# Chapter 6 - Feature Codes and Control Codes

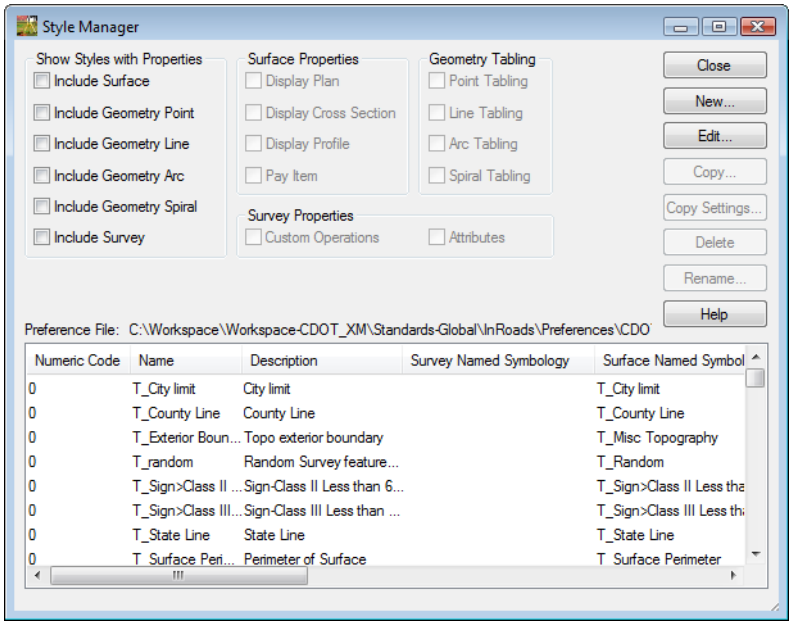
The Feature Styles defined for Survey control how a feature is displayed in the design file, written to a DTM, or exported to Geometry.
There are two main types of graphic displays: lines and cells. Additionally, there are a few codes that place text through the use of Custom Operations. The Styles definition also controls, through the association with a Named Symbology, the symbology for the graphics such as level, color, style, and weight.

Extensive effort has been made to ensure the correct symbology is defined in the Feature Style. Changes to Feature Styles will be made only by the CDOT CADD Manager. Any suggested changes should be submitted to the CADD Manager as all of CDOT's InRoads configuration is stored in the standard delivered CDOT_Civil.xin file.

## Style Manager dialog

The Style Manager dialog controls how each surveyed feature is displayed graphically. Each feature can be displayed as Lines, Cells, Text, or Symbols. The feature definitions have been standardized by CDOT and should only be modified by the CADD manager.

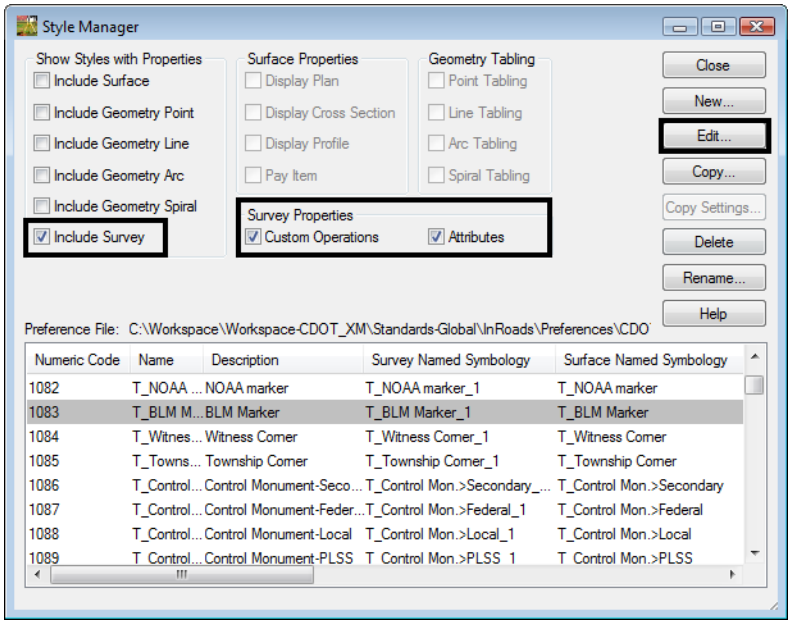
From the pull-down menu, select **Tools > Style Manager…**



# Feature Styles

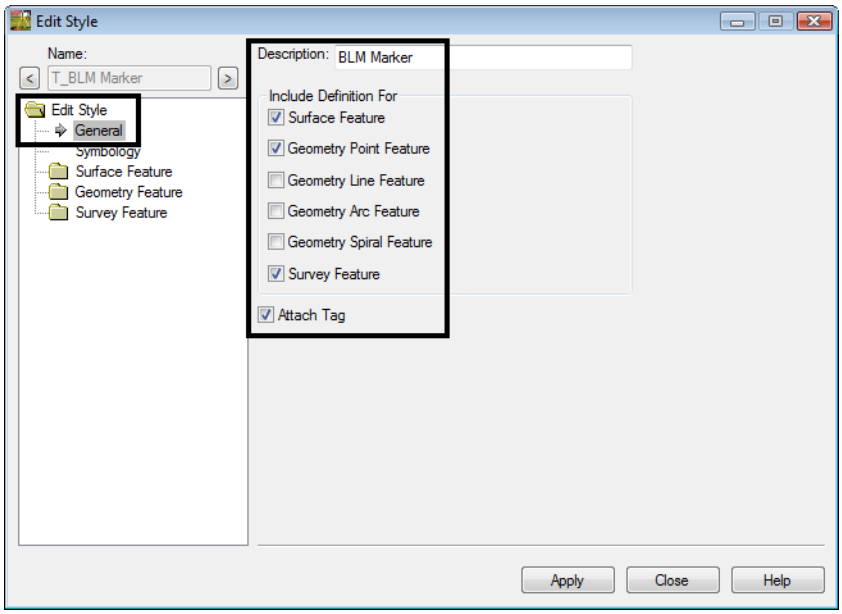
### *Dialog Filtering:*

- Toggle on '**Include Survey**' to filter the dialog to show only features configured specifically for data collection.
- Additional toggles for styles that have attributes defined for ***Custom Operations*** and ***Attributes*** further refines the list of displayed styles.



### *Feature Editing:*

From the list of Features, **<D>** a specific Feature and select **Edit** on the ***Style Manager*** dialog to open the ***Edit Style*** dialog. The ***Edit Style*** dialog controls the attributes for each available ***Feature*** in the CDOT configuration including survey coding for field collection and processing.

