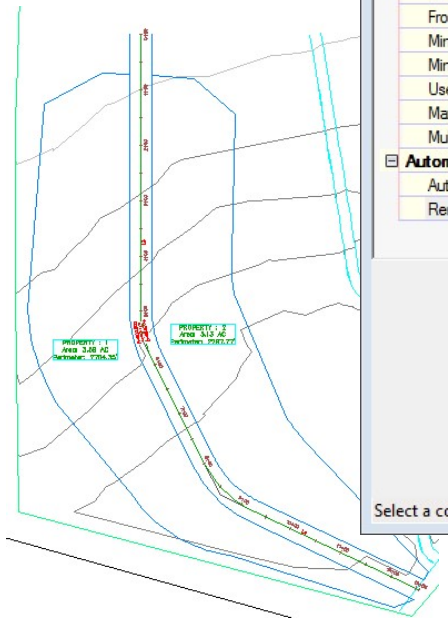
Create Parcels

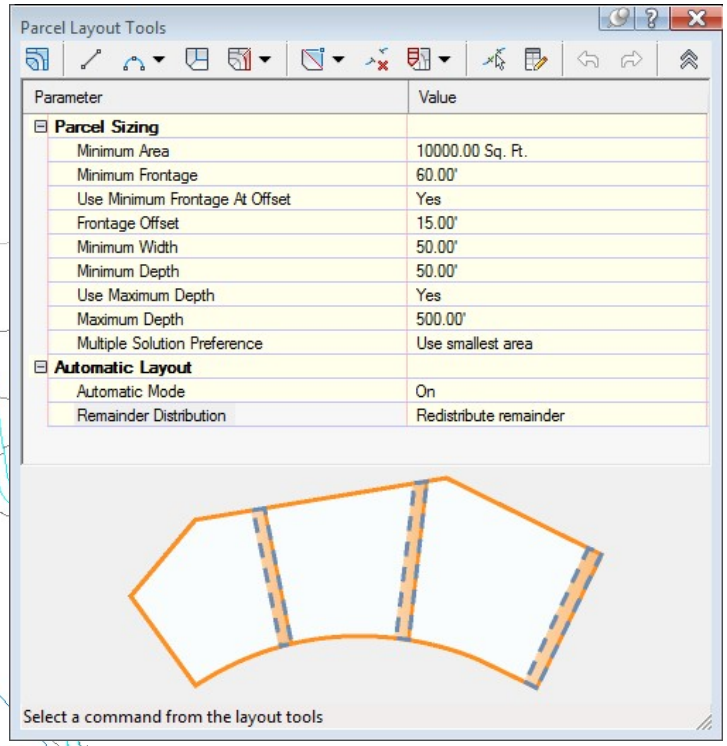
- From Objects
- Create ROW
- Parcel Layout Tools
  - Automatic, Semi-automatic or Manual Creation
  - Specify Default Area and Minimum Frontage
  - Fixed Lines and Curves
  - Slide Angle
  - Slide Direction
  - Swing Line
  - Free Form
- Specify Site, Styles, Layers, and Label Styles

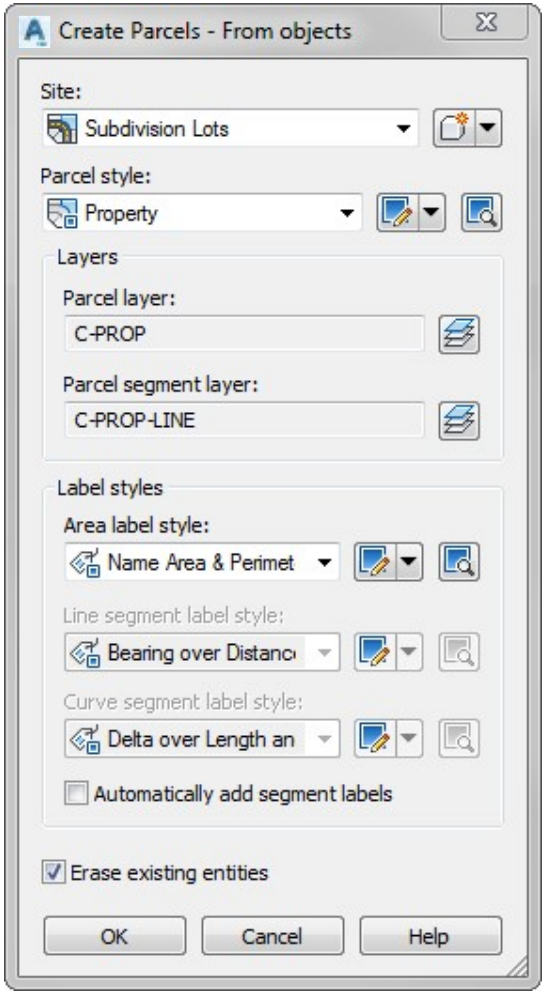


Object Intelligence

- Labels can be created on the fly
- Layers created on the fly

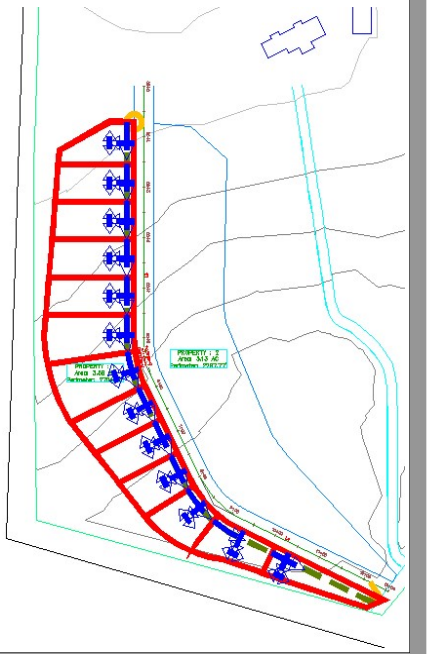






Exercise

1. **Continue in *"Road Design–Create Parcels.dwg"***
2. **Create Western Parcel from Objects**
   a. "Home" Ribbon tab > "Create Design" Panel > "Parcel" > "Create Parcel from Objects"
   b. Choose all three of the polylines that make up the parcel on the western side of the road and hit <ENTER>
   c. Site: Subdivision Lots
   d. Parcel Style: Property
   e. Area Label Style: Name Area & Perimeter
   f. Automatically Add Segment Labels: Unchecked
   g. Erase Existing Entities: Checked
   h. Hit OK
3. **Repeat the steps listed in #2 above to create a Parcel from the polylines on the east side of the road.**
4. **Subdivide Parcel 101 (Western side of the road)**
   a. "Home" Ribbon tab > "Create Design" Panel > "Parcel" > "Parcel Creation Tools"
   b. In the *Parcel Layout Tools* toolbar, choose the double arrow on the right side to expand the toolbar and set the following parameters:
      - Minimum Area: 10,000 sq. ft.
      - Minimum Frontage: 75 ft.
      - Multiple Solution Preference: Use Smallest Area
      - Automatic Mode: On
      - Remainder Distribution: Redistribute Remainder
   c. From the toolbar, select the "Slide Line Create" Tool
   d. In the dialog that appears, set the following options:
      - Parcel Style: Single-Fa
      - Area Label Style: Name Area & Perimeter
      - Automatically Add Segment Labels: Checked
   a. Select Parcel 101 (by selecting the label)
   b. Use and Endpoint OSNAP to choose SE corner of Parcel 101 as frontage start point
   c. Use and Endpoint OSNAP to choose NE corner for frontage end point
   d. For the angle, enter 90 and hit <ENTER>
   e. To accept the results, hit <ENTER> again.
   f. Hit <ESC> to end the command and close the *Parcel Layout Tools* toolbar
5. **Save the Drawing**



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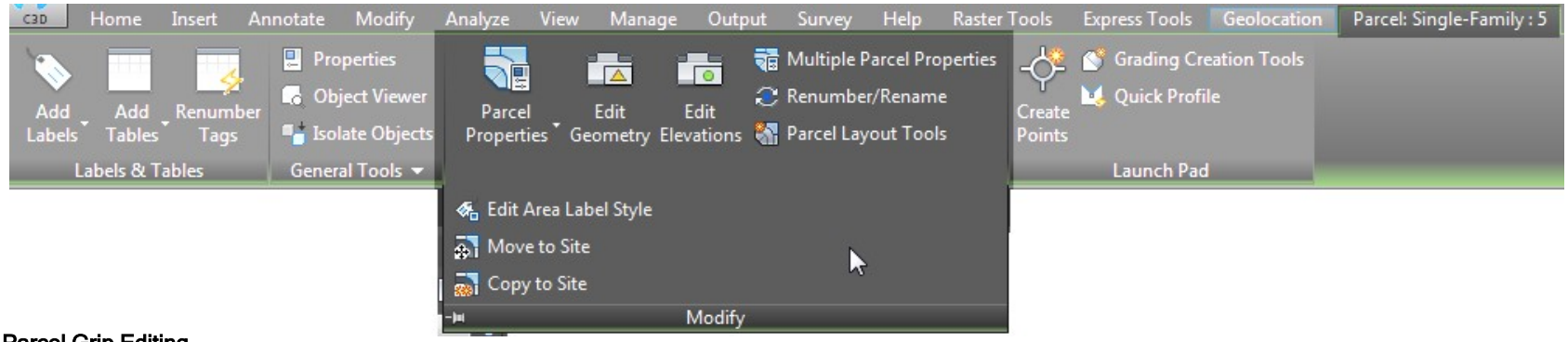


Parcel Grip Editing

- Shift Entities
- Grip placement depends on method of Parcel creation
- Move, Drag, Flip, Reverse Labels

Parcel Segment Editing

- Select Modify Tab> Design Panel> Parcel Tools or
- Select the Parcel on screen to activate Parcel Tab on the Ribbon
  - Insert/Delete PI
  - Break, Trim, Join, Reverse
  - Parcel Union/Dissolve Union
  - Delete Sub-entity
  - Sub-entity Edit
    - ⇒ Edit one Sub-entity at a time
    - ⇒ Values in Black can be edited
    - ⇒ Values in Grey are fixed
  - Parcel Offset
  - Renumber Parcels (covered in Level II)

Parcel Elevation Editing

- Assign Elevations to Parcel Segments
  - Tabular Elevation Editor (discussed later in “Grading”)
- Insert, Delete Elevation and High/Low Points
- Get Elevations from Surface

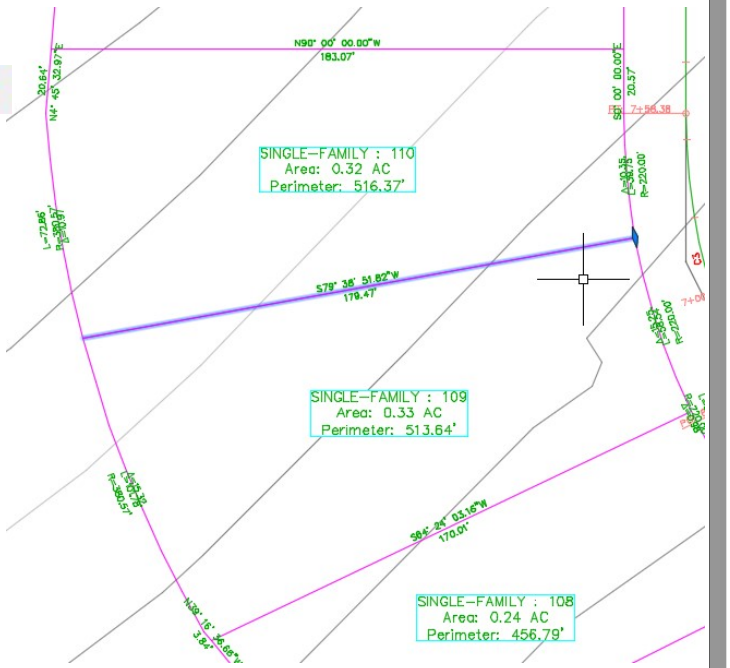
Object Intelligence

- All adjacent parcels update automatically
- All labels update automatically
- Any tables (covered later) update automatically

Quick Note
Never use AutoCAD ERASE to delete Parcels or Parcel Segments. Doing so can result in drawing corruption.

Exercise

1. **Continue in *"Road Design–Create Parcels.dwg"***
2. **Grip Edit Parcels**
   a. Select the Parcel Segment between Parcel 109 and 110 to display the grip
   b. Select the grip and drag it slightly North. Notice that the Segment maintains the 90º angle to the frontage line.
   c. Click again to place the line in the new location. Notice that the Area Labels for the two Parcels as well as the Segment Labels are automatically updated.
   d. Hit <ESC> to deselect the line
3. **Offset Parcels to build BRLs**
   a. Initiate the AutoCAD Offset command
   b. Use 15' as the offset distance
   c. Select the Area Label for Parcel 108 and then pick a point inside the same parcel
4. **Perform Parcel Unions**
   a. "Modify" Ribbon tab > "Design" Panel >"Parcel" > "Modify" context tab > "Parcel Layout Tools"
   b. In the *Parcel Layout Tools* toolbar, choose the "Parcel Union" button.
   c. For the destination Parcel, choose the Areal Label of Parcel 110.
   d. For the Parcels to union, select Parcel 109 and hit <ENTER>. Notice that the Parcel Segment is still in place but the Area Label for Parcel 110 now shows the total area for both.
   e. Click on Parcel 110 and notice that the area highlighted surrounds both of the original Parcels
   f. Click on the down-arrow in the Parcel Union button and choose "Dissolve Parcel Union".
   g. Select Parcel 110 and the Parcels will separate again (new numbers, default styles)
5. **Delete Sub Entities**
   a. With the *Parcel Layout Tools* toolbar still open, select the "Delete Sub-Entity" button
   b. Select the Parcel Segment that separ Parcels 111 and 112. Notice that the Parcel Segment is completely removed and only one Parcel remains.
6. **Close the *Parcel Layout Tools* toolbar**
7. **Save the Drawing**



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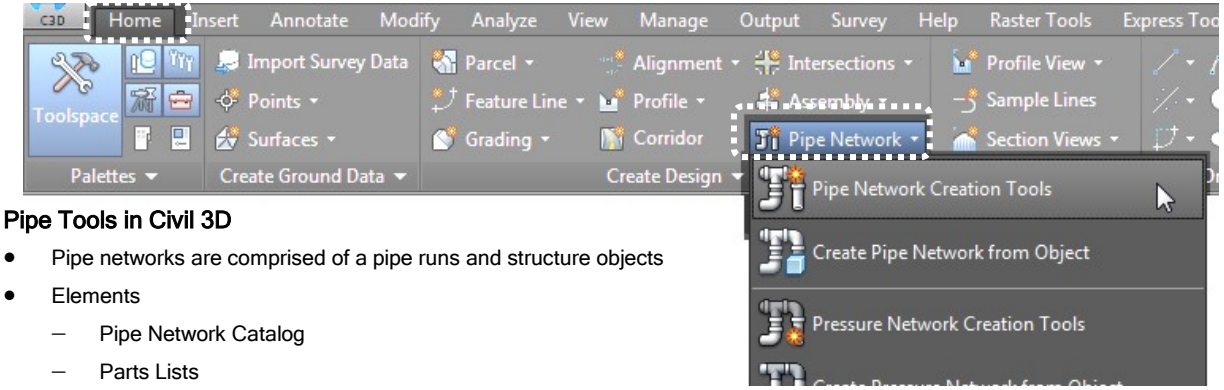
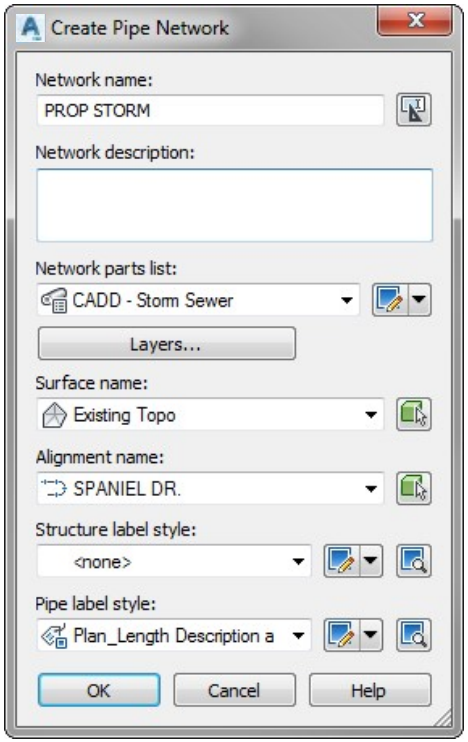


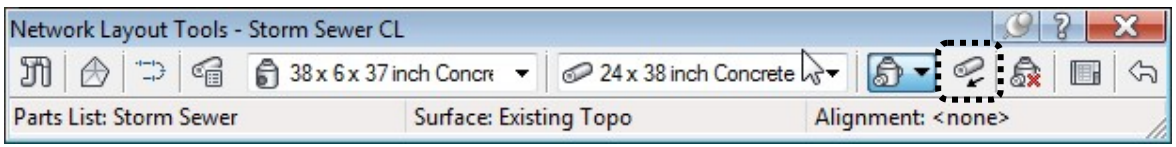


Pipe Tools in Civil 3D

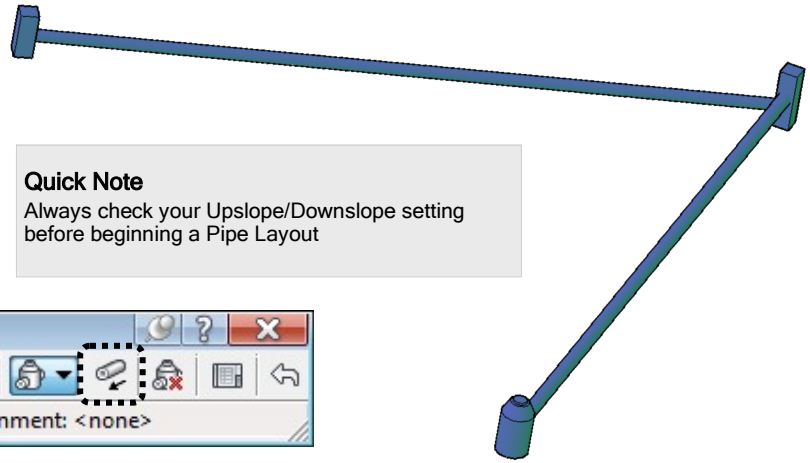
- Pipe networks are comprised of a pipe runs and structure objects
- Elements
  - Pipe Network Catalog
  - Parts Lists
  - Rule Sets
  - Structures
  - Pipes
- 'Modify' Tab> 'Design' Panel> 'Pipe Network' or Select a Pipe Network on the screen to open 'Pipe Network' Tab
- 'Home' Tab> 'Create Design' Panel> down arrow '> 'Set Pipe Network Catalog'
  - Select either an imperial or metric Pipe Network Catalog containing the desired pipes and structures to be used
- 'Pipe Network' Tab> 'Network Tools' Panel> 'Parts List'> 'Create Parts List'
  - Add Part Families for Pipes and Structures
  - Pipe Part Families can be made up of circular, elliptical, rectangular, or egg-shaped pipes
  - Within the Pipe Part Family you can select the pipe diameter and flow coefficients
  - Structure Part Families can be made up of inlet-outlet or junction structures
  - Within the Structure Part Family you can select the wall thickness, inner diameter, materials, etc.
- Can create a Pipes Rule Set
  - Specify minimum or maximum pipe cover and slopes
  - Specify minimum or maximum pipe lengths

Pipe Network Creation

- 'Home' Tab> 'Create Design' Panel> 'Pipe Network'> 'Pipe Network Creation Tools'
  - Opens the Create Pipe Network settings dialog
  - Network Layout Toolbar used to layout pipes and structures

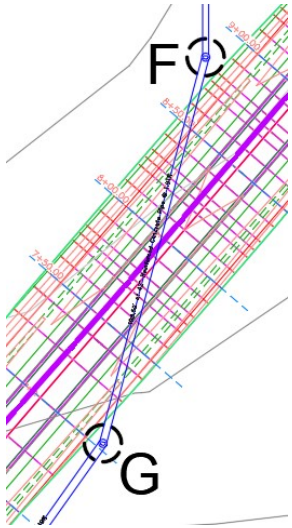


Quick Note
Always check your Upslope/Downslope setting before beginning a Pipe Layout



EXERCISE

1. Open ***"..\Gravity Pipe Networks\Road Design—Creating Pipe Networks.dwg"***
2. **Create Sanitary Pipe Network from Object**
   a. 'Home' Tab> 'Create Design' Panel> 'Pipe Network'> 'Create Pipe Network from Object"
   b. Choose Magenta SAN polyline that runs along the road
   c. Make sure flow arrow point down-station (North to South)
   d. Name: PROP SANITARY
   e. Parts List: Sanitary Sewer
   f. Pipe: 10 Inch PVC
   g. Structure: Concrete Structure 48 dia 18 frame 24 cc
   h. Surface: SPANIEL DR. FG
   i. Erase Existing Entity: Checked
   j. Hit OK



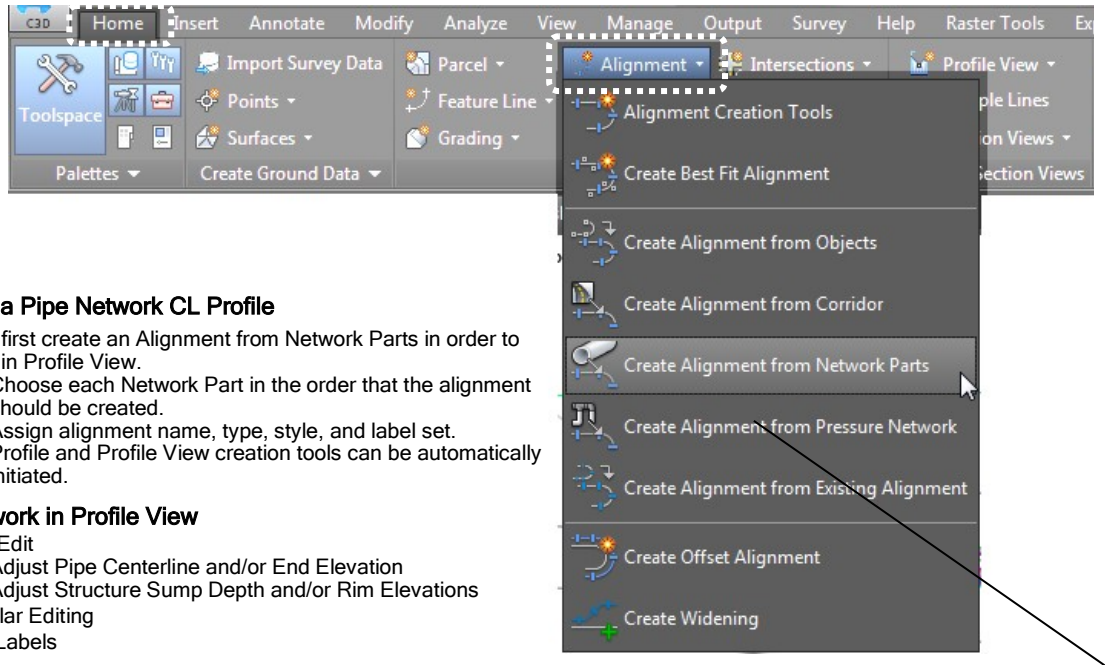
3. **Create Storm Pipe Network using Pipe Network Creation Tools**
   a. "Home" Tab> "Create Design" Panel> "Pipe Network"> "Pipe Network Creation Tools"
   b. Name: PROP STORM
   c. Parts List: CADD–Storm Sewer
   d. Surface: Existing Topo
   e. Alignment: SPANIEL DR.
   f. Structure Labels: <none>
   g. Pipe Labels: Plan_Length Description and Slope
   h. Hit OK
4. **Layout the Storm Sewer CL Pipe Network**
   a. In the *Network Layout Tools* toolbar, click the Upslope/Downslope button until the arrow is pointing down 
   b. From the Structures drop-down, choose the 24 X 24" Rectangular Structure
   c. From the Pipes drop-down, choose the 15" Concrete Circular Pipe
   d. Click the "Pipes and Structures" button and place the first structure at the center of Circle A 
   e. Follow the chart below to place the rest of the Pipes and Structures:

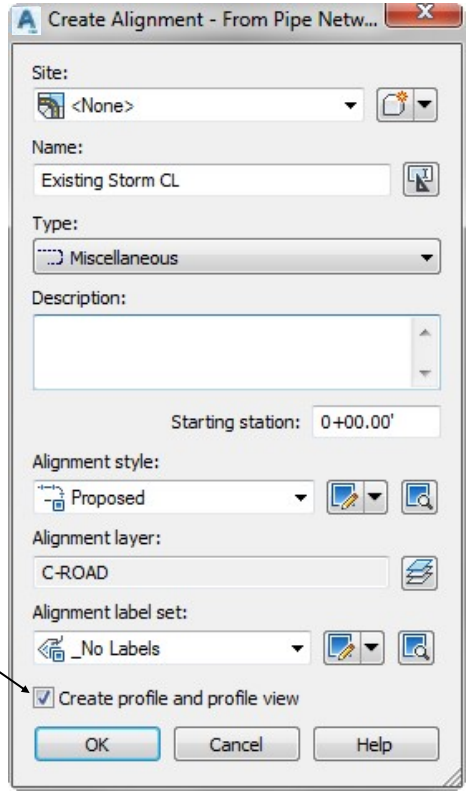
Structure	Pipe	Placement
24 X 24" Rectangular Structure	15" Concrete Pipe	Center of Circle B
Concentric Struc 48 dia 24 fra	18" Concrete Pipe	Center of Circle C
Eccentric Struc 48 dia 24 fra	27" Concrete Pipe	Center of Circle D
Concentric Struc 48 dia 24 fra	36" Concrete Pipe	Center of Circle E
Concentric Struc 72 dia 24 fra	36" Concrete Pipe	Center of Circle F
Concentric Struc 72 dia 24 fra	42" Concrete Pipe	Center of Circle G
Concentric Struc 72 dia 24 fra	48" Concrete Pipe	Center of Circle H
Concentric Struc 72 dia 24 fra	48" Concrete Pipe	Center of Circle I
68 X 6 X 57 Concrete Headwall	54" Concrete Pipe	Center of Circle J, then Hit <ENTER>
24 X 24" Rectangular Structure	15" Concrete Pipe	Start at Center of Circle K, tie into Inlet @ Circle B

5. **Close the *Network Layout Tools* toolbar and save the drawing**

NOTES

CONCEPT





Creating a Pipe Network CL Profile

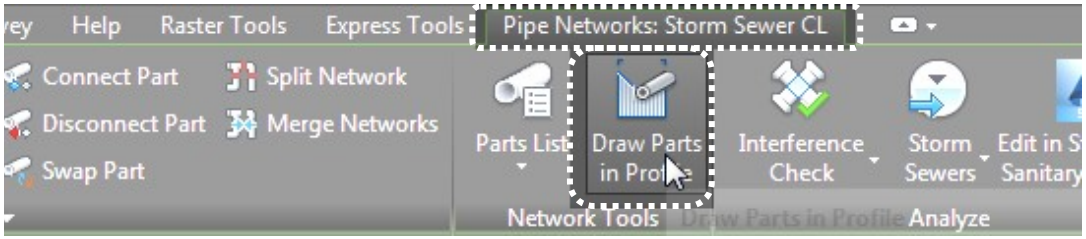
- Must first create an Alignment from Network Parts in order to draw in Profile View.
  - Choose each Network Part in the order that the alignment should be created.
  - Assign alignment name, type, style, and label set.
  - Profile and Profile View creation tools can be automatically initiated.

Edit Network in Profile View

- Grip Edit
  - Adjust Pipe Centerline and/or End Elevation
  - Adjust Structure Sump Depth and/or Rim Elevations
- Tabular Editing
- Add Labels

Display Network Parts in Crossing Profiles

- Make sure that the desired profile view is already created.
- Make sure that the pipe network parts you want to display in the profile view have valid station offset data from the alignment they reference.
- *'Pipe Networks' Tab > 'Network Tools' Panel > 'Draw Parts in Profile'*
- In the drawing, select a pipe network part from the network you wish to add to the profile view, or enter 'S' to select certain parts from the pipe network.
- Select a profile view.
- The pipe network parts are displayed in the profile view. Override the part style in the Profile View Properties to display crossing styles.

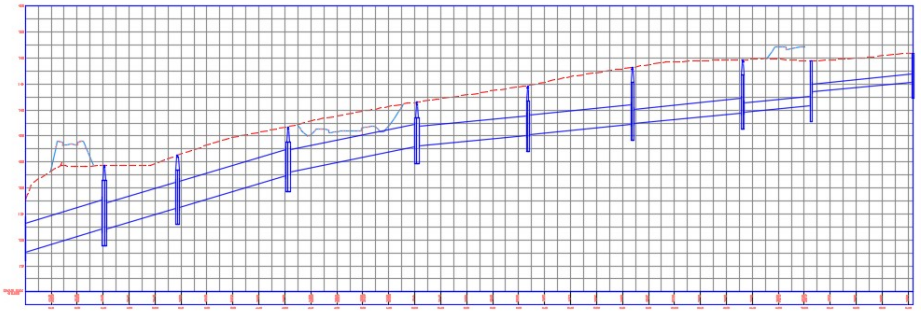


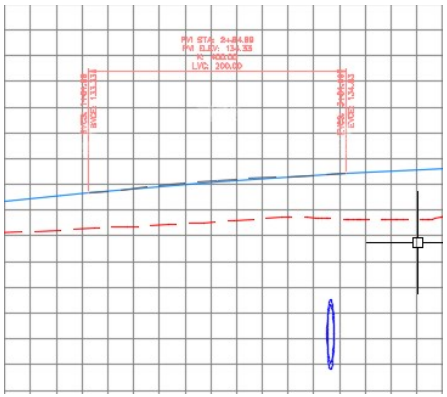
Quick Note

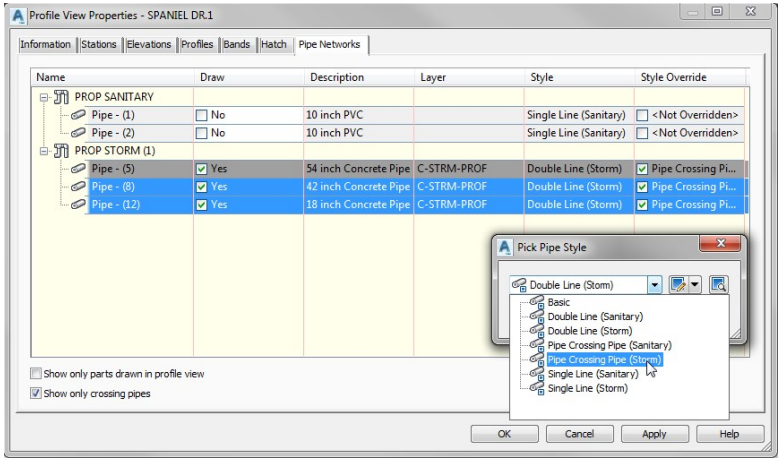
If you select a specific part in the drawing and then choose this command from the Context tab, it will insert only that individual part into the Profile View

EXERCISE

1. **Continue in *"Road Design–Creating Pipe Networks.dwg"***
2. **Create Alignment for the Storm Network**
   a. "Home" Tab> "Create Design" Panel> "Alignment" > "Create Alignment from Network Parts"
   b. Select the Headwall in Circle A, then select the Catch Basin in Circle J, and hit <ENTER>
   c. Name: PROP STORM CL
   d. Alignment Style: Basic
   e. Label Set: _No Labels
   f. Create Profile and Profile View: Checked
3. **Create the Profile and Profile View using the following settings**
   a. Sample Existing Topo and SPANIEL DR. FG Surfaces
   b. Set FG Profile sample Style to "Design Profile"
   c. Create Profile View
   d. Use "Land Desktop Profile" Style
   e. Leave defaults for stations and elevations
   f. Set both profile Label Sets to "_No Labels"
   g. Leave default selections for Pipe Network
   h. Use "EG-FG Elevations and Stations" Band set and sent Profile 2 to "SPANIEL DR. FG"
4. **Add the Storm Crossing Pipe to the Road Profile**
   a. In the plan view, select the three pipes that cross the SPANIEL DR. Alignment
   b. "Pipe Networks" context tab > "Network Tools" Panel > "Draw Parts in Profile"
   c. Select the Profile View that displays the SPANIEL DR Profiles
   d. Hit <ESC> to deselect the Pipes
   e. Select the Profile View again, right-click and choose "Profile View Properties"
   f. On the "Pipe Networks" tab, check the box at the bottom of the dialog to "Show only crossing pipes".
   g. Highlight all of the Storm Pipes in the remaining list, put a check in the box under "Style Override", and then use the drop-down that appears to choose "Pipe Crossing Pipe Storm"
   h. Hit OK twice to close both dialogs and apply the changes.
5. **Save and close the drawing**







NOTES

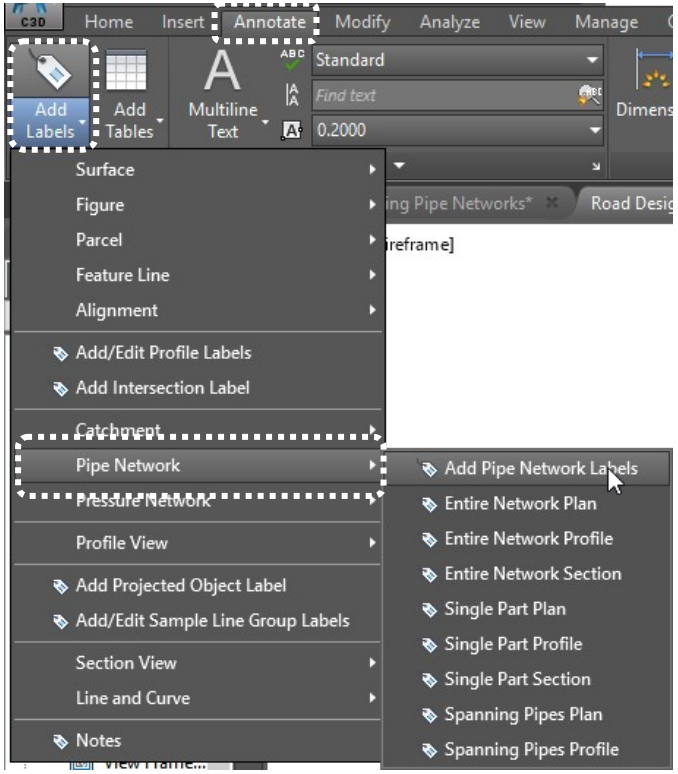
CONCEPT

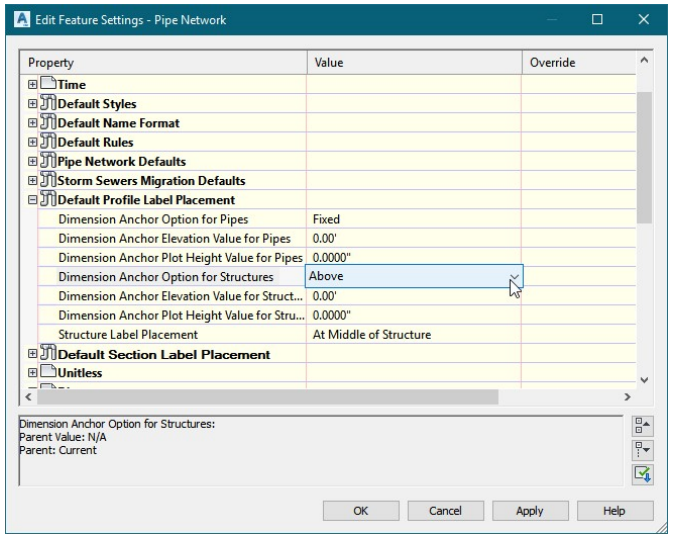
Pipe Network Labels

- Plan Labels can be added during Pipe Network Creation or afterwards
- Profile Labels must be added after Pipes and Structures have been added to Profile View
- Annotate' Tab> 'Labels & Tables' Panel> 'Add Labels' > 'Pipe Network'
- Display based on Label Styles
- Label Commands
  - Entire Network Plan
  - Entire Network Profile
  - Entire Network Section
  - Single Part Plan
  - Single Part Profile
  - Single Part Section
  - Spanning Pipes Plan
  - Spanning Pipes Profile

Pipe and Structure Labelling in Profile

- Pipe Network Profile Labels have a "Dimension Anchor" and a "Dimension Anchor Value"
- Dimension Anchor corresponds to "Structure Dimension" location in Label Style
- Dimension Anchor can be:
  - Fixed Elevation
  - Above Structure
  - Below Structure
  - Graph View top (Profile View top)
  - Graph View bottom (Profile View bottom)
- Dimension Anchor options set in Feature Settings:
  - 'Settings' Toolspace Tab> right-click on 'Pipe Networks' > 'Edit Feature Settings' > 'Default Profile Label Placement'
- Dimension Anchor options can also be changed after labels are placed using the Properties Panel
  - This is necessary when some labels must be placed on top of Structures and others must be placed below.

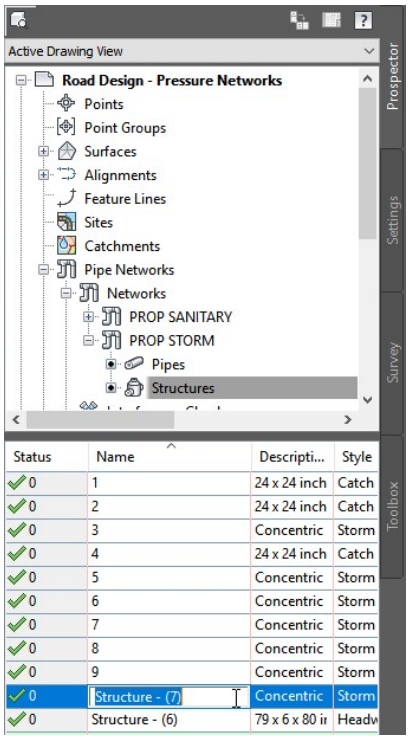


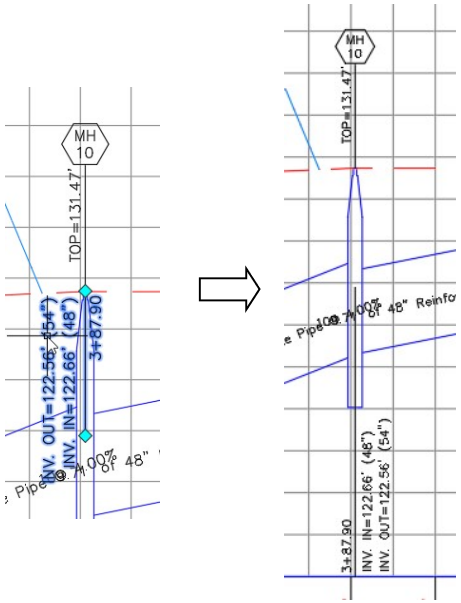


EXERCISE

1. **Continue in *"Road Design–Creating Pipe Networks.dwg"***
2. **Prepare Structures for Labeling–Change names**
   a. "Prospector" Toolspace Tab> "Pipe Networks" > "PROP STORM" > "Structures"
   b. In the Item View at the bottom of the Prospector, click in the first row under "Name", clear its contents and type "1"
   c. Repeat step b. for all Structures, incrementally increasing the number by 1 each time (see screen shot below):
   d. Once complete, use the <Shift> key to highlight all of the rows
   e. Scroll to the right and locate the "Reference Alignment" column
   f. With the rows still highlighted, right-click on the column header that says "Reference Alignment" and choose "Edit".
   g. From the dialog, choose "Spaniel Dr." and hit "OK"
3. **Establish Default Settings**
   a. "Settings" Toolspace Tab> right-click on "Pipe Networks" > "Edit Feature Settings"
   b. Expand "Default Profile Label Placement"
   c. Set "Dimension Anchor Option for Structures" to "Above"
   d. Hit "OK"
4. **Add Labels to Entire Network in Profile**
   a. 'Annotate' Ribbon tab > "Labels & Tables" Panel > "Add Labels" > "Pipe Network" > "Add Pipe Network Labels"
   b. Change the "Label type" to "Entire Network Profile"
   c. Set the "Pipe Label Style" to "Profile_Length Description and Slope"
   d. Set the "Structure Label Style" to "CADD–Storm Profile Top"
   e. Hit "Add"
   f. Select any of the Pipes or Structures in Profile to place the labels
5. **Add Labels to Entire Network in Profile**
   a. With the "Add Labels" dialog still open, change the "Label type" to "Single Part Profile"
   b. Set the "Structure Label Style" to "CADD–Storm Profile Bottom"
   c. Hit "Add"
   d. Select each Structure, one at a time, to add a second label to the structures.
   e. Close the "Add Labels" dialog

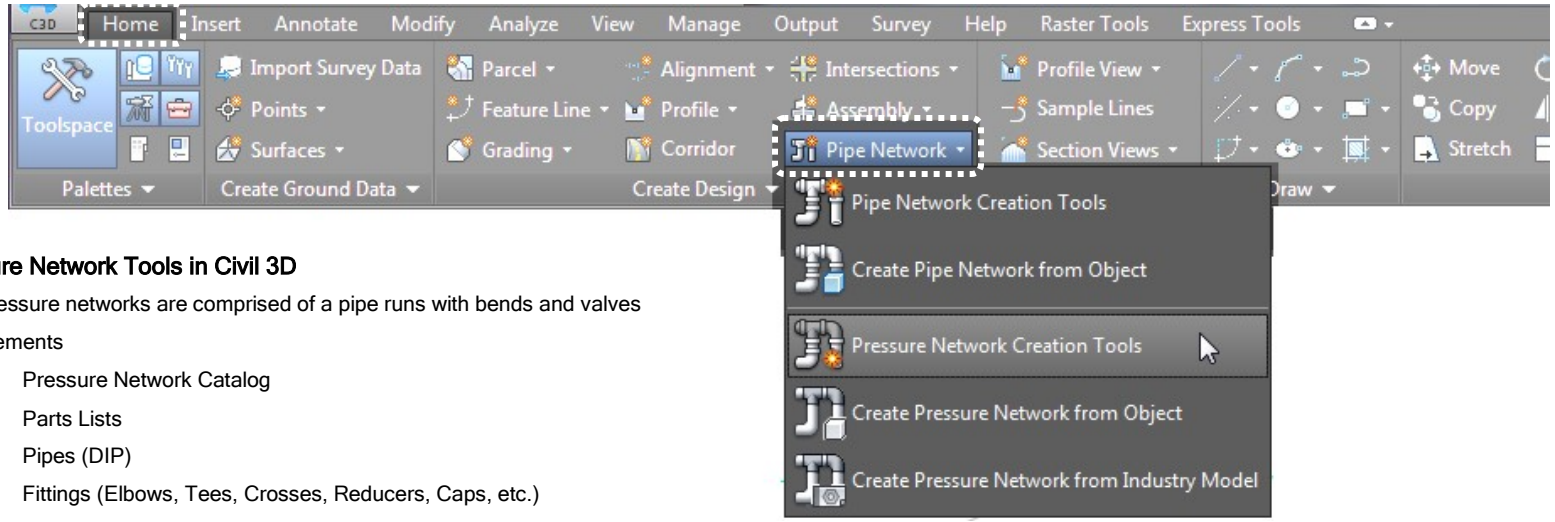
   NOTE: These Labels will not be placed in the correct location. This will be corrected in the steps below
6. **Change the Settings for the bottom labels**
   a. Select all of the Labels that contain Invert information to activate the grips
   b. Right-click and choose "Properties"
   c. Change the "Dimension Anchor Option" to "Graph View Bottom"
   d. Close the Properties Palette
7. **Save the drawing**





NOTES

CONCEPT



Pressure Network Tools in Civil 3D

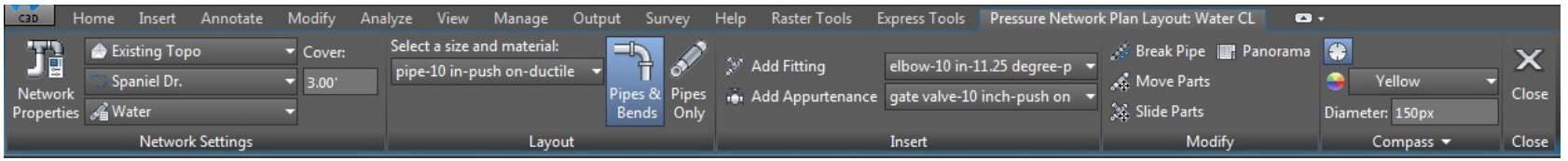
- Pressure networks are comprised of a pipe runs with bends and valves
- Elements
  - Pressure Network Catalog
  - Parts Lists
  - Pipes (DIP)
  - Fittings (Elbows, Tees, Crosses, Reducers, Caps, etc.)
  - Appurtenances (Valves)

- 'Modify' Tab> 'Design' Panel drop-down> 'Pressure Pipe Network' or Select a Pipe Network on the screen to open 'Pressure Networks' Tab
- ''Home' Tab> 'Create Design' Panel> down arrow '> 'Set Pressure Network Catalog'
  - Select one of the metric or imperial catalogs in order for the desired pipes, fittings, and appurtenances to be used
- 'Pipe Network' Tab> 'Network Tools' Panel> 'Parts List'> 'Create Parts List'
  - Add Part Families for Pipes, Fittings, and Appurtenances
  - Pipe Part Families are limited to circular DIP Pipe
  - Within the DIP Pipe Family you can select the pipe diameter and flow coefficients
  - Available Fitting Part Families and Appurtenance Part Families vary within each Part Catalog

Quick Note
Always check your Cover setting before beginning a Pressure Network Layout

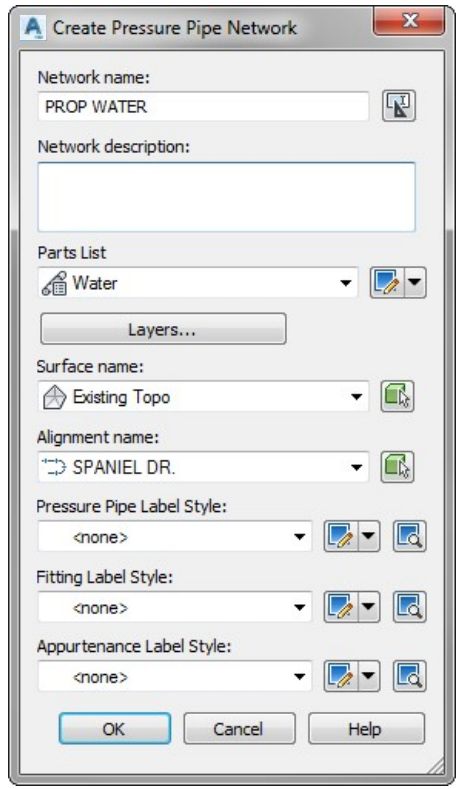
Pressure Pipe Network Creation

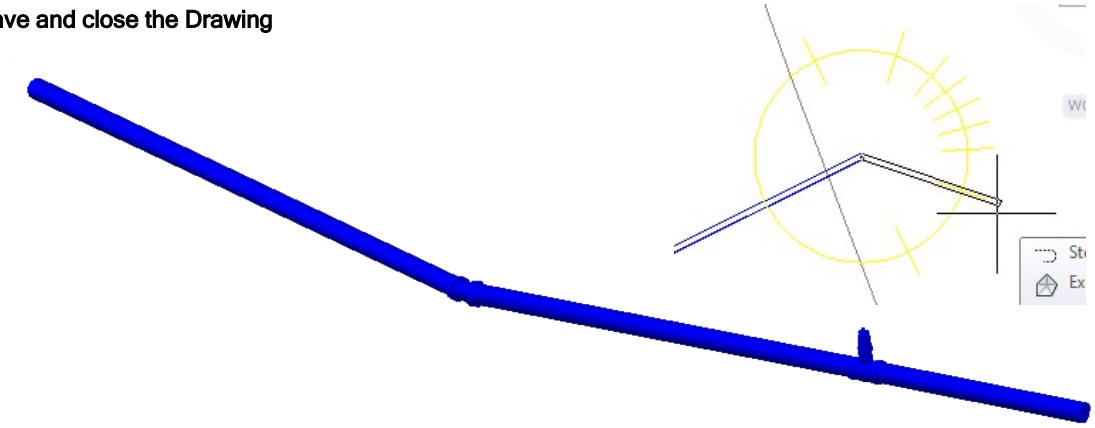
- 'Home' Tab> 'Create Design' Panel> 'Pipe Network'> 'Pressure Network Creation Tools'
  - Opens the Create Pressure Pipe Network settings dialog
  - 'Pressure Network Plan Layout' tab used for Layout
  - Angles limited to available bends and pipe deflection (see illustration on the next page)