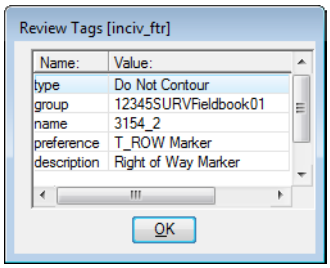



- ***Graphic Attributes***

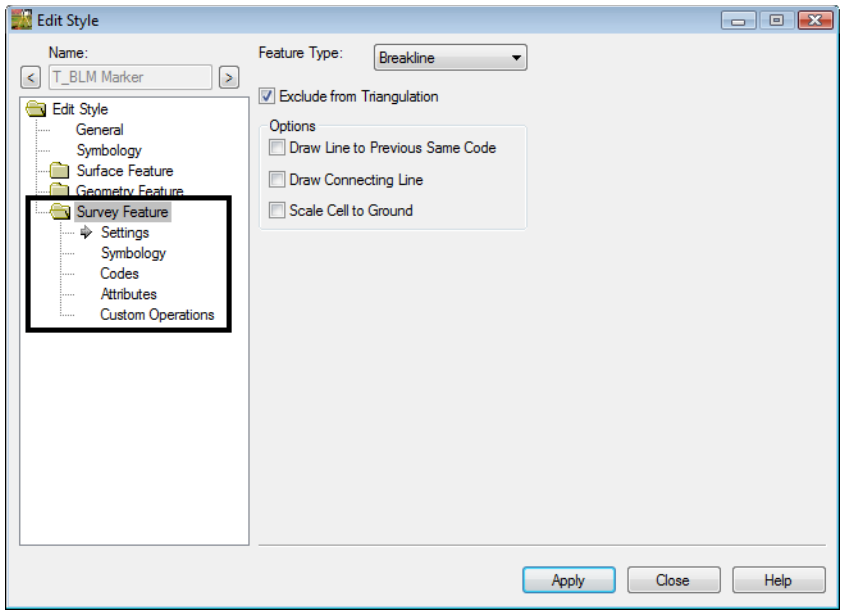
An InRoads Survey Fieldbook can be written to 3 different deliverables. These are; Planimetrics (CAD file), to a Surface (DTM), and to Geometry project (ALG). For each of these outputs unique graphic attributes can be associated during the export. Each definition corresponds to a Named Symbology in the CDOT_Civil.xin file. This will be covered later in this chapter.

- ***Attach Tag***

Attaches a MicroStation tag value to the feature when written to the design value, such as DTM type, Point name, Preference, and Description. To review attached tags use the Review Tags button from the Main toolbar in MicroStation.



Detailed information about survey features can be viewed by expanding the ***Survey Feature*** leaf.




## *Edit Style dialog*

- ***Name:***

  The selected ***Style***.

- ***Feature Type***

  - **Random**

    ***Regular*** or ***spot*** elevations. These points do not have a direct relationship with adjoining points other than a linear interpolation. For example: high or low elevations, topography shots such as trees, valves, signs, etc.

  - **Breakline**

    Breaklines are comprised of linear features where a change in grade may occur. For example: curb lines, a roadway crown, edge of pavement, ditches, ridges, toe of slope, etc. A breakline must contain at least 2 points and will restrict triangulation from crossing.

  - **Interior**

    Interior boundaries are comprised of a closed shape. They define obscure areas (voids) in a surface model. Triangulation does not occur inside interior boundaries thereby eliminating any contouring, surface modeling, or volume computations within said interior feature. Multiple interior boundaries can exist in a surface model.

    For Example: Bodies of water, building pads, areas not surveyed, etc.

  - **Exterior**

    By definition, an exterior boundary must be a closed shape. It defines the limits of the data InRoads can work with. Only one exterior boundary can exist in a surface model. For example: limits of survey data or limits of slope intercepts for a new design.

- **Exclude from Triangulation**

  These shots will collect the X,Y, and Z position of the feature but when it comes time for InRoads to triangulate the DTM these points will be left out of the surface model. Think of underground utilities or a shot on the top nut of a hydrant. If these shots were part of the triangulation there would be incorrect valleys and spikes in the DTM. However these points are stored in the DTM for other purposes such as profile or cross section display.

- **Draw Line to Previous Same Code**

  Controls planimetric line work for the specific feature. This option is used in conjunction with the control code **ST**.

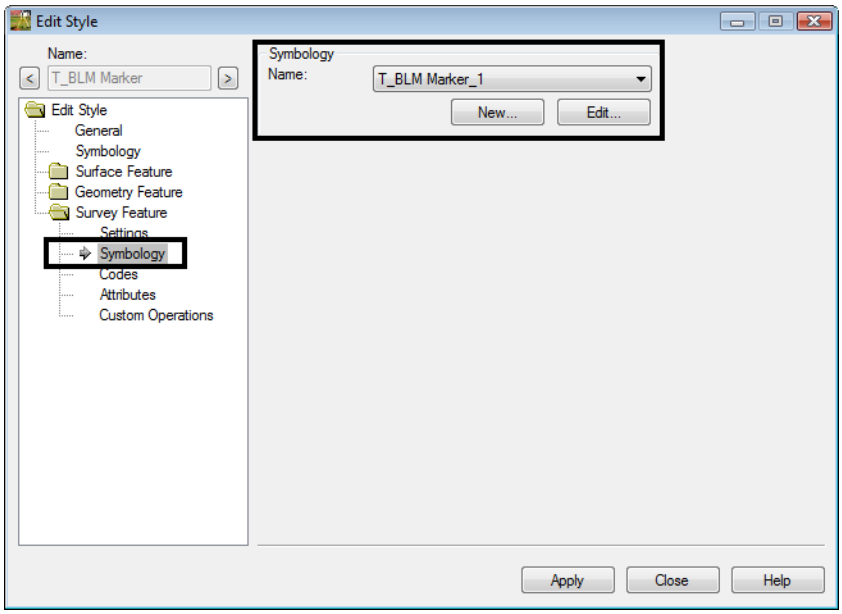
- **Draw Connecting Line**

  Controls planimetric line work for the specific feature. This option is used in conjunction with the control codes **JPT**, **JNC**, and – (dash).