EXERCISE

1. Open *"..\Pipe Network\Road Design –Pressure Networks.dwg"*
2. Create Pressure Network using Pressure Network Creation Tools
   a. "Home" Ribbon tab> "Create Design" Panel> "Pipe Network" > "Pressure Network Creation Tools"
   b. Name: PROP WATER
   c. Parts List: Water
   d. Surface: Existing Topo
   e. Alignment: SPANIEL DR.
   f. Leave the other defaults and hit OK
3. Layout Water Network
   a. In the "Pressure Network Plan Layout" command tab, set the cover to 4'
   b. From the "Select a size and material:" drop-down, choose "pipe-10 in-push on-ductile"
   c. Hit "Pipes and Bends"
   d. Use a Center OSNAP to start in the center of Circle A.
   e. Continue clicking near the center of Circles B, C, D, E, and F
   f. From the "Add Fitting" drop-down, choose "tee 10 in x 6 in", click the "Add Fitting" button and click along the pipe near circle G to place the Fitting.
   g. Click along the next pipe near Circle H to place another one.
   h. Under ""Select a size and material:", choose "pipe-6 in-push on-ductile" and hit "Add Pipes and Bends"
   i. Start from the tee near Circle G and create a lateral to the building by snapping to the building outline.
   j. From the "Add Appurtenance" drop-down, choose the 6" valve in the list, click the "Add Appurtenance button and select along the newly created 6" pipe to place a valve.
4. Examine Pressure Network in the Object Viewer
   a. In the Prospector, under "Pressure Networks", right-click on "PROP WATER" and choose "Select"
   b. From the context tab or the right-click menu, choose "Object Viewer"
5. Save and close the Drawing





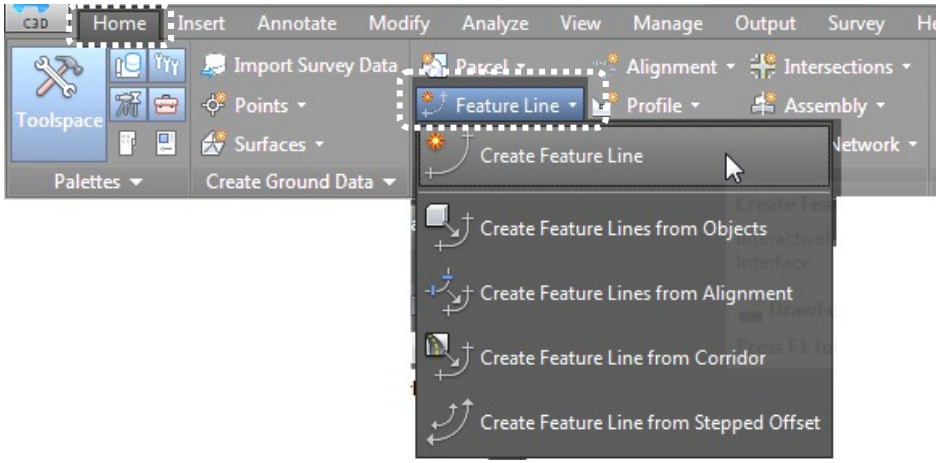
NOTES

Prposed Grading: Concepts and Feature Lines

CONCEPT

Proposed Ground

- 3 Different types of tools for building Proposed Ground in Civil 3D
  - Grading Tools
  - Corridors
  - Surfaces with Breaklines
- Final proposed ground is usually a combination of the above

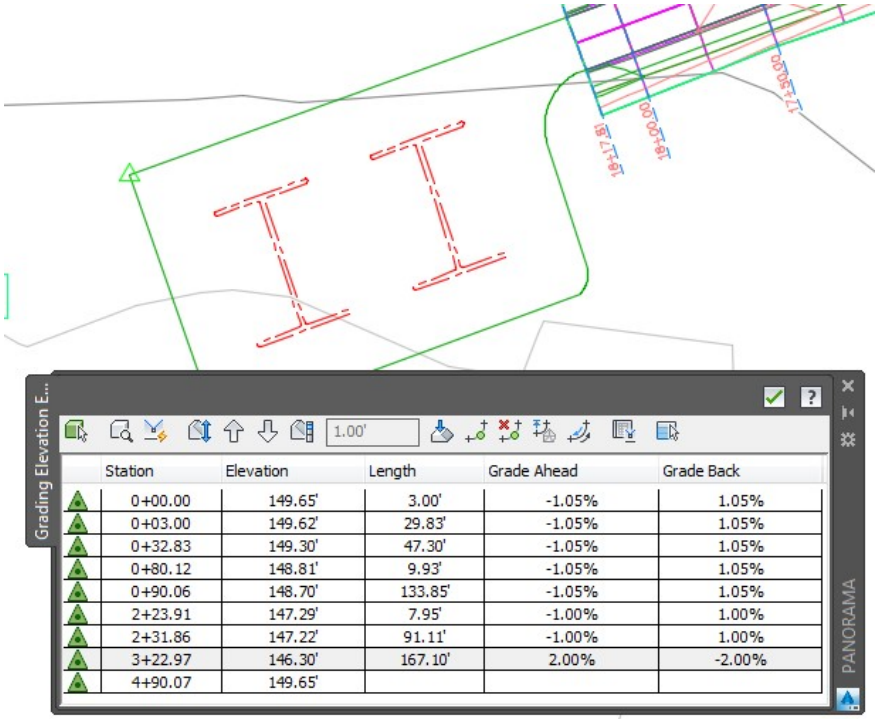


Feature Lines

- 3D linear objects used for Grading footprint, Surface Breaklines, etc.
- More intelligent than 3D Polylines
  - Allow for true 3D curves (no tessellation)
  - Carry names, styles and can be related to each other
- 'Home' Tab> 'Create Design' Panel> 'Feature Lines'> 'Create Feature Line'
  - Allows Feature Lines to be drawn "on the fly"
- Additional Methods for Creation
  - Create Feature Lines from Objects
  - Create Feature Lines from Alignment
  - Create Feature Lines from Corridor
  - Create Feature Lines from Stepped Offset
- Displayed based on Styles
- Have Elevation at each vertex
- 'Modify' Tab> 'Design' Panel> 'Feature Line'
  - Can edit, add vertices and elevations using the "Elevation Editor"
  - Can also create based on other Feature lines using "Edit Feature Lines" Tools (shown later)

Feature Line Styles

- Accessed from "Settings" tab of the Toolspace, under "General"
- Control display properties of Feature Lines (layers, colors, linetypes, etc…)
- Create one for each Feature Line type
- Civil 3D templates contain pre-made styles



Station	Elevation	Length	Grade Ahead	Grade Back
0+00.00	149.65'	3.00'	-1.05%	1.05%
0+03.00	149.62'	29.83'	-1.05%	1.05%
0+32.83	149.30'	47.30'	-1.05%	1.05%
0+80.12	148.81'	9.93'	-1.05%	1.05%
0+90.06	148.70'	133.85'	-1.05%	1.05%
2+23.91	147.29'	7.95'	-1.00%	1.00%
2+31.86	147.22'	91.11'	-1.00%	1.00%
3+22.97	146.30'	167.10'	2.00%	-2.00%
4+90.07	149.65'			

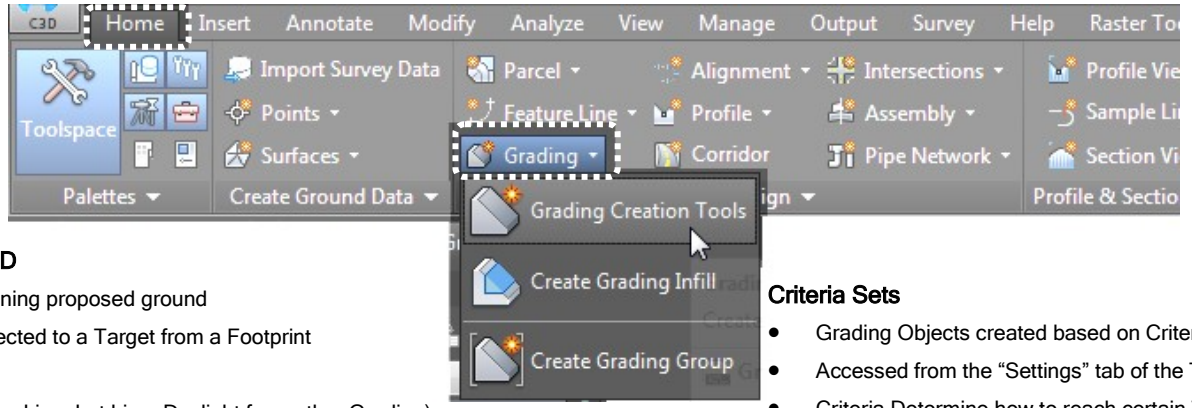
EXERCISE

1. **Open *"..\Grading\Road Design—Grading.dwg***
2. **Create Feature Lines from EOP Polyline**
   a. "Home" Ribbon tab> "Create Design" Panel> "Feature Lines" > "Create Feature Lines from Objects"
   b. Select the Edge of Pavement Polyline for the Parking Lot (blue line) and hit <ENTER>
   c. Site: Parking Lot Grading
   d. Name: Parking Lot EOP
   e. Erase Existing Entities: Checked
   f. Hit OK
3. **Set Elevations of EOP Feature Line**
   a. "Modify" Ribbon tab > "Edit Elevations" Panel > "Elevation Editor", and select the EOP Feature Line
   b. Select the row for station 0+00 and choose the "Elevation from Surface" button 
   c. From the drop-down, choose "SPANIEL DR. FG" and hit OK
   d. Repeat c and d above for the last row (station 4+90.07)
   e. From the "Modify" Ribbon tab, on the "Edit Elevations" panel, choose "Set/Grade Slope Between Points" 
   f. Select the EOP Feature Line
   g. For the start point, move your cursor near the end point (NE point that ties into the road) and left click
   h. Hit <ENTER> to accept the elevation
   i. For the end point, move your cursor counterclockwise until you come to the next point (Westernmost point) and click again.
   j. Enter a grade of -2 and hit <ENTER>
   k. Select the EOP Feature Line again
   l. For the start point, use the point you just ended on (Westernmost point) and hit <ENTER> to accept the elevation
   m. For the end point, move your cursor counterclockwise until you come to the Southernmost point (bottom of the fillet).
   n. Enter a grade of 1%
   o. Select the EOP Feature Line again, select the point you just ended on (Southernmost point), and hit <ENTER> to accept the elevation.
   p. Move your cursor counterclockwise until you have reached the next point that ties into the road and left click.
   q. Hit <ENTER> to accept the default grade and/or elevation.
4. **Create Curb & Gutter using Stepped offset**
   a. "Home" Tab> "Create Design" Panel> "Feature Lines" > "Create Feature Line from Stepped Offset"
   b. Enter an offset distance of 1' to create a 1' gutter
   c. Select the EOP Feature Line, and then click to the outside of the parking lot
   d. For the change in elevation, the "Grade" option, type in -2, then hit <ENTER>
   e. Repeat steps a–d above to create the TOC, BOC and edge of Sidewalk using the following parameters:
5. **Save the drawing**

Offset Distance	Feature Line to Offset	Side	Elevation Change Type	Change Value
0.083'	New gutter flow line	Outside	Elevation difference	0.5'
0.5'	New TOC line	Outside	Elevation difference	0'

NOTES

CONCEPT

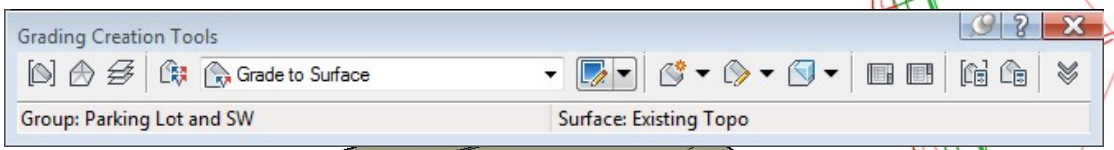


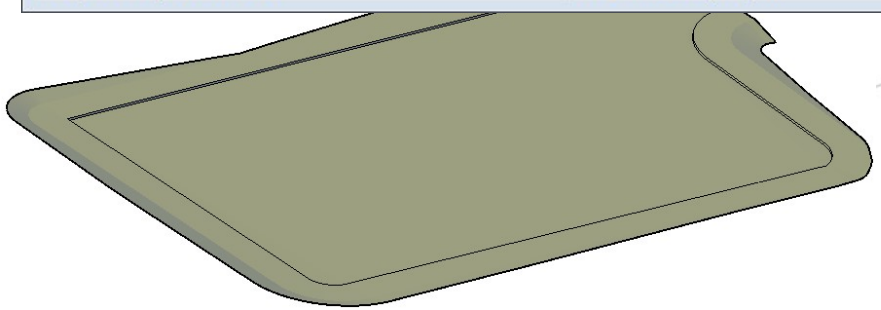
Grading Tools in Civil 3D

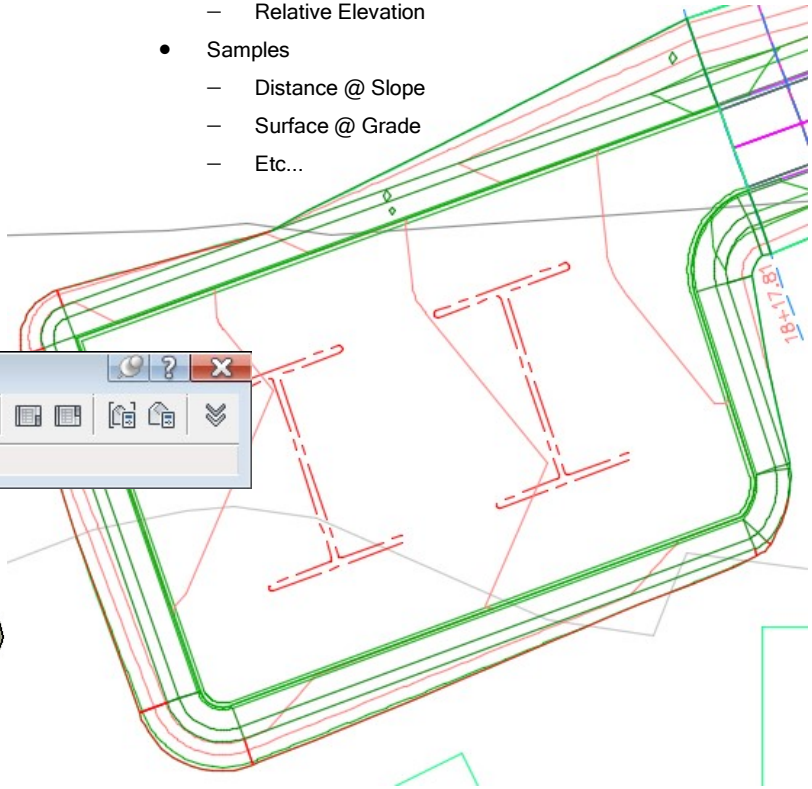
- Civil 3D tool for designing proposed ground
- Grading Objects projected to a Target from a Footprint
- Elements include:
  - Footprint (Feature Line, Lot Line, Daylight from other Grading)
  - Daylight Line
  - Projection Lines
  - Face
- Every Grading Object belongs to a Grading Group
  - All Objects in group are tied together
  - Can create one Surface out of all objects in a Grading Group
- Every Grading Group is managed by a Site and is related to objects on that Site
- 'Home' Tab> 'Create Design' Panel> 'Grading'> 'Grading Creation Tools'
  - Set Grading Group
  - Can make a Surface on the fly
  - Select Grading Criteria
  - Create Grading, edit Feature Lines, etc...

Criteria Sets

- Grading Objects created based on Criteria in Criteria Sets
- Accessed from the "Settings" tab of the Toolspace under Grading
- Criteria Determine how to reach certain Target
  - Distance
  - Surface
  - Elevation
  - Relative Elevation
- Samples
  - Distance @ Slope
  - Surface @ Grade
  - Etc...





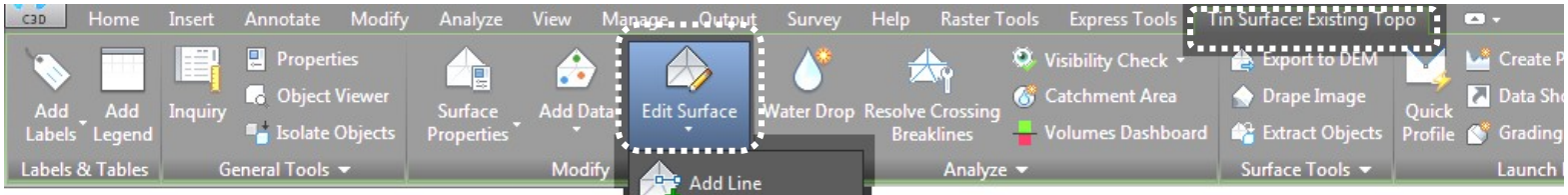


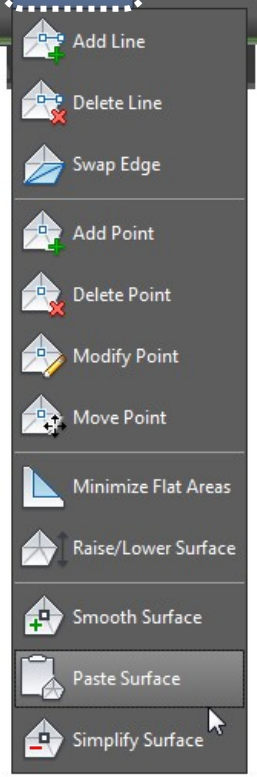
EXERCISE

1. **Continue in *"Road Design–Grading.dwg***
2. **Create a Grading Group**
   a. "Home" Ribbon tab> "Create Design" Panel> "Grading" > "Grading Creation Tools"
   b. In the *Grading Creation Tools* toolbar, choose the first button on the left to create a Grading Group 
   c. For the Site, choose "Parking Lot Grading" and hit OK
   d. Name: Parking Lot and SW
   e. Automatic Surface Creation: Checked
   f. Use the Group Name: Checked
   g. Surface Style: Contours 1' and 5' (Design)
   h. Tessellation Spacing: 5'
   i. Tessellation Angle: 0.5
   j. Volume Base Surface: Existing Topo
   k. Hit OK to create the Grading Group, then Hit OK again to close the "Create Surface" dialog
3. **Create Sidewalk Grading**
   a. On the *Grading Creation Tools* toolbar, use the Criteria drop-down to choose "Grade to Distance", then click on the "Create Grading" button 
   b. Select the BOC Feature line and click a location outside of the parking lot for the side to grade
   c. Hit <ENTER> to accept the default to Apply to the Entire Length
   d. For Distance, enter 5' and hit <ENTER>
   e. For Format, choose the "Grade" option, then enter 2 and hit <ENTER>
4. **Create Grading for grass boulevard outside of sidewalk**
   a. With the "Create Grading" command still active and "Grade to Distance" still selected as the criteria, choose the newly created sidewalk edge Feature Line
   b. Hit <ENTER> to accept the default to Apply to the Entire Length
   c. For Distance, enter 3' and hit <ENTER>
   d. For Format, choose the "Grade" option, then enter 2 and hit <ENTER>
5. **Create Grading for Daylighting (cut and fill) to the Existing Topo**
   a. On the *Grading Creation Tools* toolbar, use the Criteria drop-down to choose "Grade to Surface",
   b. Select the newly created Feature Line on the outside
   c. Hit <ENTER> to accept the default to Apply to the Entire Length
   d. For Cut Format, choose the "Slope" option, then enter 3 and hit <ENTER>
   e. For Fill Format, choose the "Slope" option, then enter 4 and hit <ENTER>
   f. Hit <ESC> to end the command
6. **Add Curb, Gutter and EOP Breaklines to the Surface**
   a. Prospector > "Surfaces" > "Parking Lot and SW" > "Definition" > right-click on "Breaklines" and hit "Add"
   b. Name: Parking Lot Breaklines
   c. Mid-ordinate Distance: 0.01
   d. Hit OK
   e. Select the Feature lines for the EOP, Gutter flow line, and TOC and hit <ENTER>
7. **Close the *Grading Creation Tools* toolbar and save the Drawing**
8. **Examine in Object Viewer**

NOTES

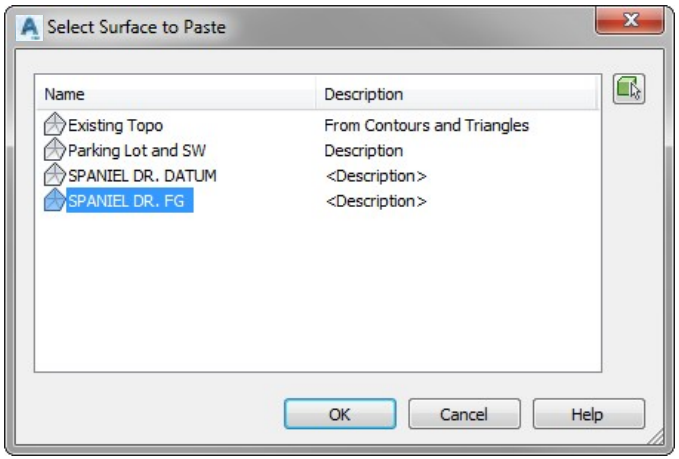
CONCEPT

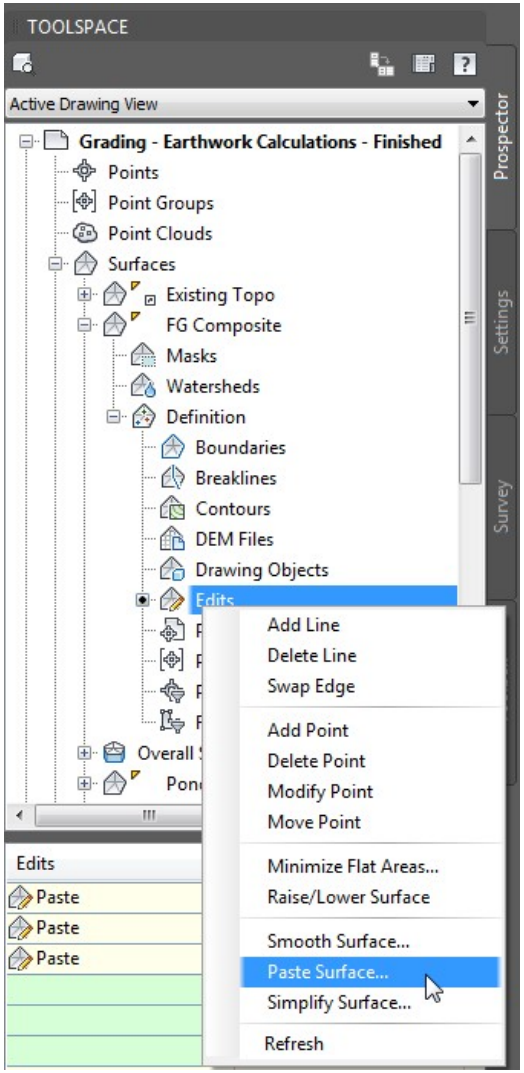




Merging Design Surfaces

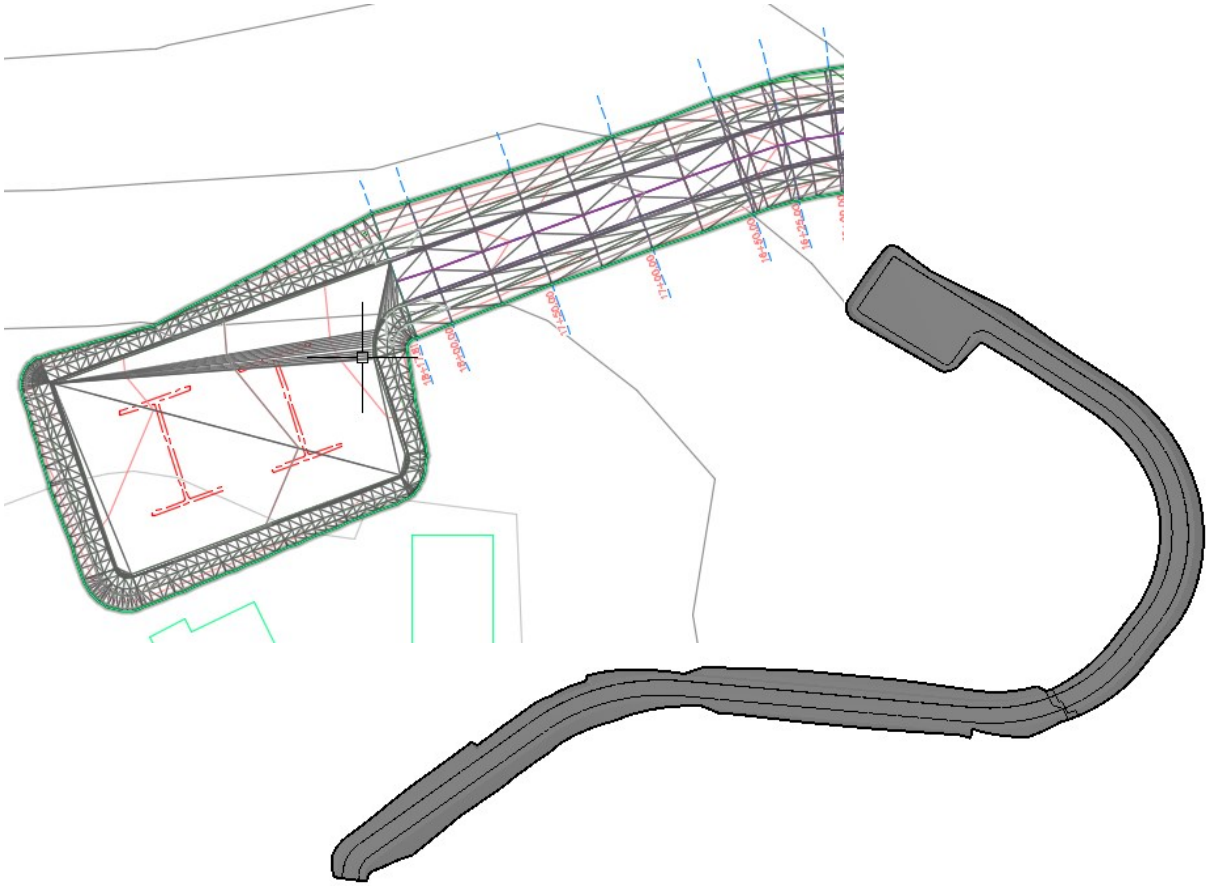
- ***NEVER PASTE PROPOSED SURFACES INTO THE EXISTING***
- Create a new Surface to paste others into
  - Under new Surface in Prospector, Right-click on “Edits” and choose “Paste Surface”
  - Choose Existing Surface
  - Repeat and choose Proposed Surfaces to Paste into base Surface
  - Surface automatically updates





EXERCISE

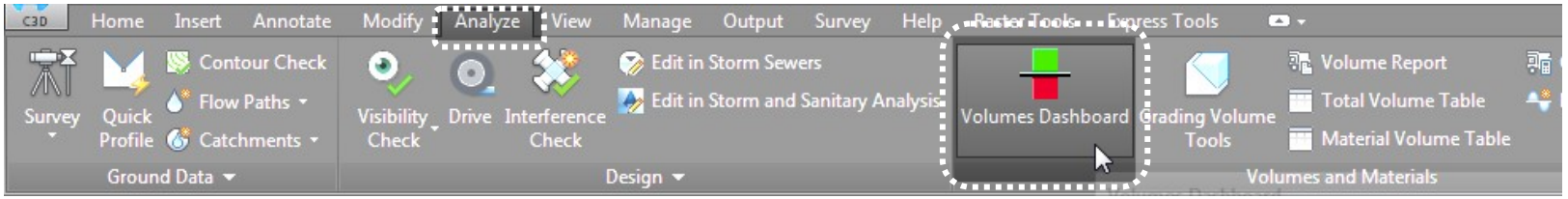
1. **Continue in *"Road Design–Grading.dwg***
2. **Create a new, blank Surface**
   a. "Home" Ribbon tab> "Create Ground Data" Panel> "Surfaces" > "Create Surface"
   b. Name: FG Composite
   c. Style: Contours and Triangles
   d. Hit OK
3. **Combine Existing and Proposed Surfaces**
   a. Prospector > "Surfaces" > "Parking Lot and SW" > "Definition" > right-click on "Edits" and choose "Paste Surface"
   b. Select "SPANIEL DR. FG" and hit OK
   c. Repeat Step a, choose "Parking Lot and SW", and hit OK
4. **Save the drawing**
5. **Use the Properties Palette to change the Style of the FG Composite Surface to "Contours 1' and 5' (Design)"**
6. **Select the FG Composite Surface and view in Object Viewer**



NOTES

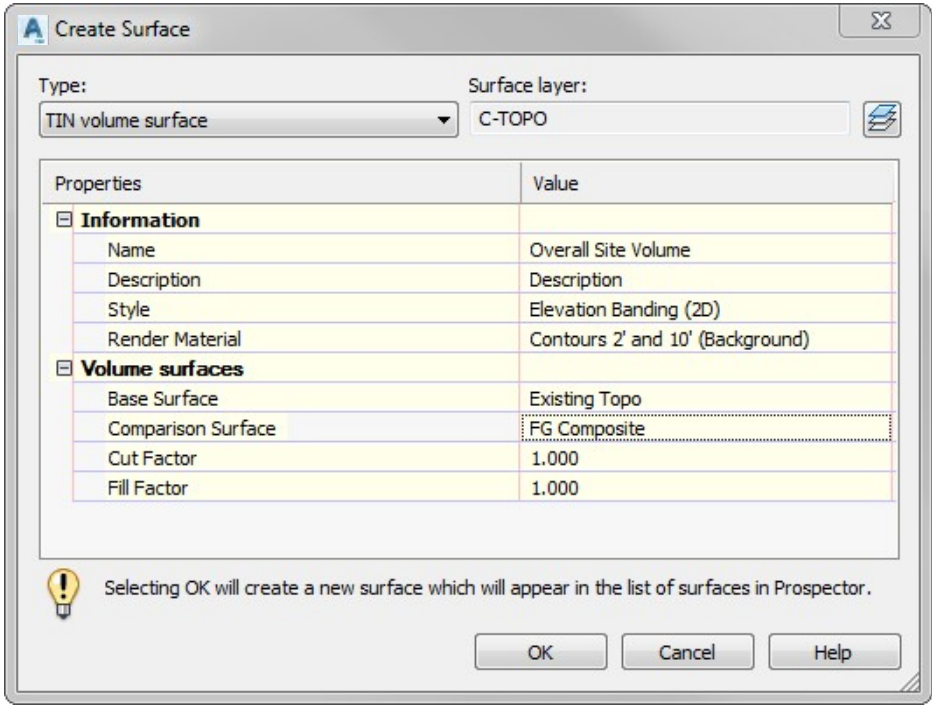
Earthwork Volumes: Volumes Dashboard

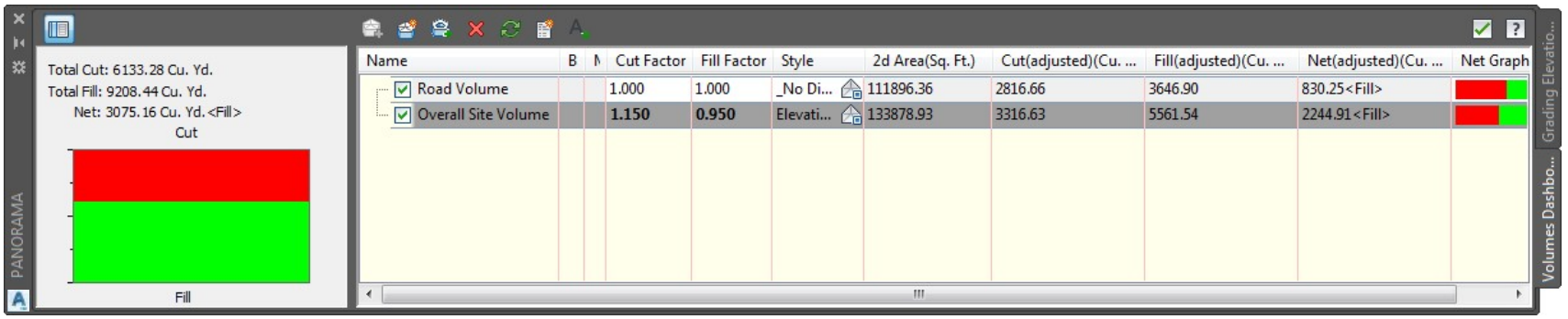
CONCEPT



Earthwork Volume Calculations in Civil 3D

- Volumes Dashboard found on the 'Analyze' tab in the 'Volumes and Materials' Panel
- Use Volumes Dashboard to:
  - Compare one Surface to Another
  - Create multiple entries
  - Create Bounded volume entries with pre-existing bounding objects
  - Create reports (HTML)
- Volumes dashboard entries create Civil 3D Volume Surfaces
  - Set name and Style (OOTB template contains elevation banding styles that can be used to quickly display Cut and Fill)
  - Cut and Fill calculated from "Base Surface"
  - Volume Surfaces appear in the Prospector
  - Volume Surfaces are dynamic if set to "Rebuild–Automatic"
  - Cut, Fill, and Net Volumes displayed
  - Can add Cut (swell) and Fill (shrink) factors to get adjusted numbers





EXERCISE

1. **Continue in *"Road Design–Grading.dwg***
2. **Launch the Volumes Dashboard**
   a. "Analyze" Tab> "Volumes and Materials" Panel> "Volumes Dashboard"
3. **Create Volume Entry/Surface for the whole site**
   a. In the *Volumes Dashboard*, hit new entry button 
   b. Name: Overall Site Volume
   c. Style: Elevation Banding (2D)
   d. Base Surface: Existing Topo
   e. Comparison Surface: FG Composite
   f. Cut Factor: 1.15
   g. Fill Factor: 0.95
   h. Hit OK
4. **Create Volume Entry/Surface for just the Road (using Datum)**
   a. In the *Volumes Dashboard*, hit new entry button:
   b. Name: Road Design Volume
   c. Style: _No Display
   d. Base Surface: Existing Topo
   e. Comparison Surface: SPANIEL DR. DATUM
   f. Hit OK
5. **Create Volume Report in the Drawing**
   a. In the *Volumes Dashboard*, hit the "Insert Cut/Fill Summary" button 
   b. Zoom to an empty area in the drawing near the edge of the Surface and left-click to place the summary
6. **Create external Volume Report**
   a. In the *Volumes Dashboard*, hit the "Generate Cut/Fill Report" button 
   b. Examine the HTML report that appears in the Web Browser window
   c. Close the report
7. **Save the Drawing**

Cut/Fill Report

Generated: 2013-01-10 13:48:25

By user: gagnm

Drawing: X:\Autodesk Projects\Civil 3D Projects\2013\Civil 3D 2013 Essentials (Online)\Data Files\Grading\X:\Autodesk Projects\Civil 3D Projects\2013\Civil 3D 2013 Essentials (Online)\Data Files\Grading\Grading - Create Grading - Finished.dwg

Volume Summary

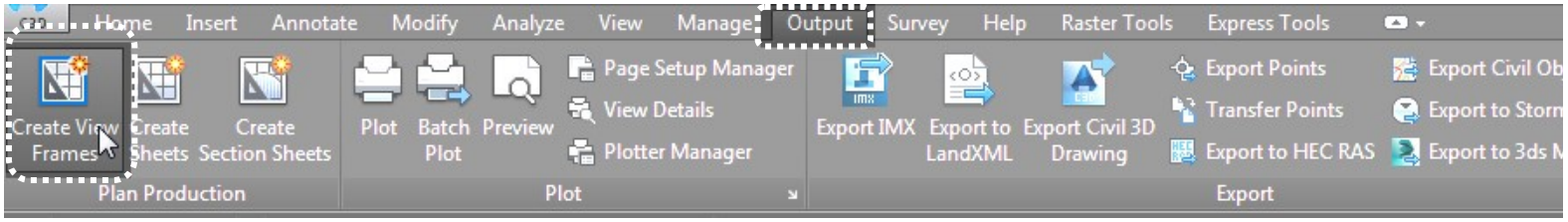
Name	Type	Cut Factor	Fill Factor	2d Area (Sq. Ft.)	Cut (Cu. Yd.)	Fill (Cu. Yd.)	Net (Cu. Yd.)
Overall Site Volume	full	1.000	1.000	1998720.66	27277.86	85.69	27192.17<Cut>
Pond Volume	full	1.000	1.000	78967.04	24479.93	66.83	24413.10<Cut>
Road Volume	full	1.000	1.000	43939.45	2227.09	17.65	2209.44<Cut>

Totals

	2d Area (Sq. Ft.)	Cut (Cu. Yd.)	Fill (Cu. Yd.)	Net (Cu. Yd.)

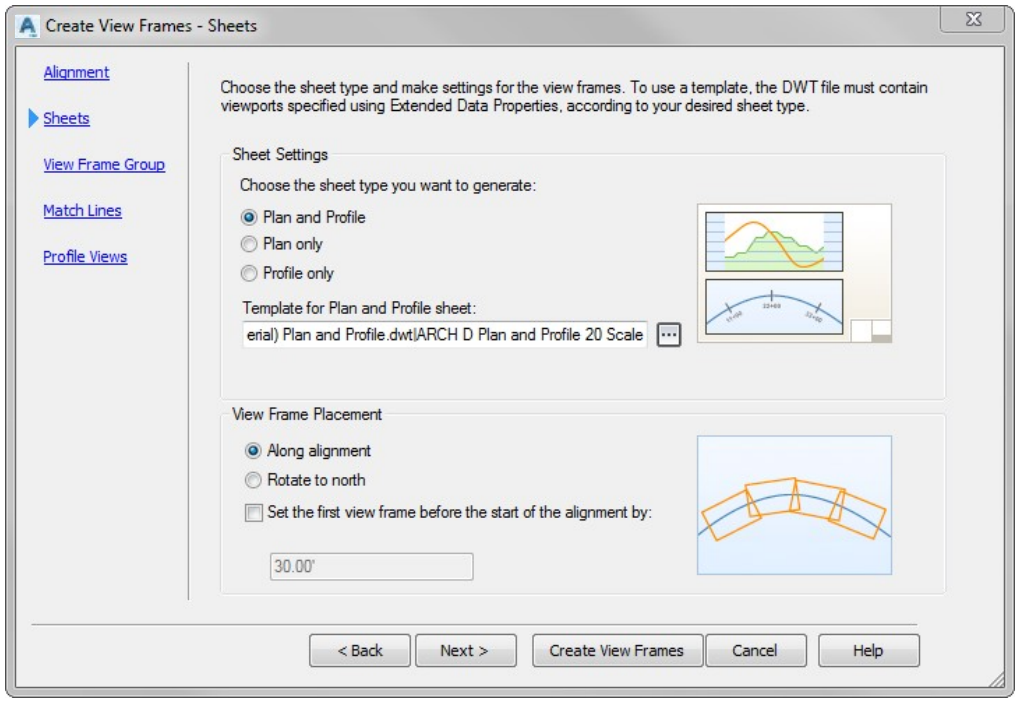
NOTES

CONCEPT



Plan Production

- Quickly Create construction documents
  - Plan
  - Profile
  - Plan and Profile
- Requirements
  - Drawing must have an Alignment
  - Must have access to a drawing template file with pre-configured viewports
  - Drawing must have a Profile for Profile or Plan and Profile document production
- Sheets/Layouts generated based on View Frames

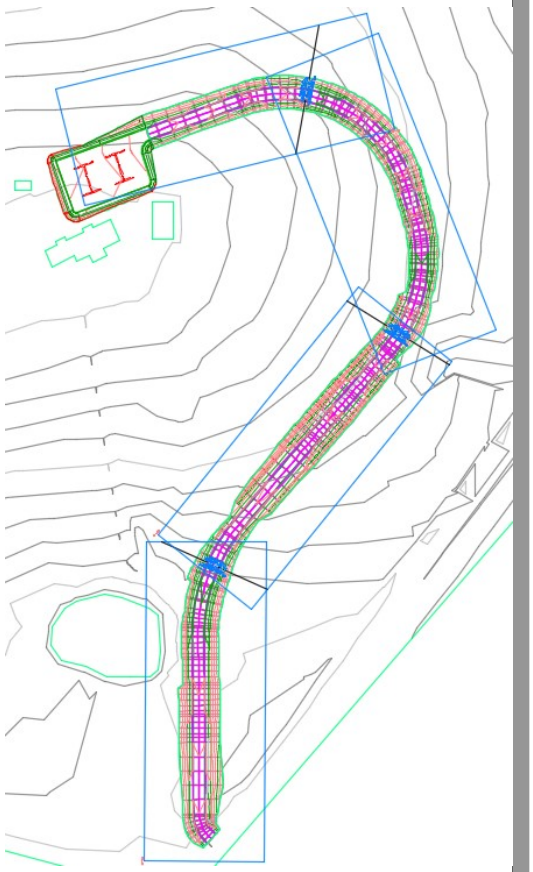


Creating View Frames

- Created based on Alignment (or Profile if just doing Profile document generation)
- Represent edges of scaled viewports
- Organized into View Frame Groups
  - Usually along one alignment
  - Display and Labeling based on Styles
- Command accessed from 'Output' Tab> 'Plan Production' Panel> 'Create View Frames'
- Wizard walks through necessary steps
- Match Lines created on the fly

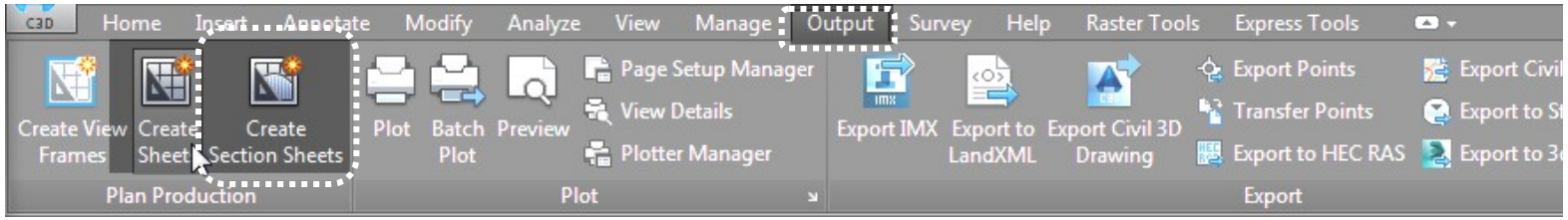
EXERCISE

1. **Open *"..\Plan Production\Plan Production–Create View Frames.dwg"***
2. **Open the *Create View Frames* wizard**
   a. "Output" Ribbon Tab> "Plan Production" Panel > "Create View Frames"
3. **Set the Alignment**
   a. Alignment: SPANIEL DR.
   b. Hit Next
4. **Set Sheet Type**
   a. Type: Plan and Profile
   b. Template: <Default Path>\Civil 3D (Imperial) Plan and Profile.dwt
   c. Layout: ARCH D Plan and Profile 20 Scale
   d. View Frame Placement: Along Alignment
   e. Set the first view frame before the start of Alignment by: On and set to 30'
   f. Hit Next
5. **View Frame Group Properties**
   a. Name: SPANIEL DR. VIEW FRAMES
   b. Label Location: Top Left
   c. Hit Next
6. **Match Line Properties**
   a. Snap Station Value down to nearest: 10'
   b. Additional Distance for repositioning: 30'
   c. Left Label Location: Middle
   d. Right Label Location: Middle
   e. Hit Next
7. **Profile View Properties**
   a. Style: CADD–Full Grid with 5X Exag
   b. Band Set: _No Bands
   c. Hit Create View Frames
8. **Save the Drawing**



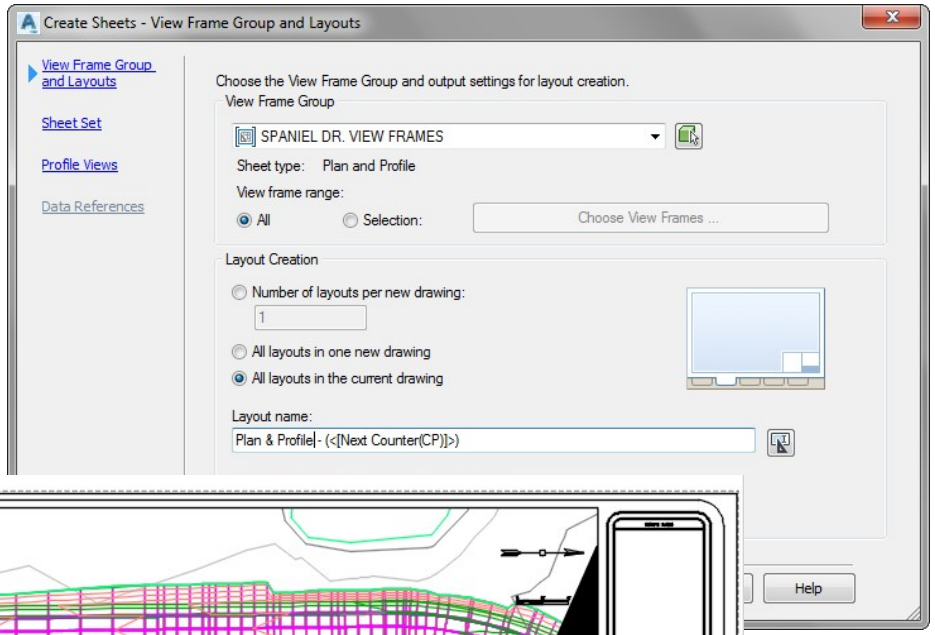
NOTES

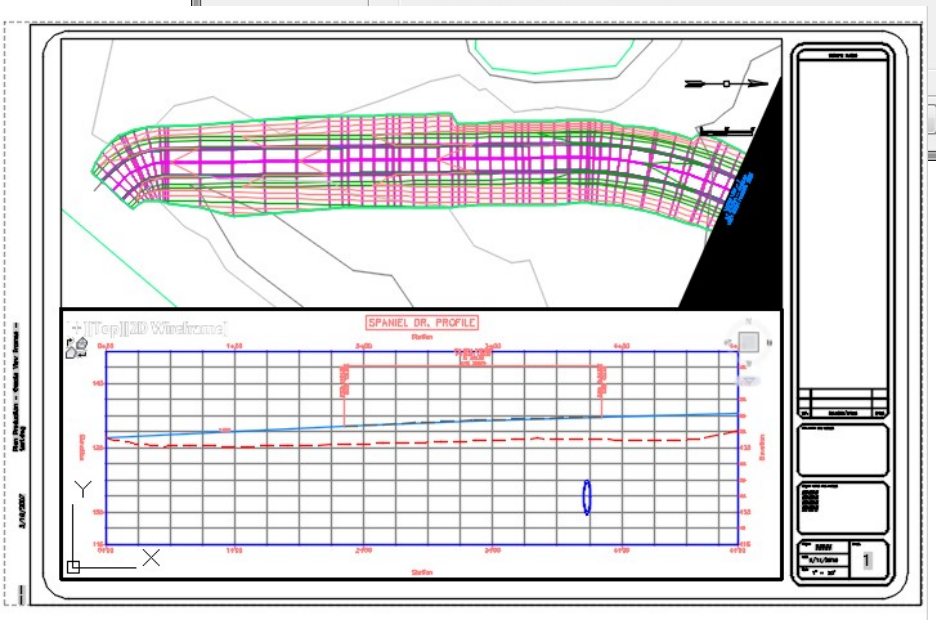
CONCEPT



Creating Sheets

- Based on View Frames in a View Frame Group
- Command accessed from 'Output' Tab> 'Plan Production' Panel> 'Create Sheets' or in the Prospector, Right-Click on View Frame Group and choose "Create Sheets"
- Sheets/Layouts created using View Frame Settings and Template Layout
- Wizard walks through necessary steps
- Layout Placement
  - New Drawing for all New Layouts
  - New Drawing for certain number of new Layouts
  - All Layouts in current drawing
- Split Profile Views created in Model space for display in Paper Space Layouts
- Sheets placed in Sheet Set Manager for Plotting/ Publishing