- **Scale Cell to Ground**

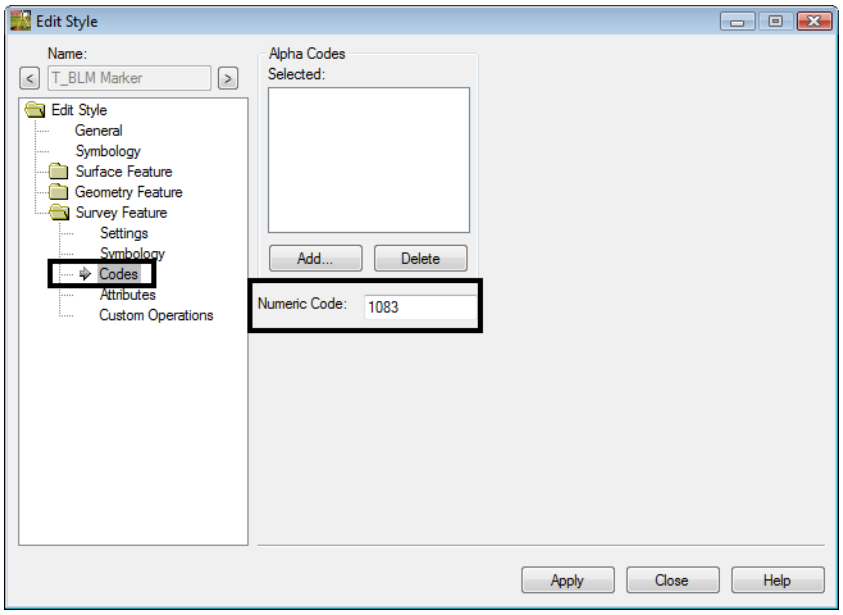
  Overrides all scale factors and uses a scale factor of 1 for cell placement

- ***Symbology leaf***




  - Defines the ***Named Symbology*** associated with the Style which in-turn defines graphic attributes for Plan line, text, and point symbology (cell) when writing the field book to a CAD file as planimetrics.

- ***Codes leaf***



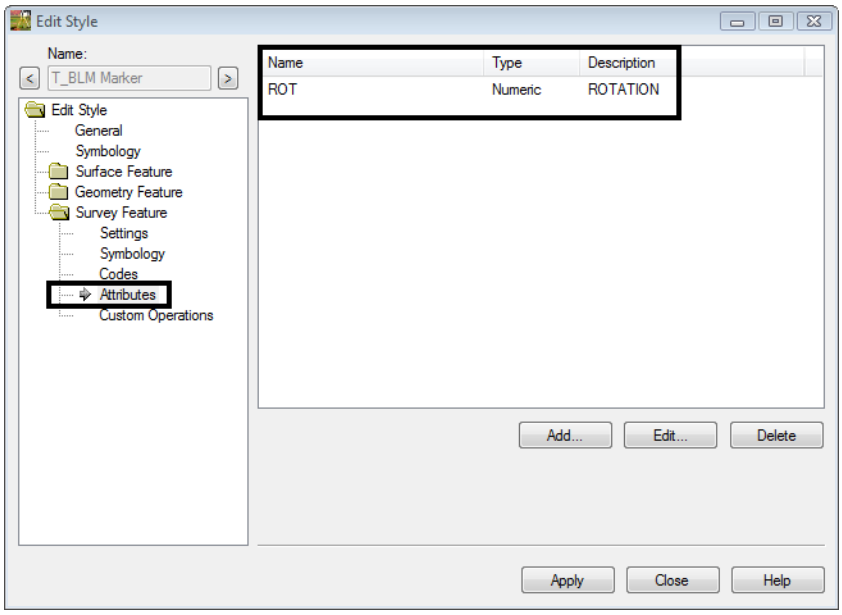

♦ **Alpha Code**

Alpha codes are used as an additional way to collect the survey data in the field. Alpha feature codes are not to be used as part of the CDOT collection process.

♦ **Numeric Code**

Associates a unique numeric code with the Feature Style.

- ***Attributes leaf***



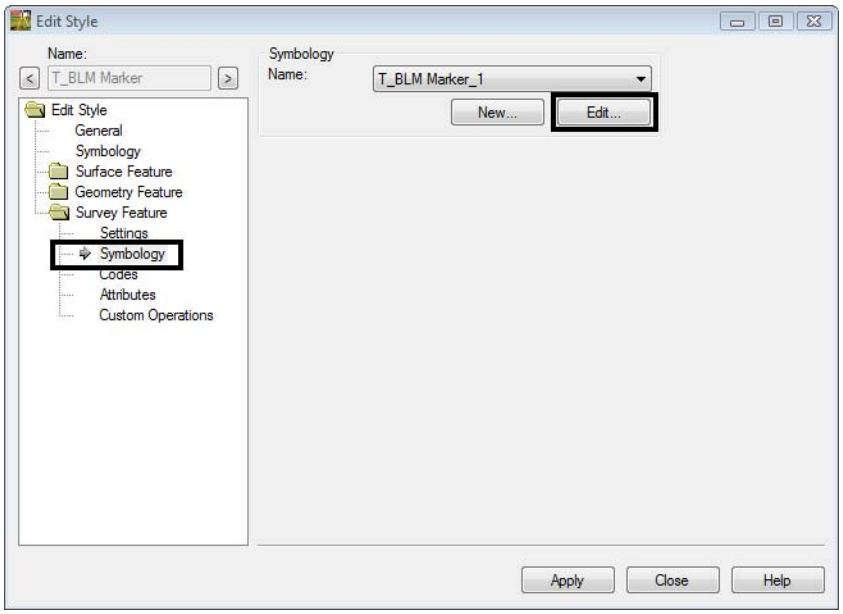

  - ♦ Attributes are used to help further define or control survey features collected in the field. Attributes can be collected as numeric or alpha data. As an example, additional information such as size, flow, and silt levels in a culvert pipe can be added to a single shot taken in the field. Any survey shots taken in the field without attributes defined will display an ***'A'*** in the status column of the electronic fieldbook. If a value is defined, a ***'V'*** will display in the fieldbook.

- ***Custom Operations leaf***

  - ♦ Custom operations can be thought of as a script file or a list of commands that are run on a certain survey feature. It can be used to control graphic types, symbology, text, placement, and also perform math functions. MicroStation and InRoads key-ins are used to enter commands strings. To view examples of custom operations **<D>** the **Help** button.