Quick Note

Take note of the elevation ranges you want to show in your smaller Profile Views. You may want to manually enter these during the Sheet Creation Process

EXERCISE

1. **Continue in *"Plan Production–Create View Frames.dwg"***
2. **Open the Sheet Creation Wizard**
   a. "Output" Ribbon Tab> "Plan Production" Panel > "Create Sheets"
3. **Set View Frame Group Options**
   a. Group: SPANIEL DR. VIEW FRAMES
   b. View Frame Range: All
   c. Layout Creation: All Layouts in the current drawing
   d. Layout Name: Plan and Profile - <[Next Counter(CP)]>
   e. Choose North Arrow block: North
   f. Hit Next
4. **Set Sheet Set Options**
   a. New Sheet Set: Huntsman's Ridge
   b. Sheet Set Storage Location: C:\Civil 3D Projects\Civil 3D 2018 Level I\
   c. Hit Next
5. **Profile View Options**
   a. Get other settings from an existing Profile View: SPANIEL DR. PROFILE
   b. Alignment: Align Profile and Plan View at start
   c. Hit "Create Sheets"
   d. Hit "OK" on the message save drawing message
6. **Zoom to a blank area in the drawing above the SPANIEL DR. PROFILE to place the smaller Profile Views.**
7. **Edit the Elevations on the Profile Views to fit the pages better**
   a. Select the first Profile View, right-click and choose "Profile View Properties"
   b. On the "Elevations" tab, choose "User Specified"
   c. Set the Minimum to 115' and the Maximum to 145', then hit "OK"
   d. Repeat Steps a–c for the remaining profiles to set new elevations:

Profile View	Minimum Elevation	Maximum Elevation
Second	120'	150'
Third	125'	155'
Fourth	130'	160'

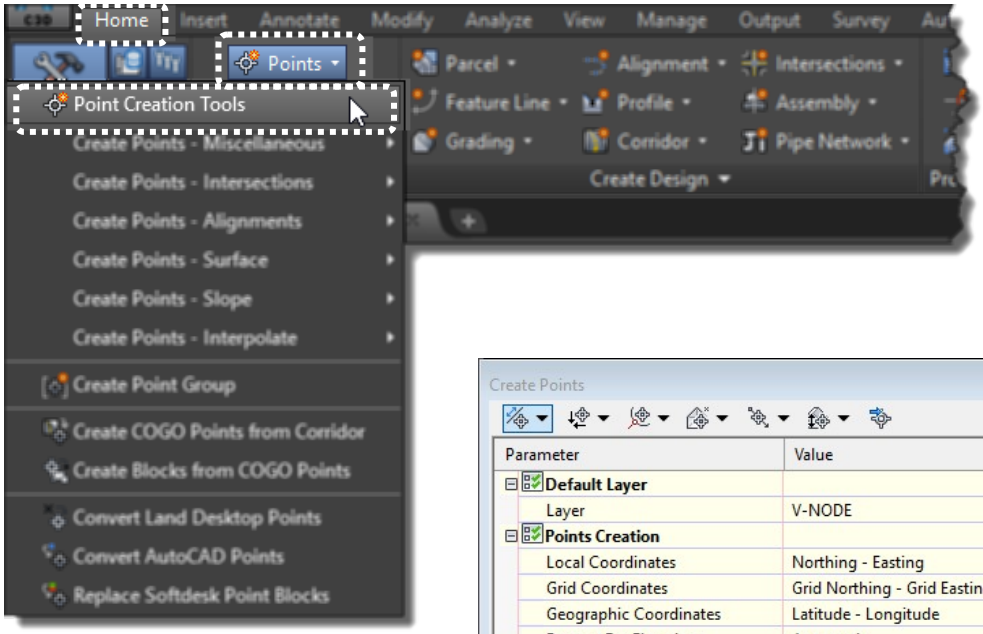
8. **Adjust the Profile Viewports on the Sheets**
   a. Select the first Plan & Profile layout tab
   b. Double-click in the Profile Viewport to activate it and unlock it
   c. Use the PAN command to center the Profile in the Viewport
   d. Relock the viewport
   e. Repeat a–d for all of the Layout tabs
9. **Save the Drawing**

NOTES

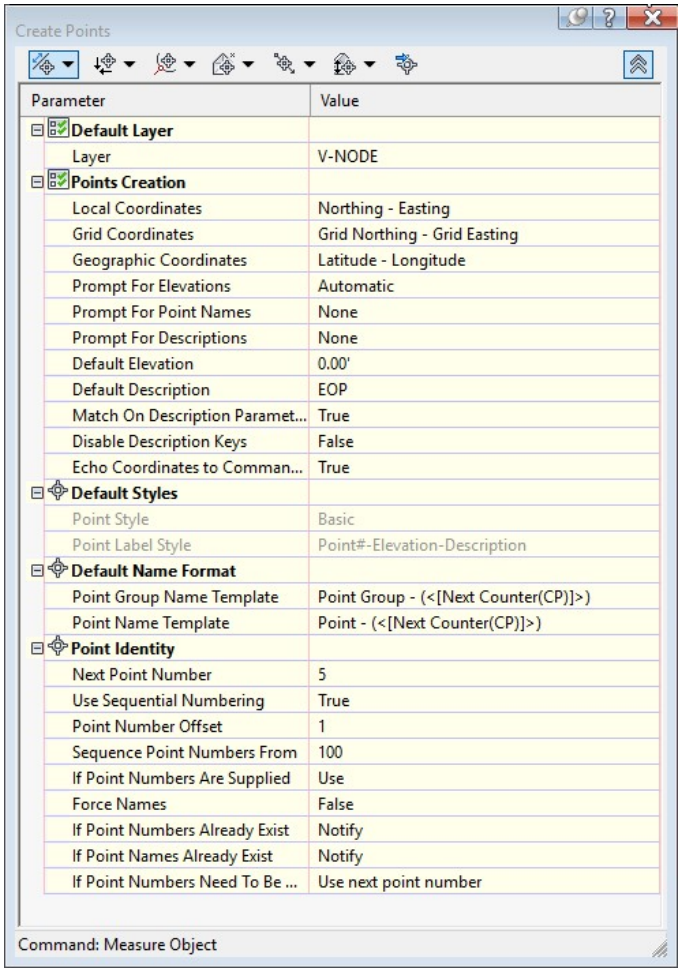
CONCEPT

Point Creation Tools

- Point Creation Tools are found on '*Home*' Tab » 'Create Ground Data' Panel
  - Panel Tools include:
    - Various Point Creation Tools (which open the Create Points toolbar)
    - Point Group Creation (covered later)
    - COGO Point Creation
    - Point Conversion Tools
  - To Create Points:
    - Choose Tool
    - Specify Location
    - Enter Name/Description
    - Specify Elevation
    - Style is assign by default setting, Point Group, or Description Keys on the fly

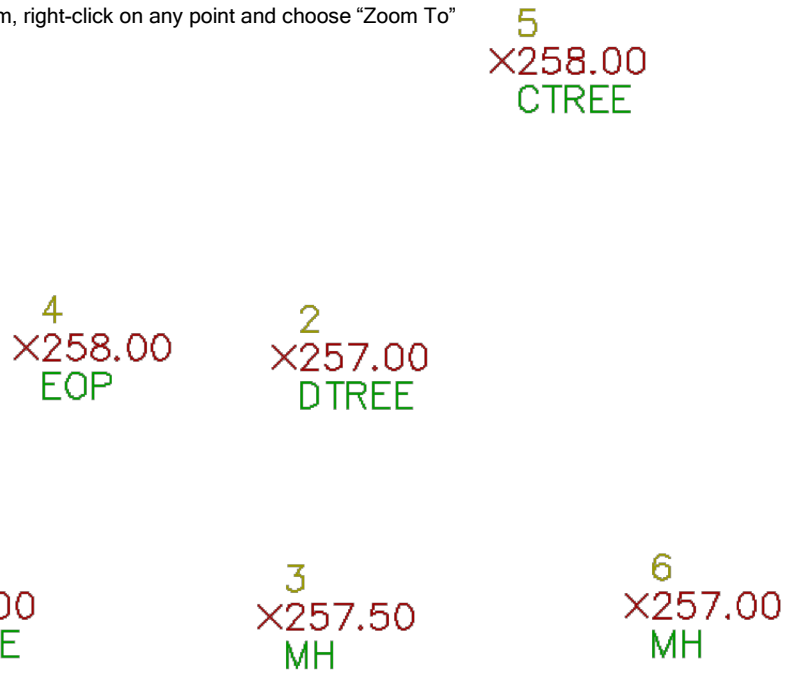


- Create Points Toolbar
  - Creation Pull-downs:
    - Include Miscellaneous, Intersections, Alignment, Surface, Interpolation, Slope, and Import Points
  - Point Creation Settings:
    - Include Default Layer, Point Creation Command Defaults, Default Styles, Default Naming, and Point Identity



Exercise

1. Open *"C:\Civil 3D Projects\Civil 3D 2018 Survey\Class Survey.dwg"*
2. **Start the "Create Points" Command**
   a. On the "Home" tab of the ribbon, on the "Create Ground Data" Panel, choose "Points", then "Create Points Miscellaneous", then "Manual"
3. **Change the Command Settings**
   a. In the "Create Points" Toolbar, hit the Chevron symbol at the far right of the toolbar to expand the options. 
   b. Expand the "Default Layer" option and make sure this is set to "V-NODE"
   c. Examine the other settings
4. **Create at least 6 Points with Miscellaneous ▯ Manual**
   a. With the Toolbar still open and active, click anywhere in the drawing to create a new point.
   b. For the description, enter CTREE and hit <Enter>
   c. At the elevation prompt, assign any elevation you want and hit <Enter>
   d. Repeat steps a–c to create 5 more points using these Descriptions: CTREE, DTREE, GRND, MH
   e. Hit <Enter> again to end the command
5. **Create EOP Points from Line**
   a. Use the 3DPoly command to create a 3D polyline to represent an Edge of Pavement
   b. Use the Properties palette to set one or more elevations along the vertices
   c. In the "Create Points" Toolbar, expand the "Points Creation" section.
   d. Set "Prompt for Elevations to "Automatic"
   e. Set "Prompt for Descriptions" to "Automatic" and for the "Default Description", type in EOP.
   f. From the first button on the Toolbar, use the drop-down arrow to choose "Polyline Vertices–Automatic"
   g. Select the polyline you just created.
5. **Examine Points List in Prospector**
   a. In the "Prospector", click on "Points"
   b. In the "Item View" at the bottom, right-click on any point and choose "Zoom To"
6. **Save the Drawing**



NOTES

CONCEPT

Points Styles

- Control display properties of Points
  - Symbol/Marker Block
  - Block Rotation/Scale
  - 3D Display Mode
  - Marker and Label layers and visibility
- Create one style for each point type
- Used for grouping and in Description Keys (Covered Later)
- Civil 3D templates contain some pre-made styles

Point Label Styles

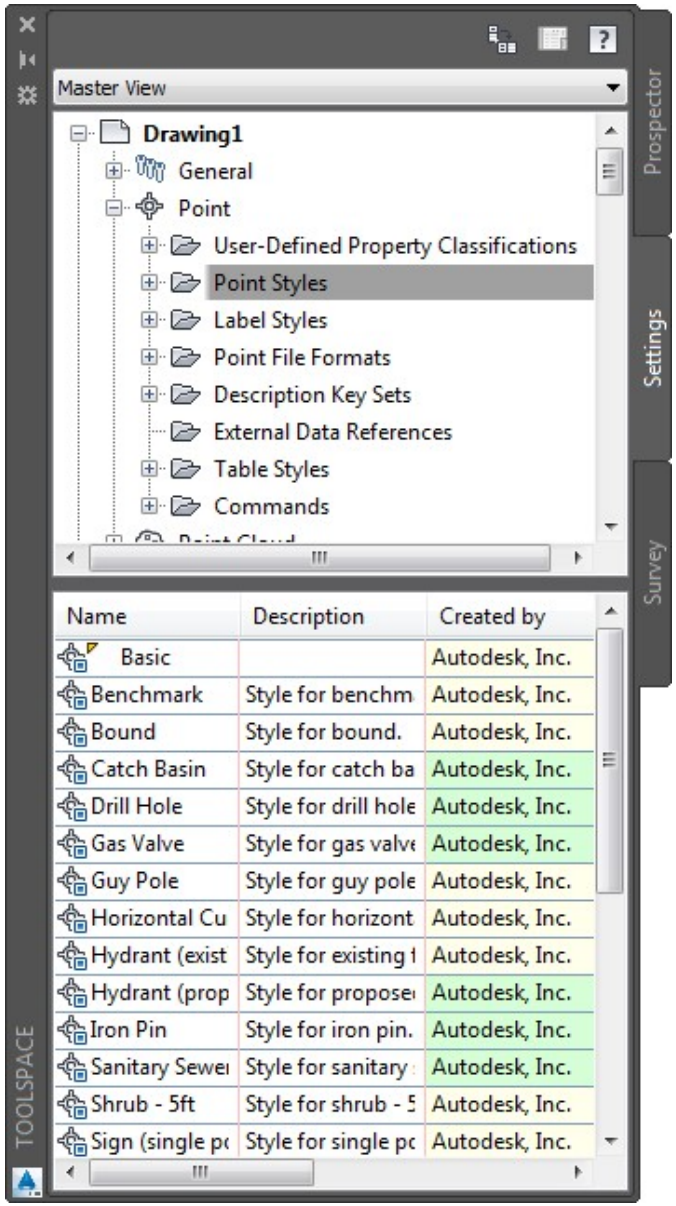
- Control display properties of Point Label Elements
  - Text Style, Orientation
  - Label visibility
  - Content and layout of text
  - Text height, color, justification
  - Dragged state of label (leader creation, arrowhead, etc…)
- Create one for each label type/setup you need
- Civil 3D templates contain pre-made styles

Create/Edit Styles - Multiple Commands

- Point right-click menu (drawing or Prospector)
- Point Group Properties dialog (right-click from drawing or Prospector)
- Settings Tab (right-click)
- Create New or Copy Existing and rename

Apply Point and Label Styles

- Point Styles and Label Styles can be applied through Point Groups or Description Keys (Covered Later)
- Change Point Styles using Prospector Item View for individual
- Change Point Label Styles
  - Right-click on point in drawing or prospector, hit “Label Properties”
  - Can change which style is applied or change properties of current style



Exercise

1. **Create a new Point Style**
   a. On the “Settings” tab of the Toolspace, expand “Point”, the Point Styles
   b. Right-click on “Tree” and hit “Copy”
   c. In the dialog that appears, go to the “Information” tab and change the Name: to “Deciduous Tree”.
   d. On the “Marker” tab, in the “Use AutoCAD BLOCK symbol for marker” window, scroll to the right and click on “Shrub 2”
   e. Change the Size “Options” to “Use Drawing Scale”. Set the “inches” to 0.2
   f. Examine the other settings on the remaining tabs, then hit “OK”

2. **Apply Point Styles to different Points**
   a. In the drawing, select the point you creating using the DTREE description.
   b. Right-click and choose “Edit Points”
   c. In the dialog that appears, scroll to the right to find the “Style” column and change this to the new “Deciduous Tree” Style you just created. Notice the change in the point in the drawing.
   d. Hit <ESC> to unselect the point
   e. Repeat steps a–d above to assign a new style to one additional point.

3. **Apply Label Styles to different Points**
   a. In the drawing, select the point you created using the DTREE description.
   b. Right-click and choose “Edit Points”
   c. In the dialog that appears, scroll to the right to find the “Label Style” column and change this to “Elevation and Description” Notice the change in the point in the drawing.
   d. Hit <ESC> to unselect the point
   e. Repeat steps a–d above to assign a label style to one additional point.

4. **Save the drawing**

NOTES

CONCEPT

Point Group Creation

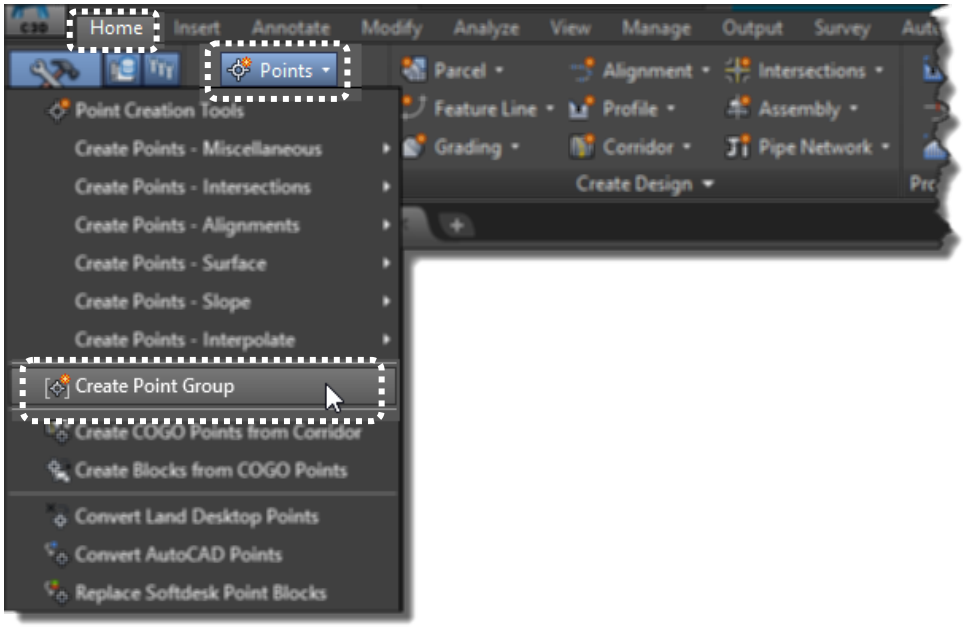
- Point Group Creation Tools are found on *'Home'* Tab » 'Create Ground Data' Panel » 'Points' Tool

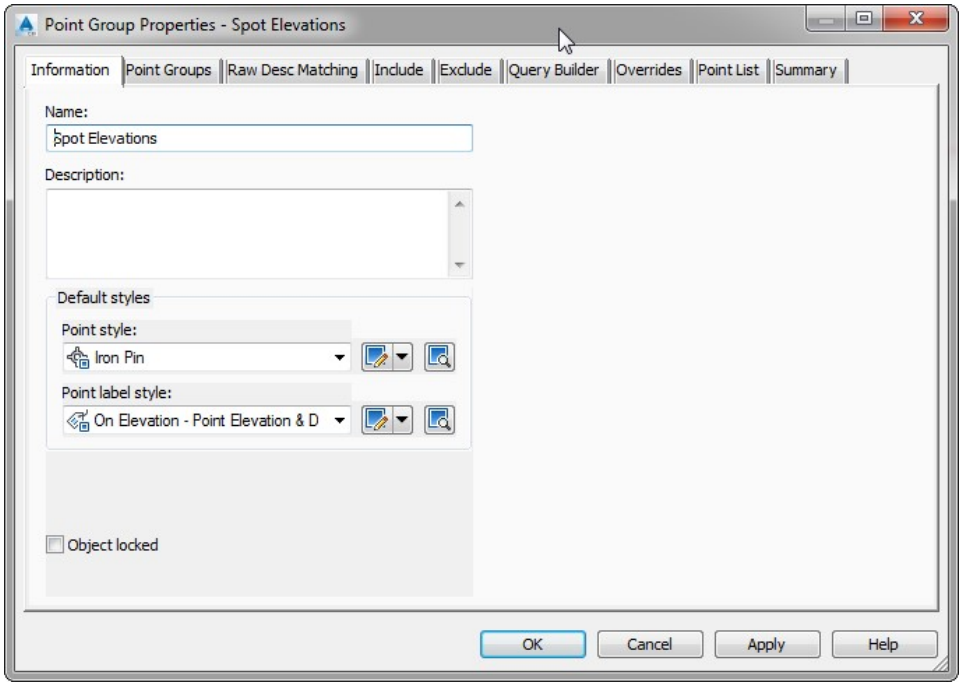
Point Groups

- Organize points with common properties including:
  - Name
  - Function
- Point group properties can be used to control Style of points within the group
- Create multiple point groups for different point types based on:
  - Number
  - Name
  - Elevation
  - Raw Description
  - Full Description
- Multiple Point Groups can be added to one Point Group
- Points with matching properties are automatically added to point groups upon creation of the point
- Point Groups can be set up and saved in drawing templates

Control Points using Point Groups

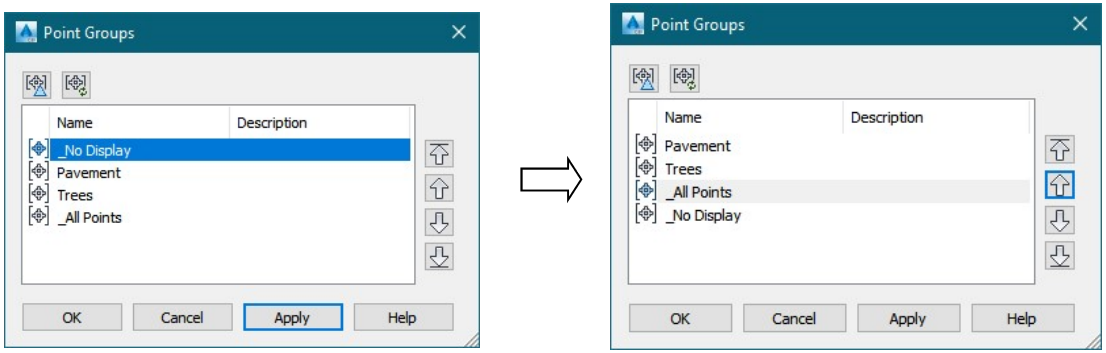
- Change Point and Point Label Styles
- Assign Group to Surface definition (covered later)
- Override individual Point properties
- Display list of Points in Group
- Lock/Unlock Points
- Delete Points
- Export Points
- Change Display Order
  - Prospector> Point Group "Properties" (from right-click)





Exercise

1. **Create a "Trees" Point Group**
   a. In the "Prospector" tab of the Toolspace, right-click on "Point Groups" and hit "New"
   b. On the "Information" tab of the dialog, change the "Name" to "Trees"
   c. On the same tab, change the "Point Style" to "Tree" and the "Point Label Style" to "Description Only"
   d. On the "Include" tab of the dialog, put a check next to "With raw descriptions matching:" and enter "*TREE*" (without the quotes)
   e. Click on the "Point List" tab to see the points that are currently in the drawing that will be included in the Point Group based on these settings.
   f. Hit "OK"
2. **Create a "Pavement" Point Group**
   a. In the "Prospector" tab of the Toolspace, right-click on "Point Groups" and hit "New"
   b. On the "Information" tab of the dialog, change the "Name" to "Pavement"
   c. On the same tab, change the "Point Style" to "Iron Pin" and the "Point Label Style" to "Point#-Elevation-Description"
   d. On the "Include" tab of the dialog, put a check next to "With raw descriptions matching:" and enter "*EOP*" (without the quotes)
   e. Click on the "Point List" tab to see the points that are currently in the drawing that will be included in the Point Group based on these settings.
   f. Hit "OK"
3. **Create a "No Display" Point Group**
   a. In the "Prospector" tab of the Toolspace, right-click on "Point Groups" and hit "New"
   b. On the "Information" tab of the dialog, change the "Name" to "_No Display"
   c. On the same tab, change the "Point Style" to "<none>" and the "Point Label Style" to "<none>"
   d. On the "Include" tab of the dialog, put a check next to "Include all points"
   e. On the "Overrides" tab, put a check in the boxes next to "Style" and "Point Label Style"
   f. Hit "OK". Notice that all of the points in the drawing have disappeared. This is because they have now all been set to Point Style and Point Label Style of <none>, and this setting is an override.
4. **Change Display Order of Point Groups**
   a. In the "Prospector" tab of the Toolspace, right-click on "Point Groups" and hit "Properties"
   b. In the dialog, select the "Trees" Point Group and use the arrows on the right to bring it to the top.
   c. Hit "OK" and notice that now only the Trees appear
   d. Repeat step b to move the "Pavement" Point Group to the top.
   e. Hit "OK" and notice that now the Pavement and Tree points are visible.
   f. Repeat step b to move the "_No Display" Point Group to the bottom of the list.
   g. Hit "OK" and notice that now all points are visible.
5. **Save the drawing**



NOTES

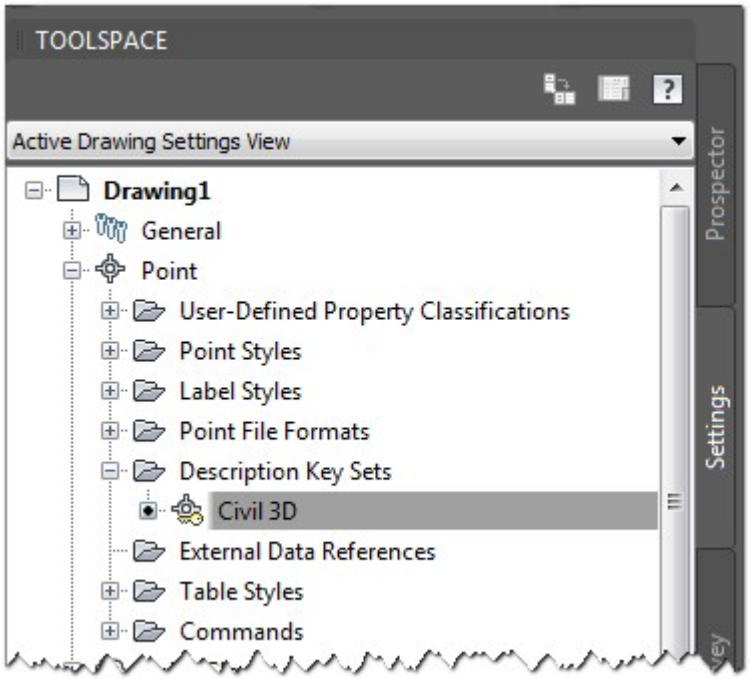
CONCEPT

Description Keys

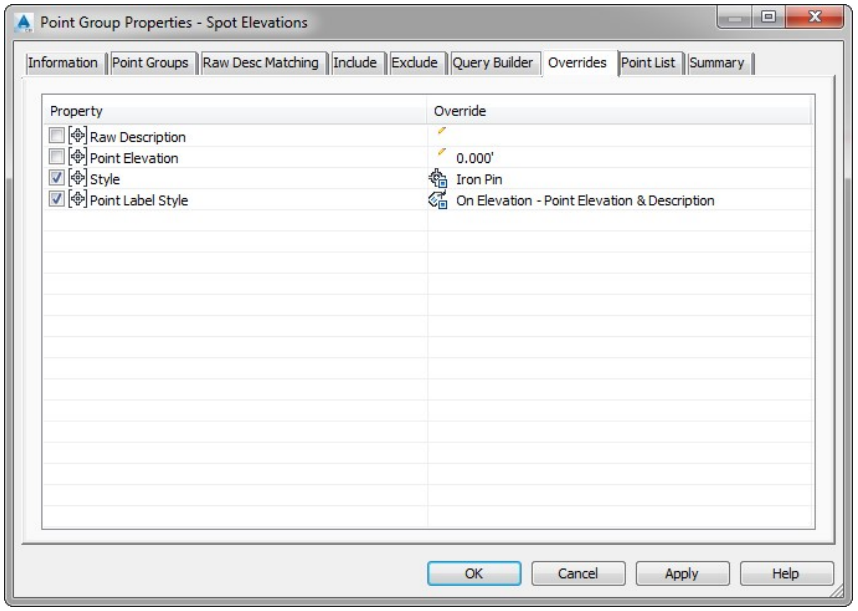
- Control properties of points upon Creation or Import
  - Point and Label Styles
  - Description
  - Layers
- Assigned based on Raw Description
  - Point Style
  - Label Style
  - Layer
  - Raw to Full Description Conversion
- Determine Scaling and Rotation
- Organized into Description Key Sets

Create Description Keys

- Create Description Key Set (*Settings* tab - right-click)
  - Can have multiple Sets per drawing
  - Control Display Order of Description Keys
- Create Description Keys within Key Set (Edit Keys)
  - Edit Keys
  - Set Point Style, Label Style, and Layer
  - Set Format of Full Description, use of Parameters



Note: Description Keys override the Point Styles assigned to the Point Groups because they assign a Point Style to the individual Points. The only way for a Point Group to override the Point Style assigned by a Description Key is by placing a check in the Override tab of the Point Group Properties dialog for Point Style (as shown here).



Exercise

1. **Create Description Key Set "Survey Keys"**
   a. From the "Settings" tab of the Toolspace, expand "Point", then "Description Key Sets"
   b. Right-click on "Description Key Sets" and choose "New". Type in "Survey Keys' and hit "OK"
   c. Back in the "Settings" tab, under "Description Key Sets", right-click on "Survey Keys'" and choose "Edit Keys"
   d. Right-click in the first row of the Panorama that appears and choose "New"
   e. Use the Screen Shot below to create the necessary Description Keys. Make sure to pay close attention to the settings in every column.
   f. When you have completed the Keys below, close the Panorama

PANORAMA

DescKey Editor

Code	Style	Point Label Style	Format	Layer	Scale Parameter	Fixed Scale Factor	Use drawing scale	Apply to X-Y	Apply to
ASH*	Tree	Description Only	$*	V-NODE-TREE	Parameter 1	1.000	No	No	No
bc*	STA	Point#-Elevation-Description	$*	V-CTRL-TRAV	Parameter 1	1.000	No	No	No
cyp*	Tree	Description Only	$1FT DIA CYPRESS	V-NODE-TREE	Parameter 1	0.083	No	Yes	No
OAK*	Deciduous Tree	Description Only	$*	V-NODE-TREE	Parameter 1	1.000	No	No	No
PINE*	Tree	Description Only	$*	V-NODE-TREE	Parameter 1	1.000	No	No	No
STA*	STA	Point#-Elevation-Description	$*	V-CTRL-HCPT	Parameter 1	1.000	No	No	No
SWMH	Storm Sewer Manhole	Point#-Elevation-Description	$*	V-NODE-STRM	Parameter 1	1.000	No	No	No
TR*	Tree	Point#-Elevation-Description	$*	V-NODE-TREE	Parameter 1	1.000	No	No	No

2. **Create Points using these Description Keys**
   a. From the "Home" tab of the Ribbon, choose "Points" > "Create Points" > "Miscellaneous".
   b. In the Toolbar that appears, expand the settings and under "Point Creation", set "Prompt for Elevations" and "Prompt for Descriptions" to "Manual".
   c. Use the command to create a point that has the description of SWMH
   d. Notice that a symbol and layer are automatically assigned
   e. Use the same command to create a point that has the description of bc (lower case)
   f. Click on the two new points, right-click and choose "Edit Points". Review the Panorama and notice that a Point Style and Label Style have been assigned

3. **Save the drawing**

NOTES

CONCEPT

Data Contained in Civil 3D Survey Database

- Central data store for all survey-specific data in a project
  - Contains all control points, known directions, observation measurements, traverse definitions, figures, and standard deviations based on equipment data
  - Data either imported from data collector or created manually
  - Stores Angles in Radians and Distances in Meters
  - Drawing units and coordinate zones can be independent of Survey Database Units
  - Data is transformed on the fly
  - Data can come from multiple sources
- Databases keep data separate from drawings
  - Prevents unwanted changes/edits
- Right-click on "Survey Databases" on *Survey* tab of Prospector and hit "New Local Survey Database"
- Can be accessed from multiple drawings attached to the Survey Database
- Must Open Database before you can use its data in a Drawing

Networks

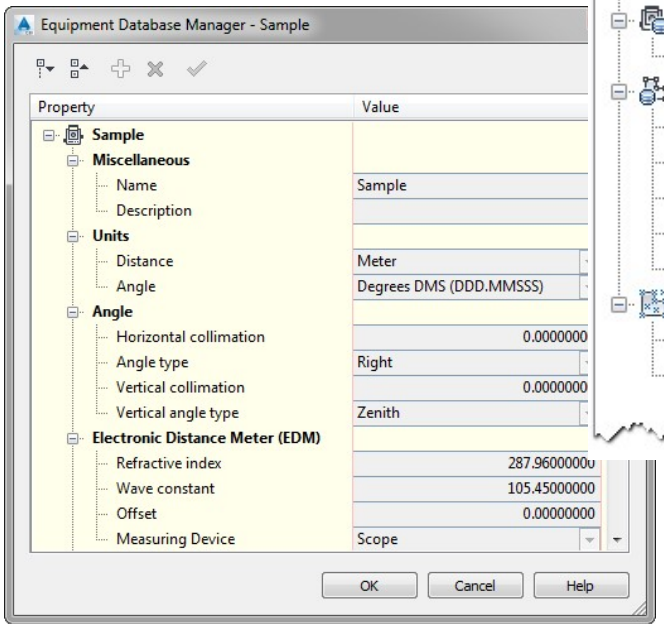
- Collection of related control points, instruments setups, observations, and traverses
  - Stored in Survey Databases
  - Database can contain multiple Networks
  - Networks can contain data from multiple data sources

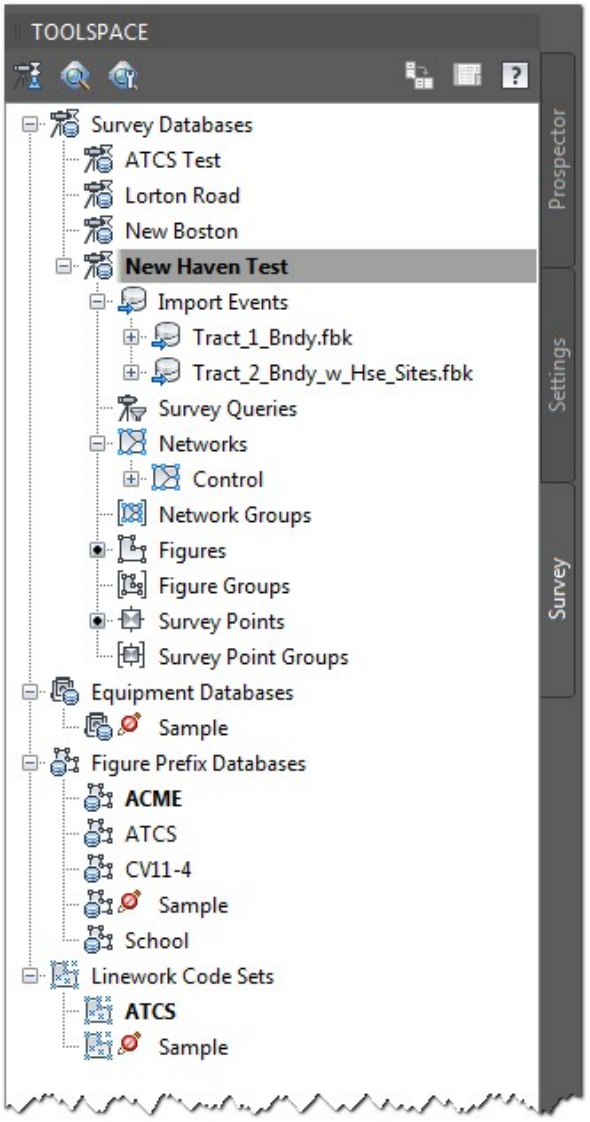
Equipment Databases

- Contains one or more equipment definitions
  - EDM Values
  - Prism information
  - Standard Deviations
  - Etc…

Figure Prefix Databases

- Collection of Code Prefixes
  - Establishes which codes are used for linework creation
  - Establishes settings and Style for all figures (Layer, Style, Creation Type, etc.)
- Codes stored in Figure Prefix Databases
  - Can have multiple databases set up for different code sets





Exercise

1. Create and Open Survey Database

a. In the *Survey* tab of the Toolspace, right-click on “Survey Databases” and hit “New Local Survey Database”
b. Enter “Class Database” in the dialog that appears
c. If it is not already shown in bold, right-click on new Survey Database and hit “Open Survey Database”

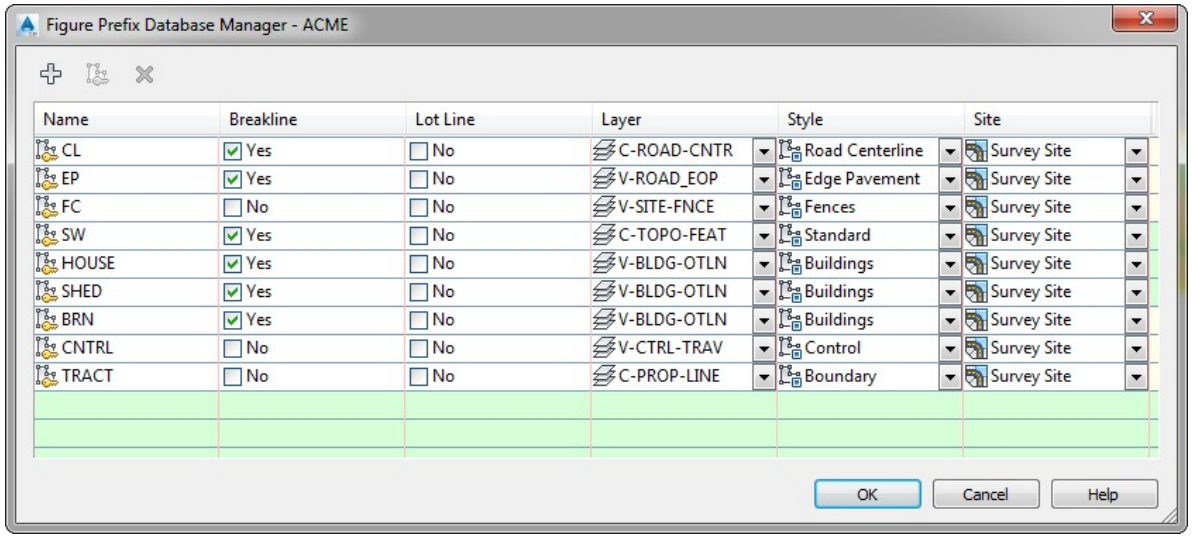
2. Examine Equipment Database

a. In the *Survey* tab of the Toolspace, under “Equipment Databases”, expand “Sample”
b. Right-click on the “Sample” Equipment.
c. Examine the settings and make any desired changes in the dialog.

3. Create Figure Prefix Database

a. In the *Survey* tab of the Toolspace, right-click on the “Figure Prefix Databases” and hit “New”
b. Type “Class” in the dialog that appears and hit “OK”

Note: We will create the figure prefixes in a future exercise



NOTES

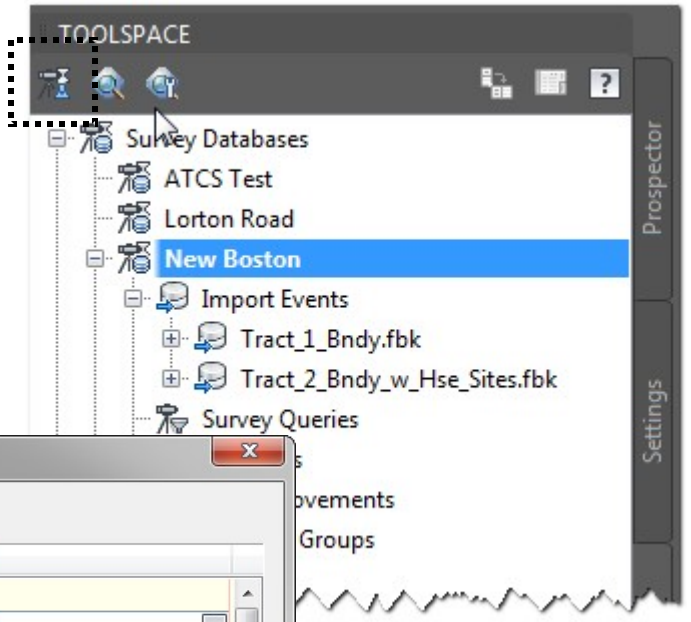
CONCEPT

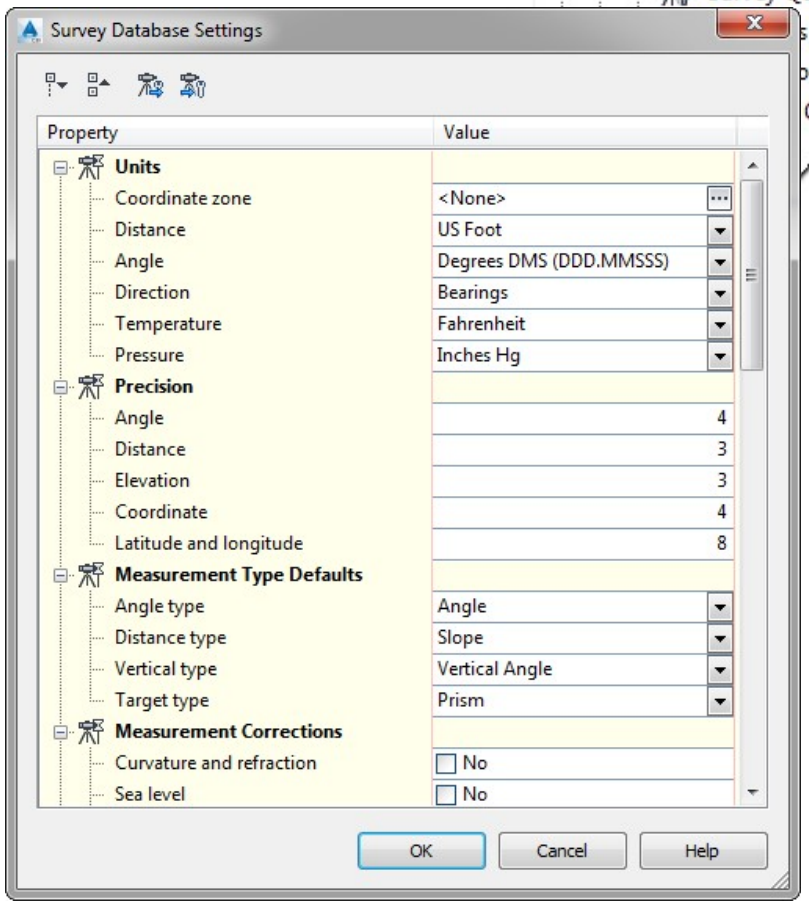
User Settings

- Accessed from *Survey* tab of the Toolspace
  - Choose the button at the top-left of the tab
- Specific to a user
- Set preferences for Survey data only
  - External Editor
  - Current Equipment and Figure Prefix Databases
  - Settings for interactive graphics
  - Etc…

Survey Database Settings

- Accessed from the '*Survey*' tab of the Toolspace
  - Survey Database must be Open
  - Right-click on Database name and choose "Edit Survey Database Settings"
- Specific to individual Survey Database
- Set preferences for Survey only
  - Database Units and Precision
  - Default Measurement Types
  - Corrections
  - Etc..



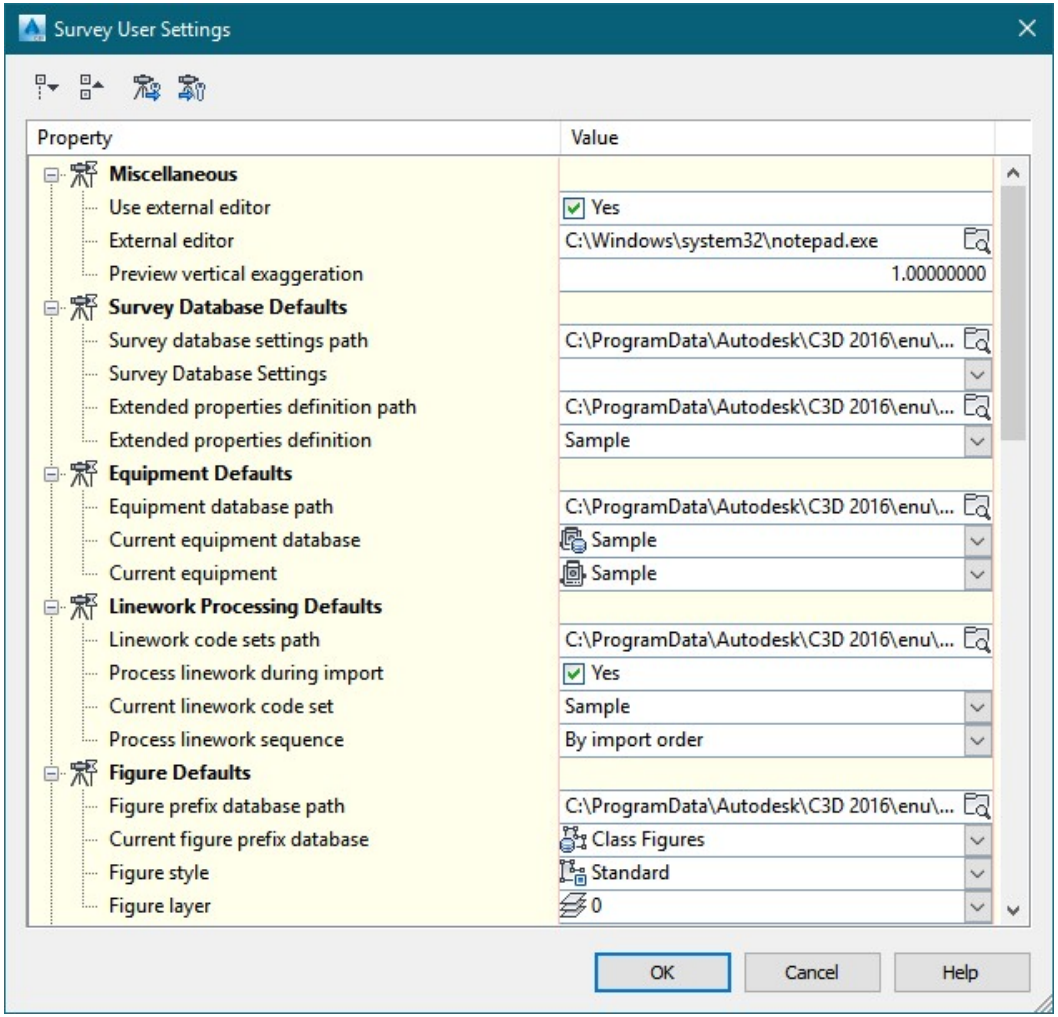


Exercise

1. **On the *Survey* tab of the Toolspace, choose the "Edit User Settings" button**

2. **Set the current Survey Equipment Database**
   a. Set the "Current Equipment Database" to "Sample"

3. **Set the current Survey Figure Prefix Database**
   a. Set the "Current Figure Prefix Database" to "Class"