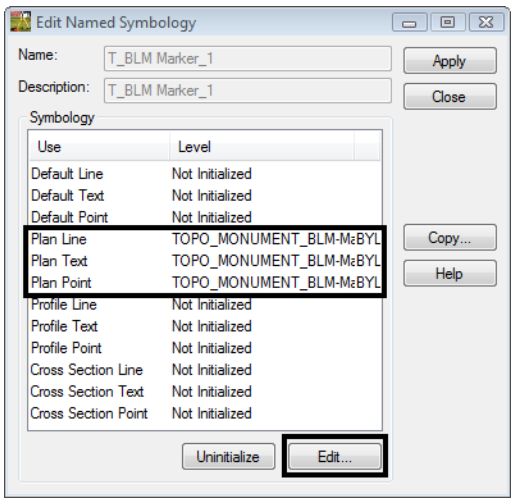
- ***Graphic Attributes***

  As mentioned previously, an InRoads Survey Fieldbook can be written to 3 different deliverables. These are: Planimetrics (CAD file), to a Surface (DTM), and to Geometry project (ALG). For each of these outputs unique graphic attributes can be associated during the export. This style corresponds to a Named Symbology in the CDOT_Civil.xin file.



### Edit Style dialog

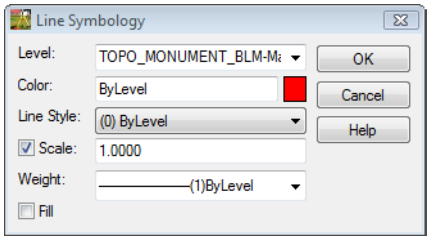
Selecting the ***Edit*** button in the symbology portion of the Edit Style dialog opens the identified Named Symbology.




Identifying a specific attribute and selecting ***Edit*** opens additional detailed information on how the graphics will be written as linework, text, or cell to the CAD file.

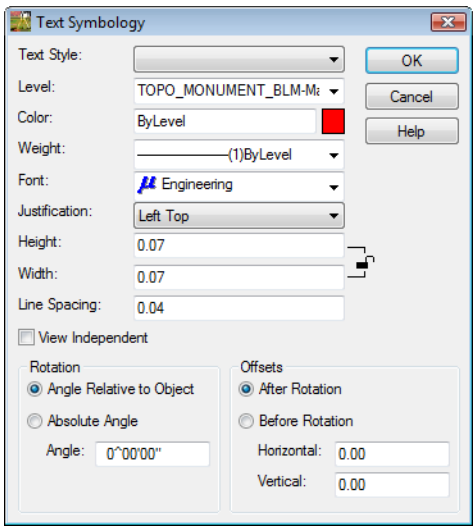
- ***Line Symbology***

  Controls the Level, Color, Style, and weight of lines or arcs for individual features written to graphics.



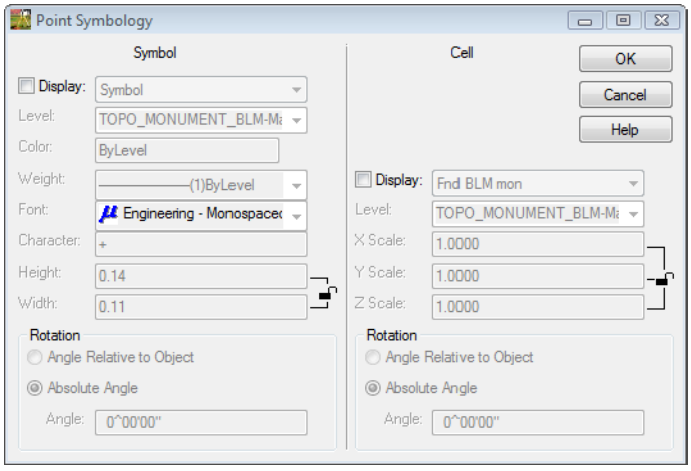
- ***Text Symbology***

  Controls the symbology, text size, and font for any text displayed with through the use of custom operations.




- ***Point Symbology***

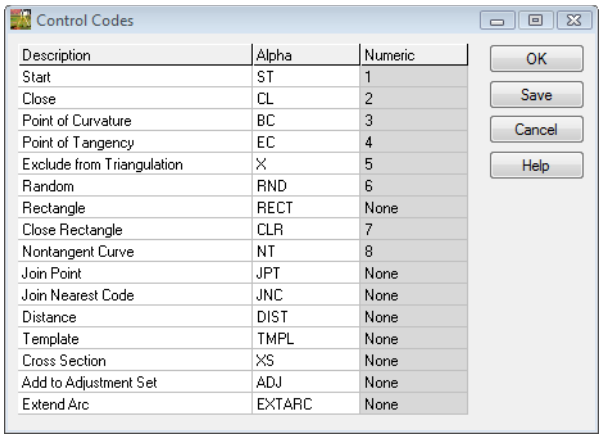
  Controls the symbology, text size, and font for any text displayed with through the use of custom operations.




***Note:*** The radio buttons for both Symbol and Cell display is disabled for all survey items represented by cells in the CDOT configuration. The placement of these is accomplished through the use of ***Custom Operations*** so field-collected attributes such as rotation can be applied at time of cell placement.
A symbol is a custom font character, similar to a True Type Font Wingdings. Symbols can be used in addition to any cells being placed. CDOT does not currently use any Symbols.

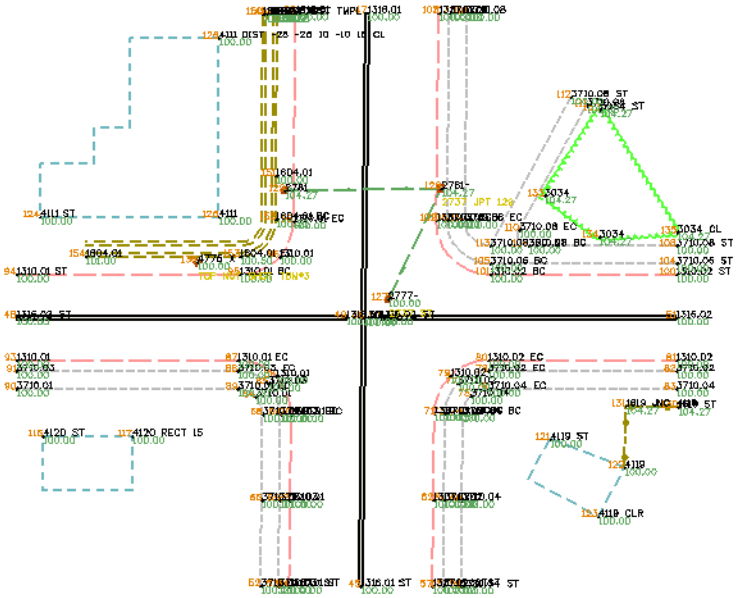
## *Control Codes*

Control Codes are also stored in the CDOT_Civil.xin file. To access these select **Survey > Control Codes**. Control codes are used in conjunction with CDOT's ***Numeric feature codes***. By using control codes the surveyor can define such items as the beginning of strings, points of tangency, offset shots as well as other shot modifiers. Control codes can be either alpha (upper or lower case) or numeric characters and are input following the feature code. Each code has an example below.