NOTES

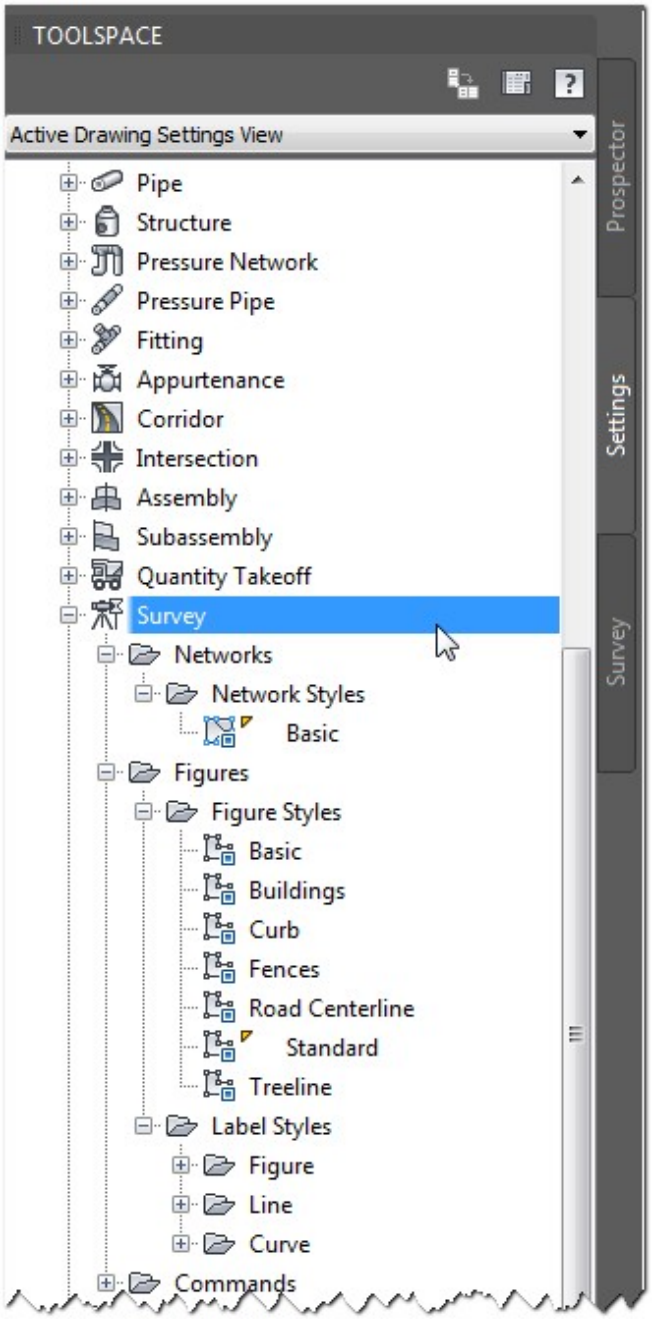
CONCEPT

Network Styles
- Control display properties of Networks
  - Known Control Points
  - Unknown Control Points
  - Sideshot Points
  - Network Lines
  - Direction Lines
  - Sideshot Lines
  - Error Ellipses
- Create one for each Network Type
- Civil 3D templates contain pre-made styles

Figure Styles
- Control display properties of Figures
  - Figure Lines
  - Vertex Markers
  - Midpoint Markers
  - Endpoint Markers
  - Additional Markers
- Create one for each Figure type
- Civil 3D templates contain pre-made styles

Create/Edit Styles - Multiple Commands
- Network or Figure right-click menu (drawing or *Prospector*)
- Settings Tab (right-click)
- Create New or Copy Existing and rename

Apply Network and Figure Styles
- Network and Figure Styles applied during creation or changed later
- Change Network and Figure Styles using *Prospector* Item View



Exercise

1. Create new Figure Styles

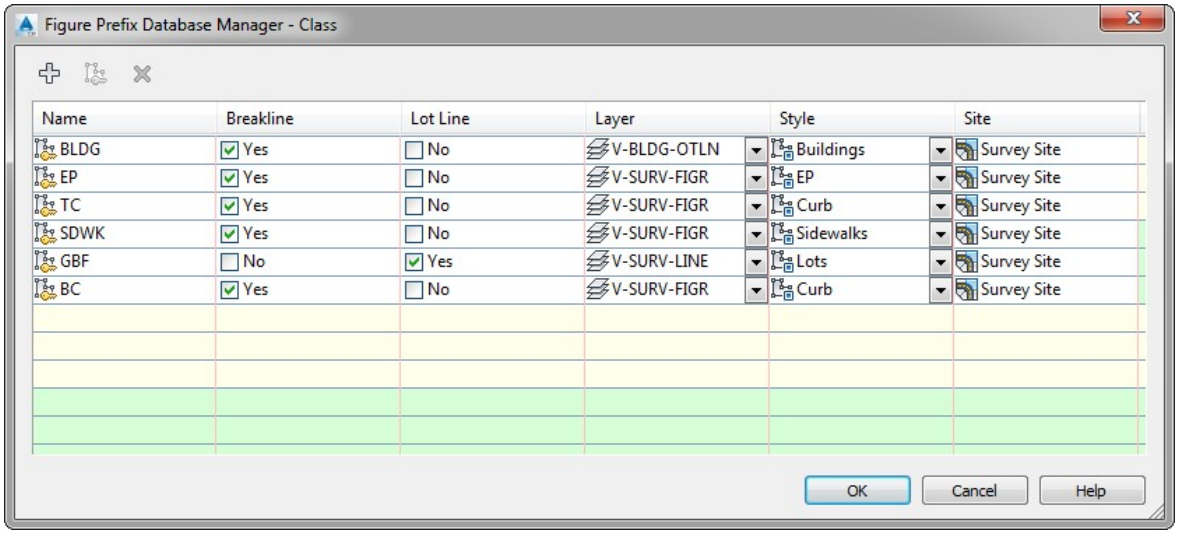
a. In the “Settings” tab of the Toolspace, expand “Survey’, then “Figures”, then “Figure Styles”
b. Right-click on “Curb” and hit “Copy”
c. On the “Information” tab, change the Name to “EP”
d. On the “Display” tab highlight all of the components and click under the layer column. Choose “C-ROAD-FEAT” and hit “OK.
e. Repeat this step for all of the other View Directions.
f. Repeat steps a–e to create a style called “Sidewalks” that uses the layer called “C-TOPO-FEAT”
g. Repeat steps a–e to create another style called “Lots” that uses the layer called “C-PROP-LOTS”

2. Create Figure Prefixes using Styles

a. In the *Survey* tab of the Toolspace, under “Figure Prefix Databases”, right-click on “Class” and hit “Manage Figure Prefix Database”

a. Hit the  button to add a new Figure Prefix

a. Enter the Prefixes and settings below, hitting  each time to add a new Prefix:

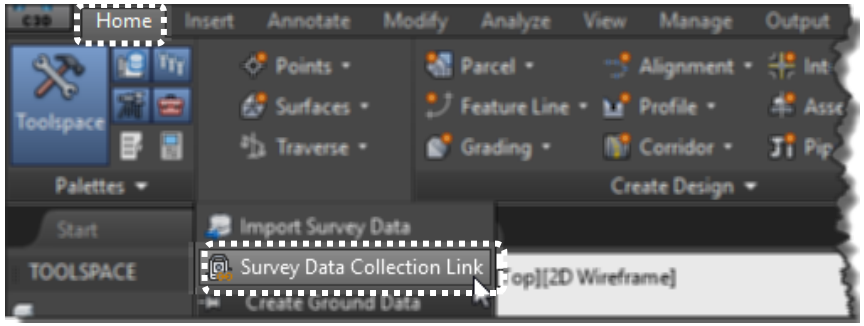


NOTES

CONCEPT

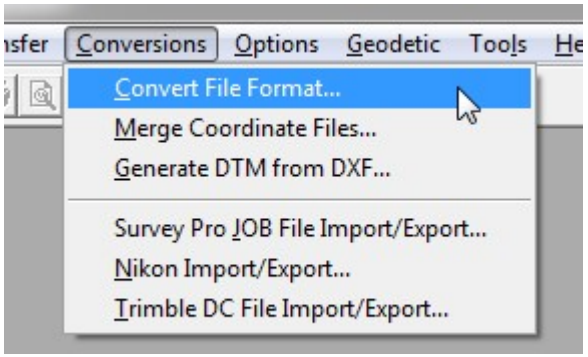
Two Connection Options

1. Survey Data Collection Link
2. Third-Party Link add-ons



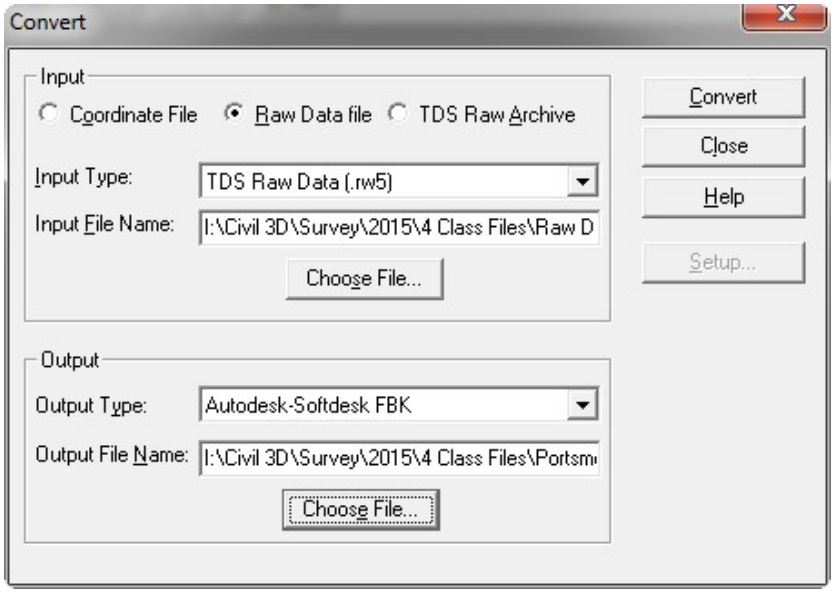
1. Survey Data Collection Link

- Same tool that was in Land Desktop's Survey extension
- Accessed from the '*Home*' tab » 'Create Ground Data' Panel » 'Survey Data Collection Link'
- Transfer Data to/from Data Collectors
- Import/Export Options
- Perform file conversions where necessary
- Supported Input Formats
  - AutoCAD DXF
  - AutoCogo
  - ASCII (User-defined, ASCII 2, etc.)
  - CLM
  - Autodesk-Softdesk FBK
  - Sierra Cybernetics
  - Draftix
  - TDS .raw, .rw5, .cr5
  - Sokia SDR Numeric 4, Alpha 14
  - Topcon FC-4, DL-100 Digital Level, GTS210/220/310 Raw
  - SMI
  - Leica GSI Raw, GRE3
  - WILDSoft
  - SurvCAD
  - PacSoft Coordinates
  - MapTech
  - MTI
  - Lewis & Lewis
  - C & G



2. Third-Party Link add-ons

- Add-ons to Civil 3D:
  - Trimble Link
  - Leica X-Change
- Often downloadable from respective company websites
- Specific commands for working with individual brand models.



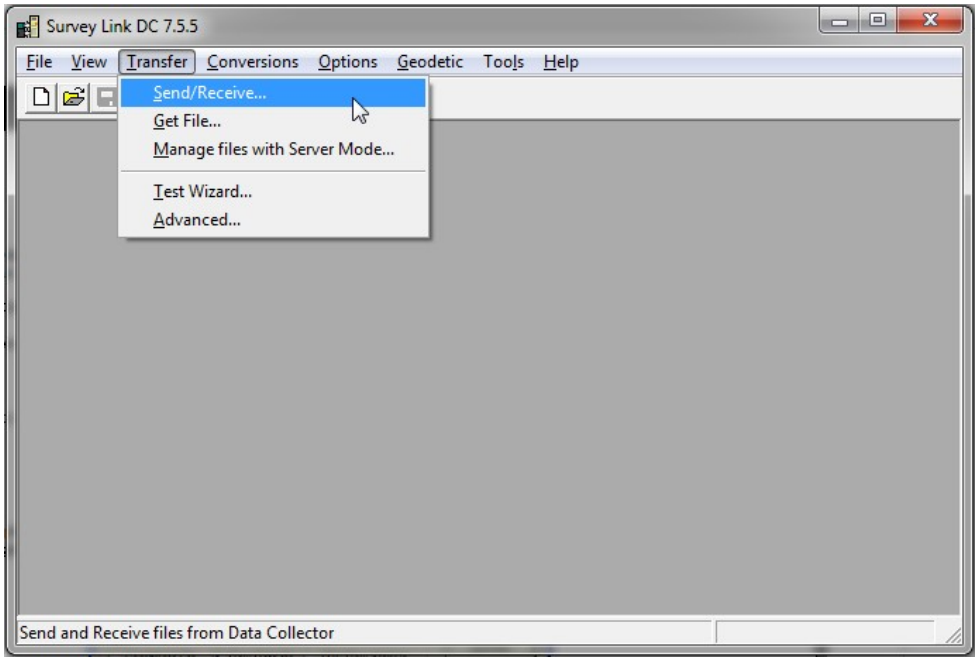
Exercise

1. **Open Survey Data Collection Link**
   a. On the “Home” tab of the Ribbon, hit the down-arrow next to the name of the “Create Ground Data” Panel and choose “Survey Data Collection Link”

2. **Convert raw data to FBK**
   a. From the “Conversions” menu, choose “Convert File Format”
   b. Input: Raw Data File
   c. Input Type: TDS Raw Data (.rw5)
   d. Input File Name: C:\Civil 3D Projects\Civil 3D 2019 Survey \Raw Data\Portsmouth Heights.rw5
   e. Output Type: Autodesk-Softdesk FBK
   f. Output File Name: C:\Civil 3D Projects\Civil 3D 2019 Survey \Portsmouth.fbk
   g. Hit “OK”

3. **Repeat Step 2 for “topo2.rw5”**
   a. Input File Name: C:\Civil 3D Projects\Civil 3D 2019 Survey \Raw Data\topo2.rw5
   b. Output File Name: C:\Civil 3D Projects\Civil 3D 2019 Survey \Topo2.fbk
   c. Hit “OK”

4. **Examine the two Fieldbooks that were created**

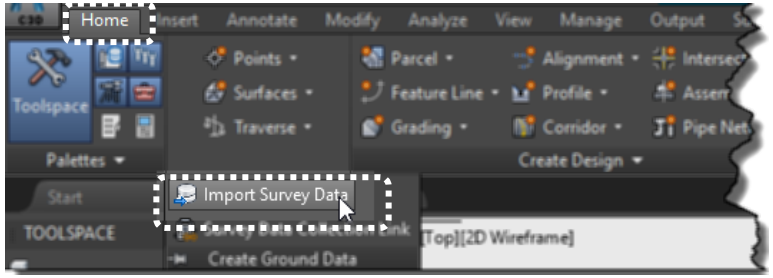


NOTES

CONCEPT

Import Survey Data Wizard

- "Import Survey Data" command
  - Located on the '*Home*' tab in the 'Create Ground Data' Panel
    OR
  - From the *Survey* tab of the Toolspace, right-click on "Import Events" under the desired Open Survey Database
- Wizard steps through necessary options for data insertion into Survey Database and drawing
  - Choose/create Database
  - Specify import file type, format, and name
  - Choose/create Network
  - Import Options

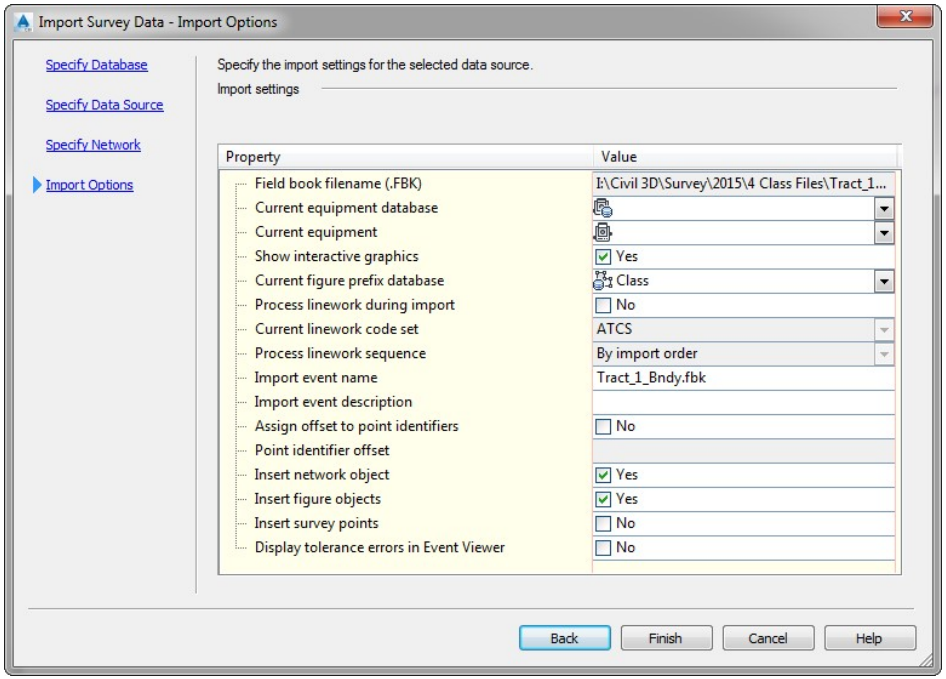


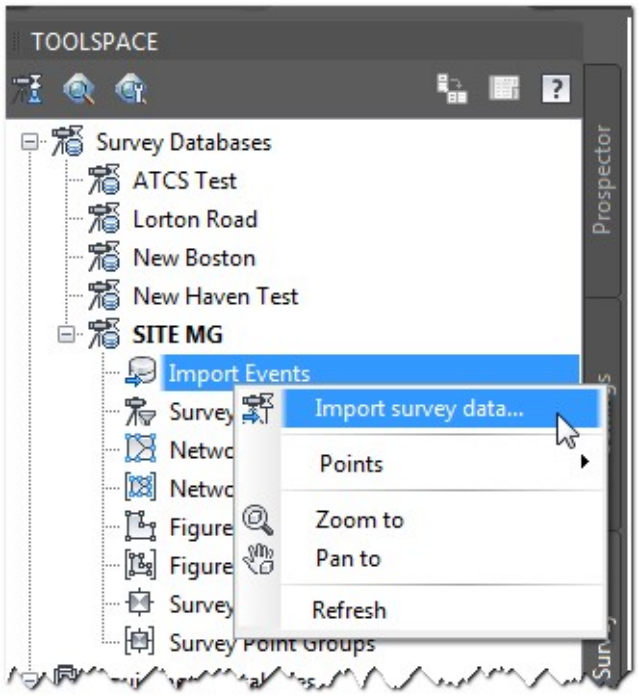
Import Settings and Options

- Must be imported into an existing Network
  - May have one network per import file (Control, Sideshots, etc…)
- Can show previews as the data is added to the database
  - Can insert data (points and figures) during import or later from right-click menu

Import File Formats

- Fieldbook (.fbk) file
- LandXML
- Point File (ASCII)





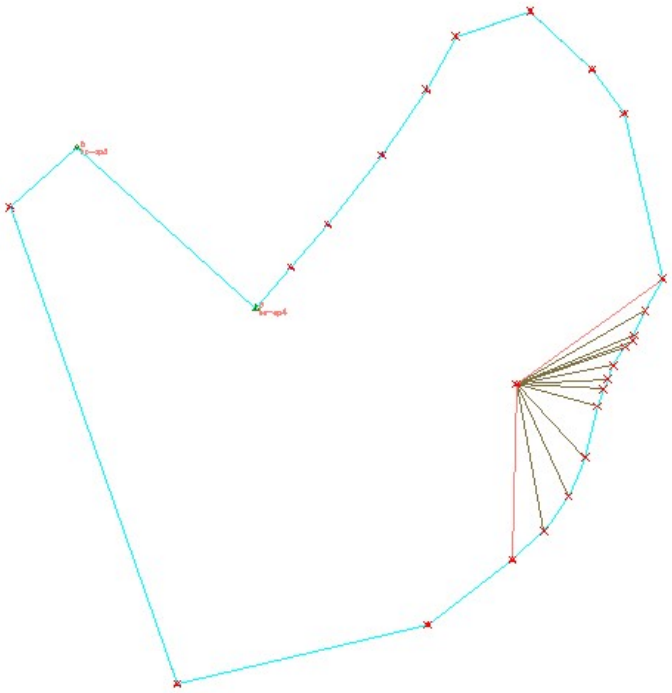
- Points from Drawing

Exercise

1. **Create Network**
   a. On the “Survey” tab of the Toolspace, expand the “Class Database”.
   b. Right-click on “Networks” and hit “New”
   c. In the dialog that appears, type in “TRACT-1” and hit “OK”

2. **Import Fieldbook**
   a. From the ‘Home’ tab of the ribbon, on the “Create Ground Data” Panel choose “Import Survey Data”
   b. In the dialog that appears, choose the “Class Database” Survey Database and hit “Next”
   c. For the “Data source type”, choose “Fieldbook” file.
   d. Browse to C:\Civil 3D Projects\Survey Class, choose “TRACT_1_BNDY.fbk” and hit “Open”, then hit “Next”
   e. Choose “TRACT-1” Network and hit “Next”
   f. Set “Show Interactive Graphics” to “Yes”
   g. Make sure the “Current Figure Prefix Database” is set to “Class”
   h. Uncheck “Process Linework During Import”
   i. Make sure “Insert Network Object” and “Insert Figure Objects” are both set to “Yes”
   j. Set “Insert survey points” to “No”
   k. Hit “Finish”
   l. Watch the preview as the data is added.
   m. Examine data in Survey tab

3. **Insert Survey Points**
   a. Back on the “Survey” tab of the Toolspace, expand “Networks”, then “TRACT-1”
   b. Right click on “Control Points”, choose “Points”, then “Insert into drawing”
   c. Repeat b for Setups and Survey Points



NOTES

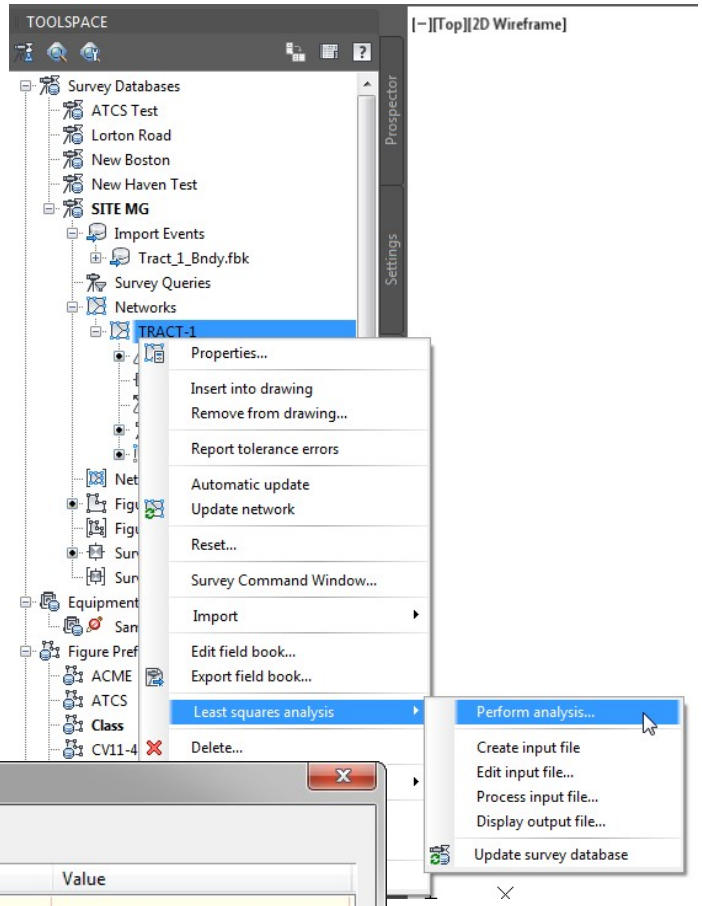
CONCEPT

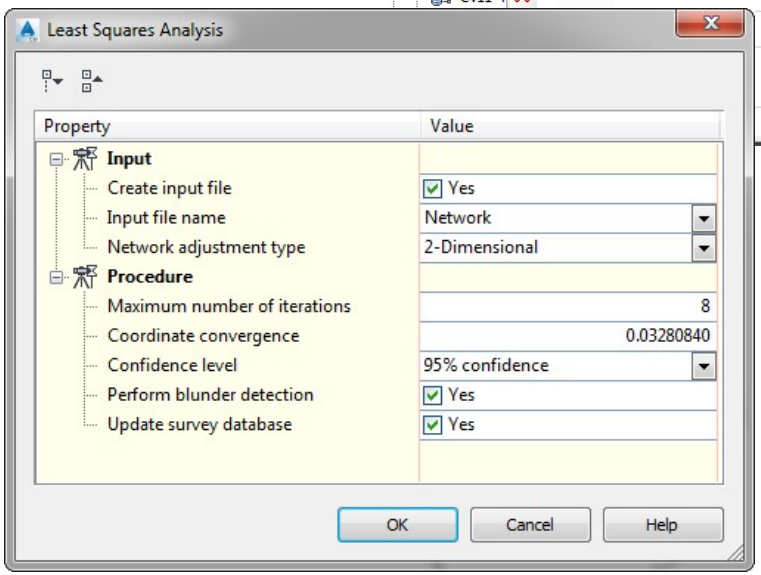
Least Squares Analysis
- Run on one Network at a time
  - Uses Observation Equation Method
  - Adjustments made to Points in the Survey Database and any resulting linework
- *From the "Survey" tab, right-click on a Network, choose "Least Squares Analysis", then "Perform Analysis"*
  - Dialog provided with settings