| Description | Alpha | Numeric |
|---|---|---|
| Start | ST | 1 |
| Close | CL | 2 |
| Point of Curvature | BC | 3 |
| Point of Tangency | EC | 4 |
| Exclude from Triangulation | X | 5 |
| Random | RND | 6 |
| Rectangle | RECT | None |
| Close Rectangle | CLR | 7 |
| Nontangent Curve | NT | 8 |
| Join Point | JPT | None |
| Join Nearest Code | JNC | None |
| Distance | DIST | None |
| Template | TMPL | None |
| Cross Section | XS | None |
| Add to Adjustment Set | ADJ | None |
| Extend Arc | EXTARC | None |

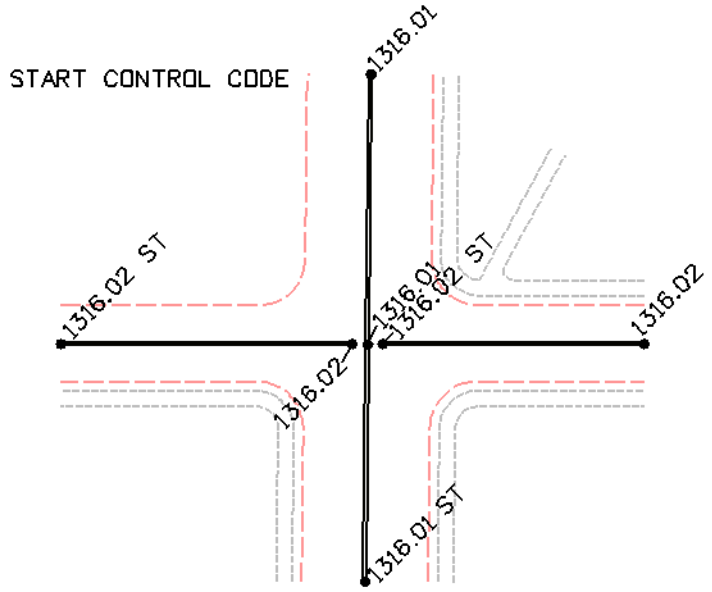
***Intersection Control Code example***



- Start

  Alpha ***ST*** | Numeric ***1***

  Control Code ***Start*** begins planimetric lines; there is no code to end a string. InRoads Survey will continue a string until no further data is collected using that code and string identifier. If the same code and string identifier is entered using the ST control code, the previous string will be terminated and a new string begun. See the example below for feature code 1316.02 (feature.string# ST)

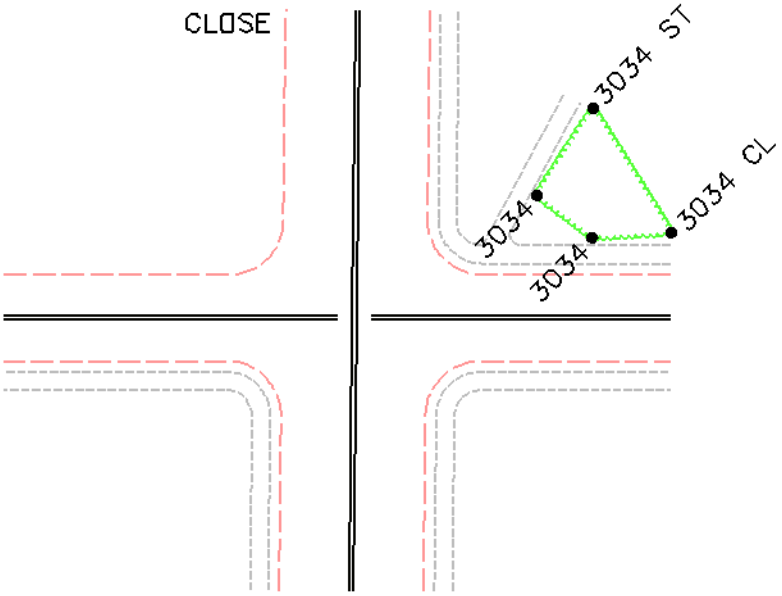



***Note:*** It is not mandatory that string identifiers be used. This is only necessary if you wish to collect data using identical feature codes and need to develop multiple strings simultaneously. Examples of this may be when surveying in a crisscross fashion and wish to collect multiple 1310 (edge of oil) strings. If surveying in a linear fashion (collecting the entire length of the physical feature) a code such as 1310 st could be used and reused when moving from one pavement edge to another

- Close

  Alpha ***CL*** | Numeric ***2***

  Control Code Close will create a closed shape from the last shot to the first shot of the feature. Closed shapes in InRoads can be used as Interior or Exterior DTM point types. Closed shapes in MicroStation will become linestrings.




***Note:*** Only a survey feature with a point type Breakline will honor the Close control code when it is pushed to a surface.

- Point of Curvature

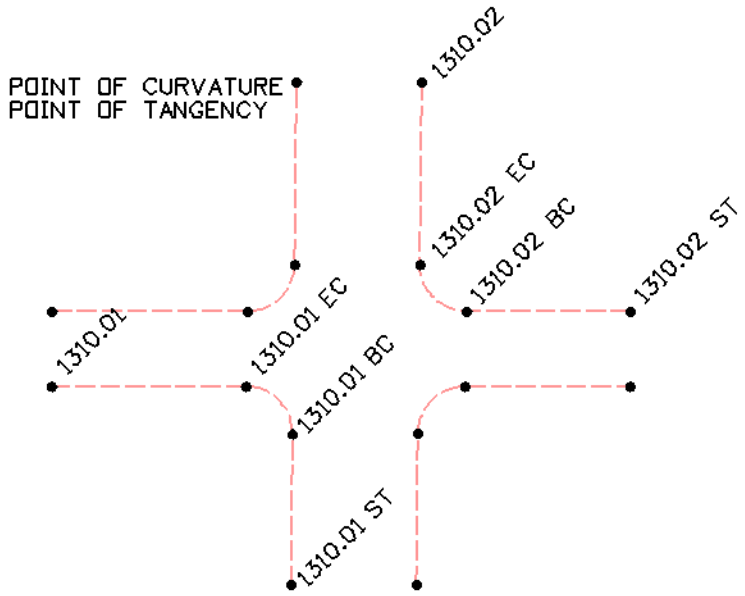
  Alpha ***BC*** | Numeric ***3***

  Control code Point of Curvature identifies the beginning of the curve. The incoming tangent of the curve controls the degree of curve.

- Point of Tangency

  Alpha ***EC*** | Numeric ***4***

  Control code Point of Tangency identifies the end of the curve. The outgoing tangent of the curve controls the degree of curve



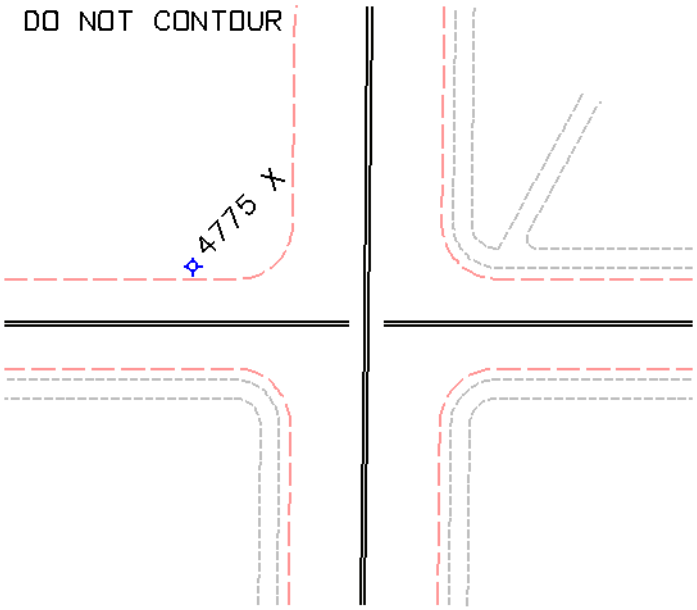

***Note:*** If a single point on arc is taken then the tangent lines are ignored and the curve is generated by the three points PC, POC, and PT.

***Note:*** If more than one point is taken on the arc then the tangent lines are used when calculating the PC and PT of the curve. CDOT has standardized using the control code NT non-tangent to follow all BC and EC shots. Coding with NT will not add calculated PC's and PT's to the linear features. The PC's and PT's will be observed points as in the field.

- Exclude from Triangulation

  Alpha ***X*** | Numeric ***5***

  Control code Exclude from Triangulation identifies points that will not (and should not) be used to generate surface contours. Any point not resting on the terrain should be excluded from triangulation. Points that are coded with "**X**" could include such items as fire hydrants, manhole inverts, benchmarks and control points, valve boxes, and other similar features.



- Random

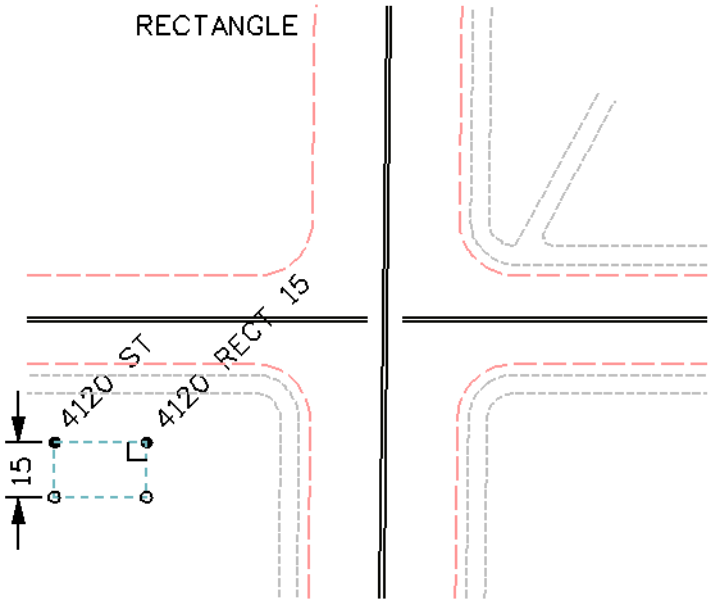
  Alpha ***RND*** | Numeric ***6***

  Control code Random overwrites DTM point types set in the Survey Feature table. For example Breaklines become Random types and Do Not Contour point types become Random points Excluded from triangulation.

- Rectangle

  Alpha ***RECT*** | Numeric ***None***

  Control code Rectangle will draw a rectangle based on two points shot in the field and a measured distance. The two points collected in the filed define the direction of the baseline and the measured distance defines the width. The previous two points collected in the filed define the direction of the baseline. To turn left of the baseline use a negative number (-15); to turn right of the baseline use a positive number (15). Each added point using the Rectangle command will be considered a derived point in Survey.

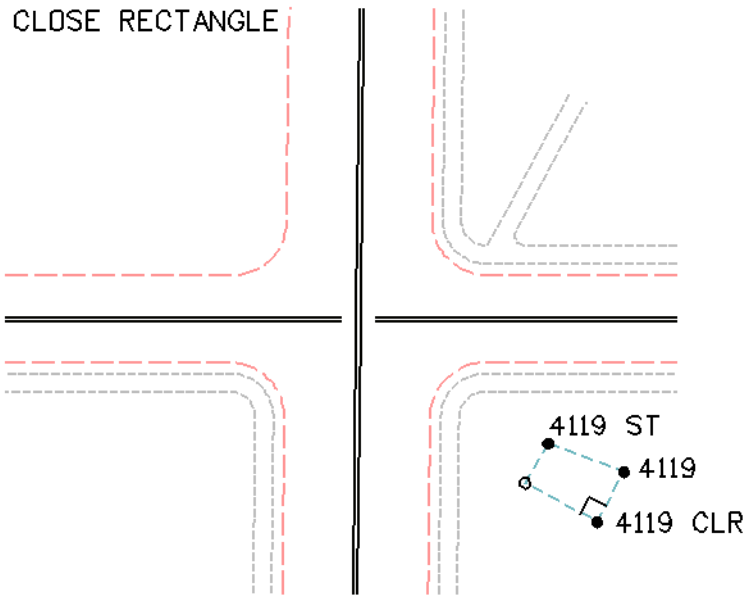



***Note:*** Only a survey feature with a point type Breakline will honor the Rectangle control code when it is pushed to a surface.