Input and Output Files
- Input Files
  - Least Squares Analysis Input File created with station-to-station observations (does not consider side shots)
  - File called "network.lsi"
  - Can add or make changes to Input File in a text editor using "Edit Input File" command
  - Can process the Input File to calculate the adjustment and create a least squares network adjustment file (network.adj) and a least squares network output file (network.lso).
- Output Files
  - Network.lso
  - Can view the Output File using the "Display Output File" command

Traverses
- Create based on Control Points
- Right-click on "Traverse" under desired Network and choose "New"
- Requires initial Station, Initial BS, station range and Final FS
- Can have multiple Traverses per Network
- Perform Traverse Analysis
  - Right-click on the traverse and choose "Traverse Adjustments"
- Analysis Types
  - Compass Rule
  - Transit Rule
  - Crandall Rule
  - Least Squares

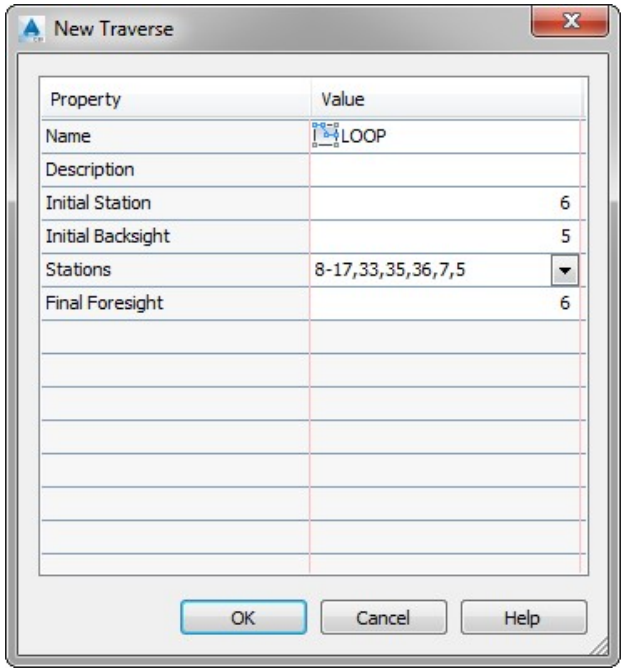
Updating the Network
- After running analyses, update the Database to reflect the changes.
  - Adjustments made to Points in the Survey Database and any resulting linework



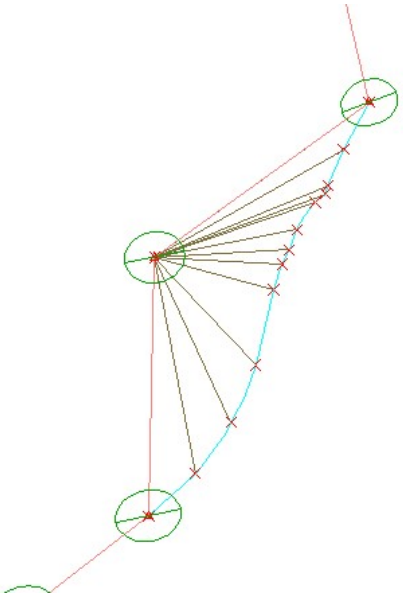


Exercise

1. **Create a Traverse**
   a. Under “Class Database”, expand “Networks”, then “TRACT-1”, right-click on “Traverses” and hit “New”
   b. In the dialog that appears set the name to “Control”
   c. For the Initial station, type in 6 and the rest of the dialog should populate. Check to make sure the values match the screen shot below:



2. **Run Least Squares Analysis**
   a. Right-click on the “TRACT_1” Network and choose “Least Squares Analysis”, then “Perform Analysis”
   b. Set “Network Adjustment Type” to “2-Dimensional” and hit “OK”
   c. Examine the files that are created
3. **If yellow warning signs appear under the Network, right -click on each subsection and hit “Update”**
4. **Zoom in and Examine Error Ellipses**



NOTES

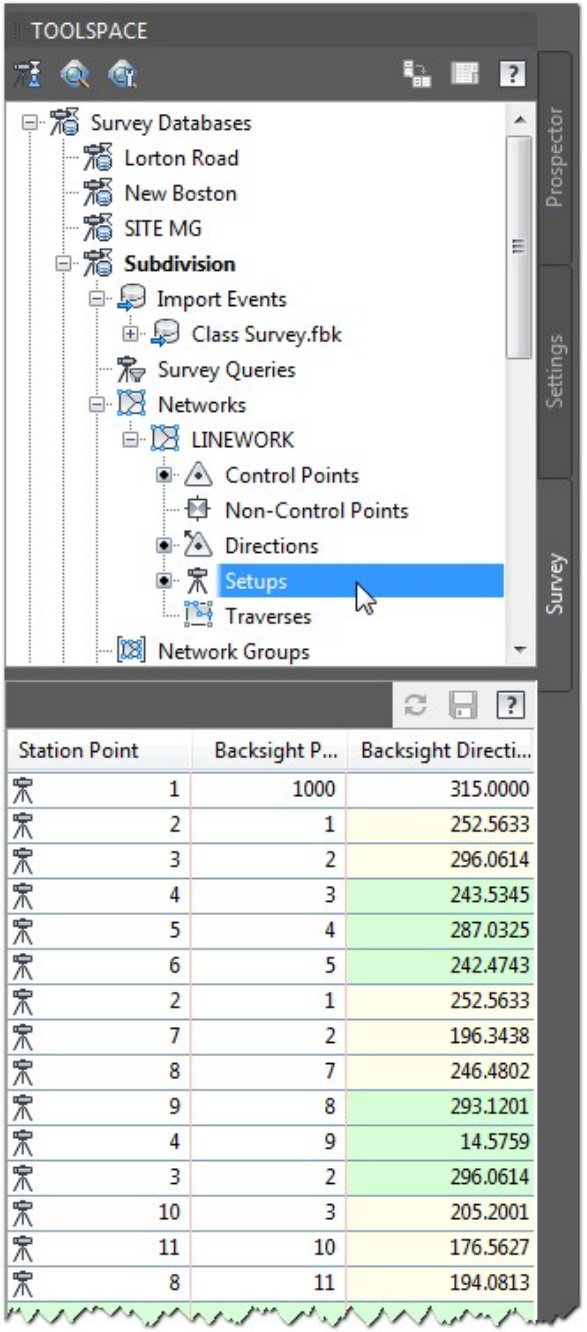
CONCEPT

Editing Fieldbooks

- Can edit the imported Fieldbook in a text editor
- *Right-click on desired Network and hit "Edit Field book"*

Editing Data in the Database

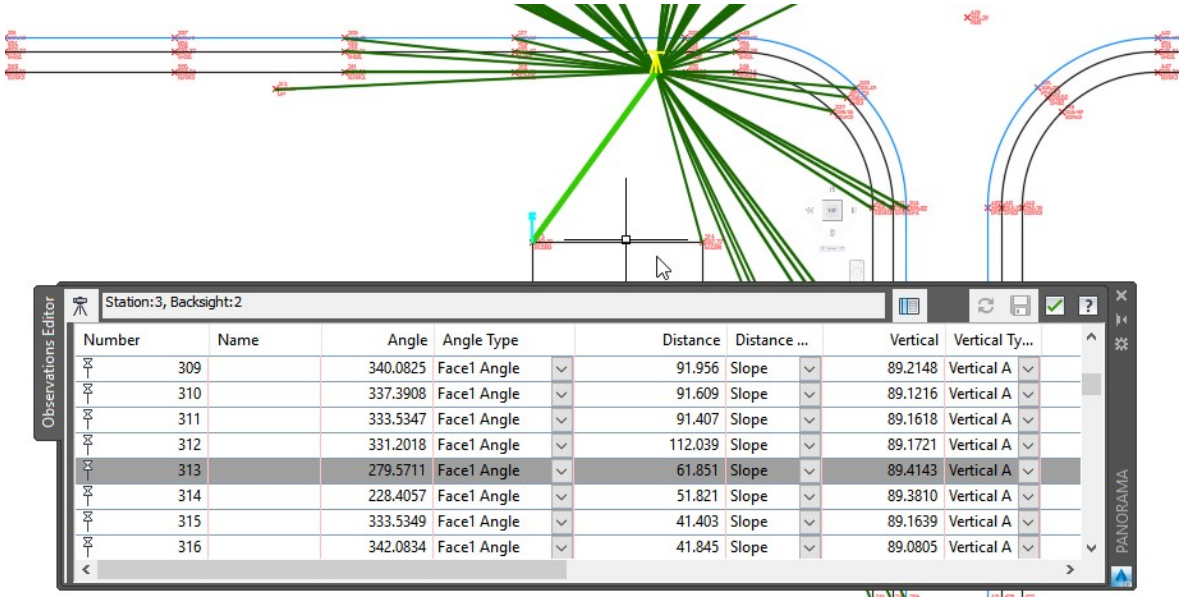
- Changes are cascading
  - Changes to setups will change all related observations and Figures
  - Changes to observations will change all related Figures
  - Etc...
- Edit in Item View
  - Click on any category (Control Points, Setups, etc…) and use Item View as editor
  - To save back to the database, hit the button at the top of the Item View.
  - To see changes appear in the drawing, right-click on the Network or Figures and hit "Update [item]"
- Use Panorama
  - Right-click on any category (Control Points, Setups, etc…) and hit "Edit"
  - To save back to the database, hit the button at the top right of the Panorama
  - To see changes appear in the drawing, right-click on the Network or Figures and hit "Update [item]"



Station Point	Backsight P...	Backsight Directi...
1	1000	315.0000
2	1	252.5633
3	2	296.0614
4	3	243.5345
5	4	287.0325
6	5	242.4743
2	1	252.5633
7	2	196.3438
8	7	246.4802
9	8	293.1201
4	9	14.5759
3	2	296.0614
10	3	205.2001
11	10	176.5627
8	11	194.0813

Exercise

1. **Create New Database and Network (see page s 19 and 27 for additional instructions)**
   a. Database Name = Subdivision
   b. Network Name = Linework
2. **Create a New Drawing (see page 7 for additional instructions)**
   a. Use "_AutoCAD Civil 3D (Imperial) NCS.dwg" and save as C:\Civil 3D Projects\Civil 3D 2019 Survey\Linework.dwg
3. **Import Fieldbook**
   a. From the 'Home' tab of the ribbon, choose "Import Survey Data"
   b. Choose the "Class Database" Survey Database and hit "Next"
   c. For the "Data source type", choose "Fieldbook" file.
   d. Browse to C:\Civil 3D Projects\Civil 3D 2019 Survey and choose "Class Survey.fbk", hit "Open', then hit "Next".
   e. Choose "Linework" Network and hit "Next"
   f. Set "Show Interactive Graphics" to "Yes"
   g. Set Current Figure Prefix Database to "Class"
   h. Uncheck Process Linework During Import
   i. Make sure "Insert Network Object" and "Insert Figure Objects" are both set to "Yes"
   j. Set "Insert survey points" to "No"
   k. Hit "Finish"
   l. Watch the preview as the data is added.
4. **Edit an Observation**
   a. Click on "Survey Points"
   b. In the Item View, scroll down to point number 313, right-click and choose "Edit Setups that Observe"
   c. In the "Distance" column, change the value for Point 313 to 60.5.
   d. Hit the "Save" button in the Panorama to commit the change
   e. Back in the "Survey" Toolspace tab, click on "Figures" and hit "Update". The building line will now follow the new location of the point



NOTES

CONCEPT

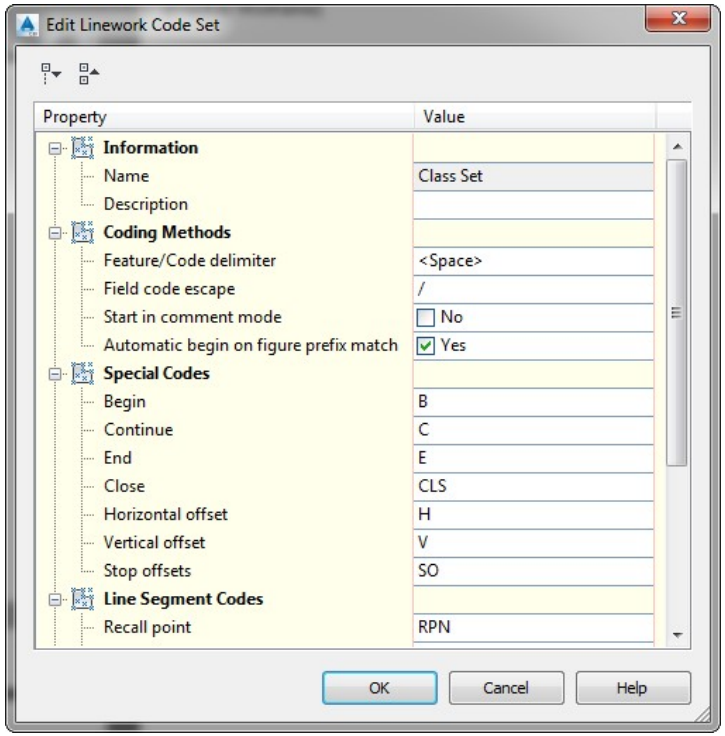
Linework Codes in Point Description

- Descriptions matching an entry in the Figure Prefix Database automatically generate a figure (linework)
- Linework Commands entered in Point Description (MCS, C3, etc…)
- Commands and descriptions separated by specified character (usually a space)

```
259,1359175.4916,761359.0973,126.1697,ew bc
260,1359187.2916,761317.6974,126.1697,ew
261,1359192.5616,761287.3474,126.1697,ew
271,1359060.4619,761382.3572,126.1697,ew
272,1359093.4118,761386.2072,126.1697,ew
273,1359155.9917,761380.3372,126.1697,ew rpn259 ec
274,1359880.2402,761370.7673,0.0000,brn cls
275,1358737.5325,761491.9970,131.4197,epr
276,1358658.2027,761431.1071,131.3097,epr
```

Linework Code Sets

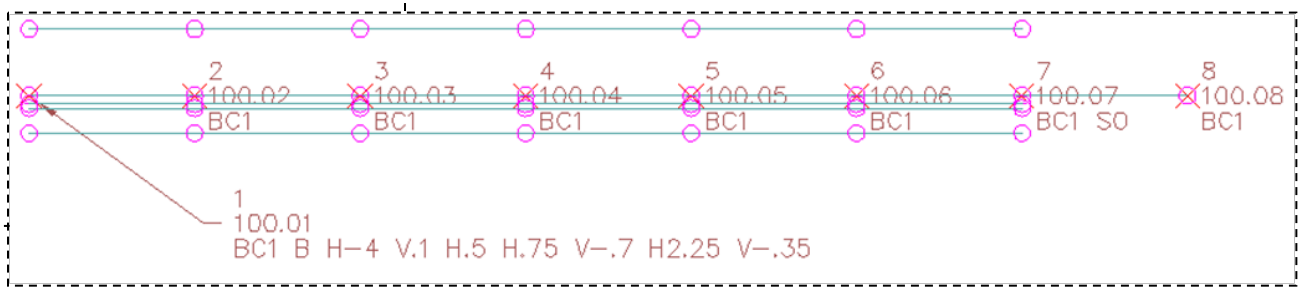
- Specify and Interpret field code syntax for automated linework creation
- Created and Organized in the '*Survey*' tab of the Toolspace
  - Right-click on "Linework Code Sets" and choose "New"
- Customize codes to match company/survey standards and practices
- <Space> is recommended Feature/Code delimiter
- Dialog provided with settings



Horizontal and Vertical Figure Offset Codes

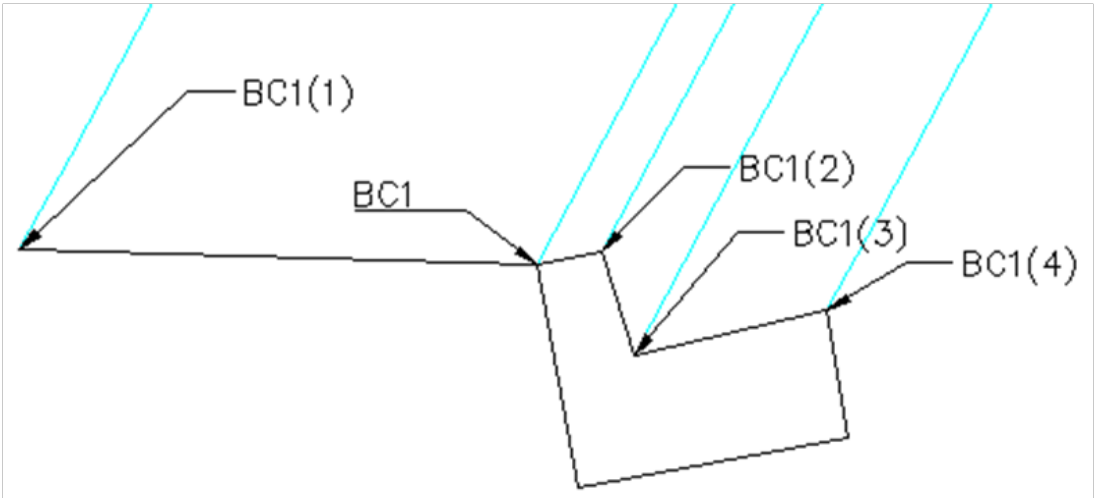
- Indicate parallel, relative vertical and/or horizontal offset(s) for a figure
- Codes entered into Point description
  - Parallel figure begins at the point where the H or V codes are given
  - Can insert multiple horizontal and vertical offsets from one point/figure
  - Can use SO (or other chosen code) to stop one or more offsets at a certain point along the figure.

```
1,500,490,100.01,BC1 B H-4 V.1 H.5 H.75 V-.7 H2.25 V-.35

2,500,500,100.02,BC1

3,500,510,100.03,BC1

4,500,520,100.04,BC1

5,500,530,100.05,BC1

6,500,540,100.06,BC1

7,500,550,100.07,BC1 SO

8,500,560,100.08,BC1
```



Exercise

1. **Create Linework Code Set**
   a. In the “Survey” Toolspace tab, right-click on “Linework Code Sets” and choose “New”
   b. Enter “Class Set” as the name
   c. Change the Begin Curve code to “PC”
   d. Change the End Curve code to “PT”
   e. Change the Point on Curve code to “POC”
   f. Hit “OK”
   g. Right-click on new Linework Code set and choose “Set Current”
2. **Create a New Drawing (see page 7 for additional instructions)**
   a. Use “_AutoCAD Civil 3D (Imperial) NCS.dwg”
   b. Save the new drawing as C:\Civil 3D Projects\Civil 3D 2019 Survey\Offset example.dwg
3. **Import ASCII file with Linework Codes and Offsets**
   a. From the ‘Home’ tab of the ribbon, choose “Import Survey Data”
   b. Choose “Class Database”
   c. Choose ASCII file, PNEZD comma-delimited and browse to C:\Civil 3D Projects\Civil 3D 2019 Survey\Offsets.txt
   d. Create a new Network called “Offsets”
   e. Set “Show Interactive Graphics” to “Yes”
   f. Set Current Figure Prefix Database to “Class”
   g. Make sure “Insert Network Object” and “Insert Figure Objects” are both set to “Yes”
   h. Set “Insert survey points” to “Yes”
   i. Hit “Finish”
4. **Examine Data**
   a. Examine data in the Survey tab
   b. Examine data in the drawing using ORBIT or Object Viewer



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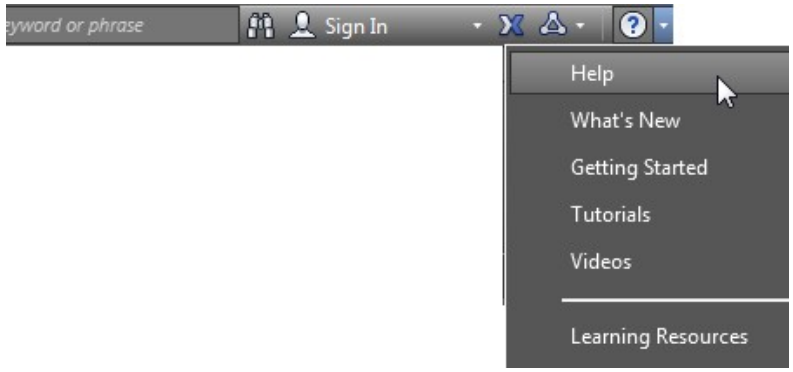
CONCEPT

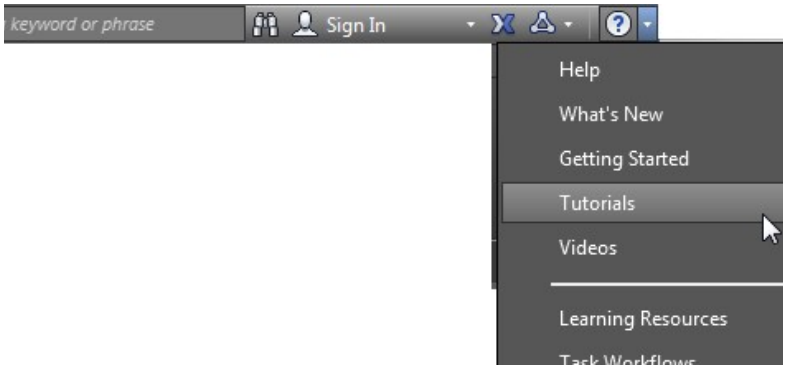
Help Menu

Accessed from the "Help" pull-down menu or by hitting F1:

Tutorials

Accessed from the "Help" pulldown menu:





Online Resources

- Autodesk Civil 3D Website
- http://www.autodesk.com/civil3d
- Information about Civil 3D including:
  - Overview and features
  - AutoCAD Civil vs. AutoCAD Civil 3D
  - White Papers and Customer Success Stories
  - Support knowledge base
  - Partner and add-on products
  - etc.

Autodesk Civil 3D Discussion Group

- http://discussion.autodesk.com/
  → Choose Civil 3D
- User and Autodesk forum:
- Large database of Q&A
- Ask a question and receive answer from users, resellers, and Autodesk personnel

The CAD Geek Blog

- http://www.TheCADGeek.com
- Tips and tricks, how-to videos, and industry insights for Autodesk related products; AutoCAD, Civil 3D, and Map 3D.

Other Classes

- Other classes offered by CADD include:
  - AutoCAD Civil 3D Level II: Road Design
  - AutoCAD Civil 3D Level II: Visualization
  - AutoCAD Map 3D Introduction
  - AutoCAD Level I/II
  - AutoCAD 2016/2017 to 2018 Update