- Close Rectangle

  Alpha ***CLR*** | Numeric ***7***

  Control code Close Rectangle will draw a trapezoid based on three points shot in the field. The last two points become the baseline and the fourth point generated will be 90 degrees to the baseline.

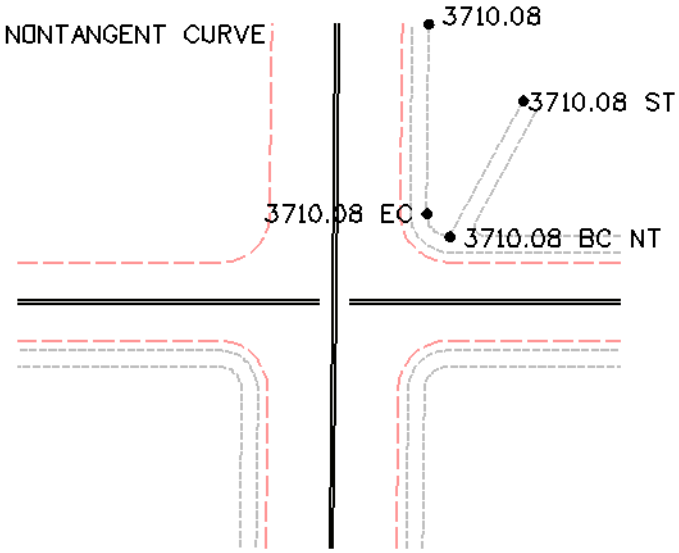



***Note:*** Only a survey feature with a point type Breakline will honor the Close Rectangle control code when it is pushed to a surface.

- Nontangent Curve

  Alpha ***NT*** | Numeric ***8***

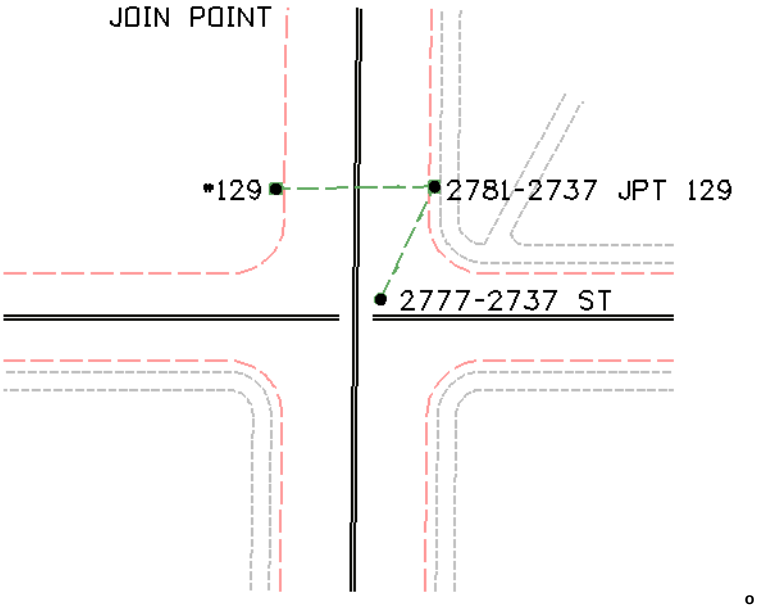
  Control code Nontangent Curve identifies a curve that will be nontangent to either the incoming or outgoing tangent lines. This control code works in conjunction with BC or EC.



- Join Point

  Alpha ***JPT*** | Numeric ***None***

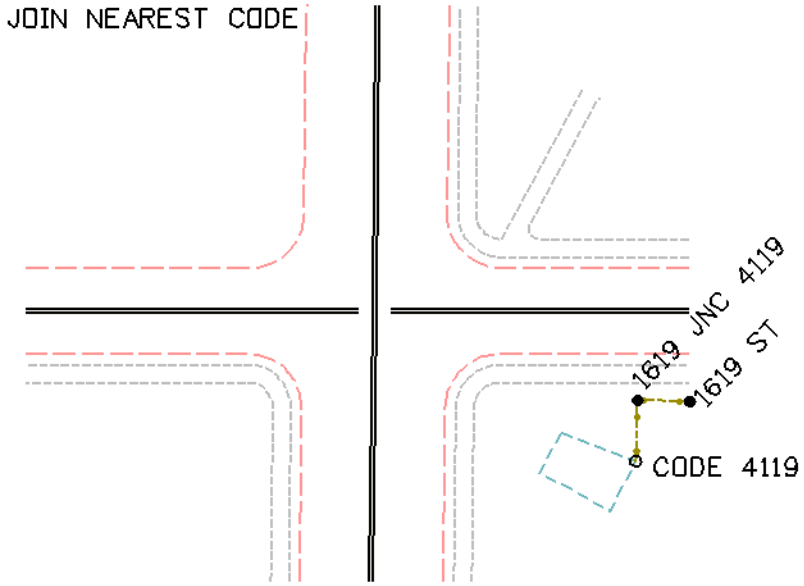
  Control code Join Point will draw a connecting line to the specified point number in the fieldbook using the current feature style.



- Join Nearest Code

  Alpha ***JNC*** | Numeric ***None***

  Control code Join Nearest Code will locate the closest code specified and draw a connecting line using the current feature style.

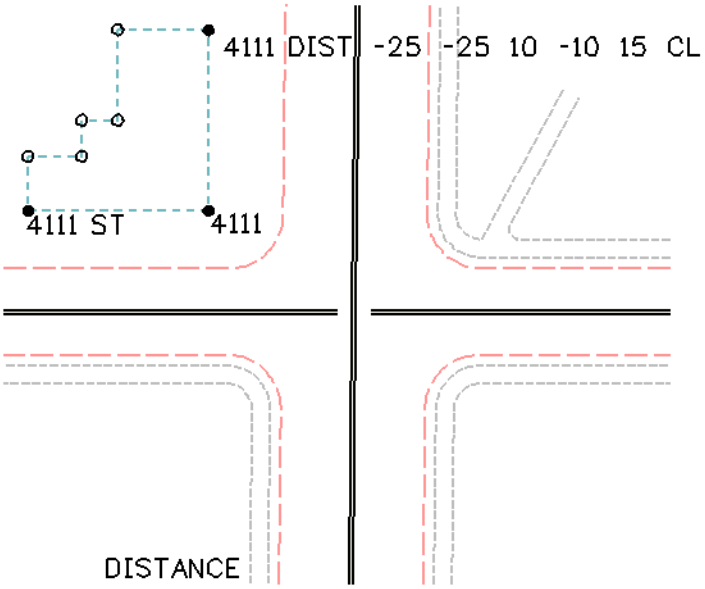


- Distance

  Alpha ***DIST*** | Numeric ***None***

  Control code Distance will continue to draw lines based on measured distances and direction. The previous two points collected in the filed will define the direction the next point will be calculated from. The angle will always be a 90 degree deflection angle, turned looking forward from the last point collected or calculated. To turn left of the baseline use a negative number (-25) to turn right of the baseline use a positive number (10). ***Each point using the Distance command will be considered a derived point in Survey and will also be used in calculation of DTM surfaces and ALG geometry alignments.***

  ***Note:*** Attention should be paid to the elevations assigned by this method that the surface is only as good as this info is. There may be work-arounds for these instances, but if accurate info is needed, the effort should be made in the field to collect actual data.

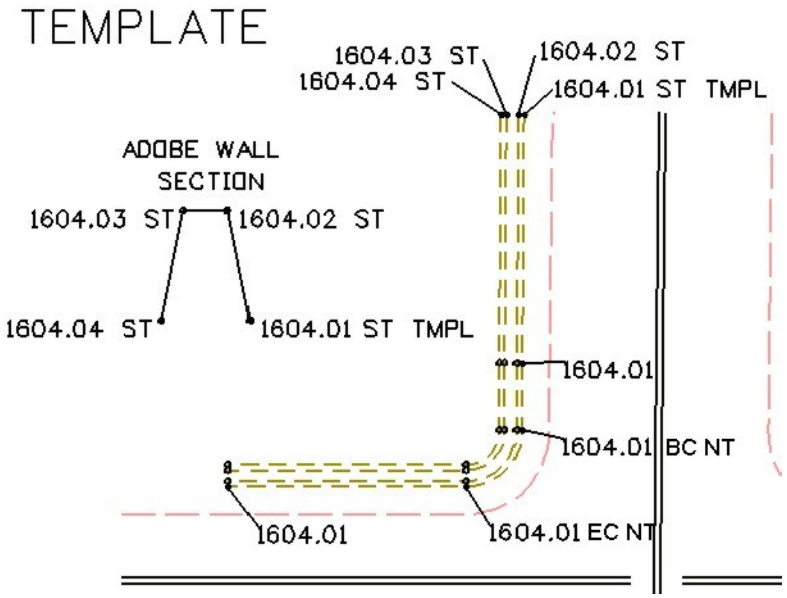



  ***Note:*** Only a survey feature with a point type Breakline will honor the Distance control code when it is pushed to a surface.

- Template

  Alpha ***TMPL*** | Numeric ***None***

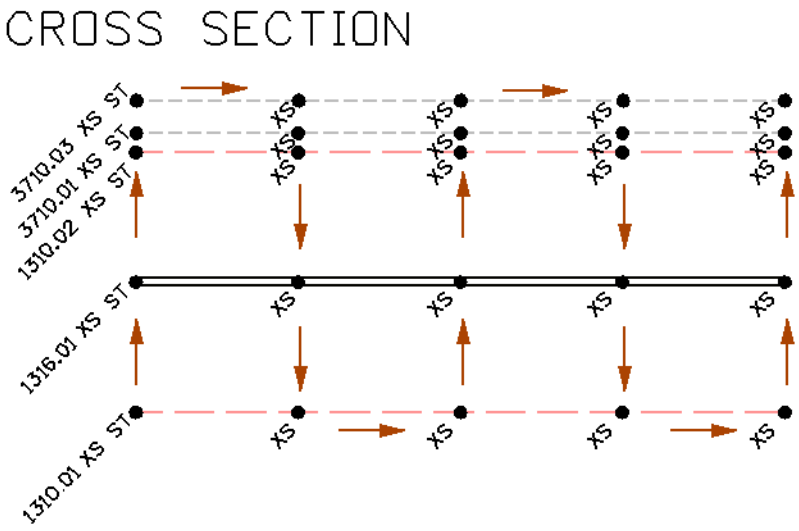
  Control code Template defines multiple survey features that are uniform in distance and elevation from a baseline. Using the template control code will lessen the number of shots needed in the field.



- Cross Section

  Alpha ***XS*** | Numeric ***None***

  Control code Cross Section allows any uniform set of corridor shots to be collected efficiently. Start by collecting the start of each new feature, and then continue to collect the shots in a crossing pattern.




***Note:*** When the raw data is imported into the field book it will convert the code XS to the correct feature code.

- Add to Adjustment Set

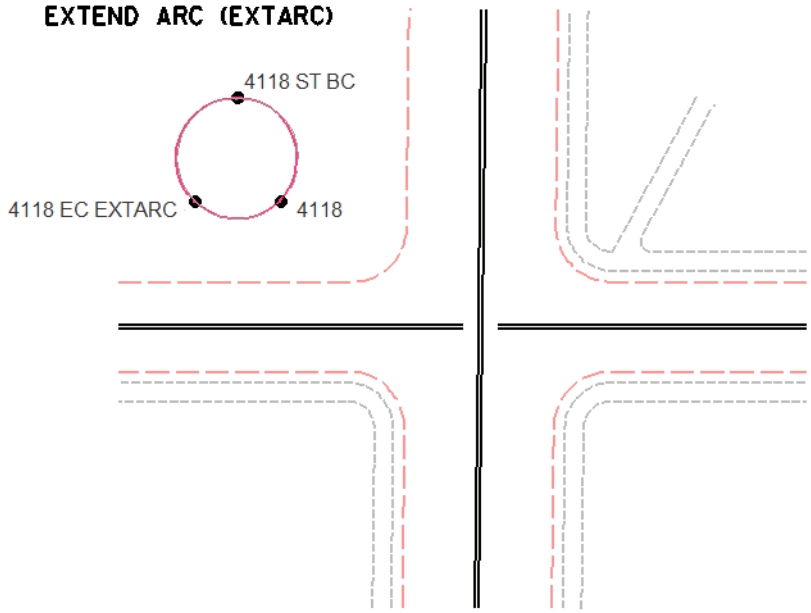
  Alpha ***ADJ*** | Numeric ***None***

  Control code Add to Adjustment Set defines a sideshot of an unknown point to be included to the adjustment set data.

- Extend Arc

  Alpha ***EXTARC*** | Numeric ***None***

  Extend Arc command works with the code PC to create a circular shape. The shape is created by joining two arcs which are defined by three shots taken in the field

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***Note:*** When the feature is pushed to a DTM the feature will not keep the circular shape. The DTM feature will be made up of two line segments.