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...**

📓 Style Manag	er			- • •
Show Styles wi		Surface Properties	Geometry Tabling Point Tabling	Close
Include Geo	metry Point	Display Cross Section	Line Tabling	New
Include Geo	metry Line	Display Profile	Arc Tabling	Edit
Include Geo	metry Arc	Pay Item	Spiral Tabling	Copy
Include Geo	metry Spiral	Survey Properties		Copy Settings
Include Surv	rey	Custom Operations	Attributes	Delete
				Rename
Preference File:	C:\Workspace\W	Vorkspace-CDOT_XM\Stanc	dards-Global\InRoads\Prefer	Help
Preference File: Numeric Code	C:\Workspace\W Name	Vorkspace-CDOT_XM\Stand	dards-Global\InRoads\Prefer Survey Named Symbology	ences\CDO [.] Help
				ences\CDO [.] Help
Numeric Code	Name	Description		ences\CDO [·] Help Surface Named Symbol
Numeric Code 0	Name T_City limit T_County Line	Description City limit		ences\CDO' Help Surface Named Symbol ^ T_City limit
Numeric Code 0 0	Name T_City limit T_County Line	Description City limit County Line		ences\CDO Surface Named Symbol ~ T_City limit T_County Line
Numeric Code 0 0 0	Name T_City limit T_County Line T_Exterior Boun. T_random	Description City limit County Line Topo exterior boundary	Survey Named Symbology	ences\CDO Surface Named Symbol A T_City limit T_County Line T_Misc Topography
Numeric Code 0 0 0 0	Name T_City limit T_County Line T_Exterior Boun. T_random T_Sign>Class II .	Description City limit County Line Topo exterior boundary Random Survey feature	Survey Named Symbology	Help Surface Named Symbol T_City limit T_County Line T_Misc Topography T_Random
Numeric Code 0 0 0 0 0	Name T_City limit T_County Line T_Exterior Boun. T_random T_Sign>Class II .	Description City limit County Line Topo exterior boundary Random Survey feature Sign-Class II Less than 6	Survey Named Symbology	Help Surface Named Symbol T_City limit T_County Line T_Misc Topography T_Random T_Sign>Class II Less tha
Numeric Code 0 0 0 0 0 0	Name T_City limit T_County Line T_Exterior Boun. T_random T_Sign>Class II. T_Sign>Class III. T_State Line	Description City limit County Line Topo exterior boundary Random Survey feature Sign-Class II Less than 6 Sign-Class III Less than	Survey Named Symbology	Help Surface Named Symbol T_City limit T_County Line T_Misc Topography T_Random T_Sign>Class II Less tha T_Sign>Class III Less tha

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.

Show Styles wi		s Surface Properties	G	eometry Tabling Point Tabling		Close	
Include Geo	metry Point	Display Cross S	ection	Line Tabling		New	
Include Geo	metry Line	Display Profile		Arc Tabling		Edit	
🔲 Include Geo	metry Arc	Pay Item		Spiral Tabling		Copy	
Include Geo	metry Spiral	Survey Properties			1	Copy Setting	gs.
Include Sun	/ey	Custom Operation	ons 🗸	Attributes		Delete	_
aference File:	C:\Worken	ace/Workenace.CDOT XI	M\Standarde.(Slobal\InBoade\P	references\CDO	Rename.	
	C:\Workspa	ace\Workspace-CDOT_XM Description		Global\InRoads\P ned Symbology	references\CDO [`] Surface Named	Help	
Numeric Code	Name			ned Symbology		Help	
Numeric Code 082	Name T_NOAA	Description	Survey Nan	ned Symbology rker_1	Surface Named	Help	
Numeric Code 082 083	Name T_NOAA T_BLM M	Description NOAA marker	Survey Nan T_NOAA ma	ned Symbology rker_1 :er_1	Surface Named T_NOAA marker	Help	
Numeric Code 082 083 084	Name T_NOAA T_BLM M T_Witnes	Description NOAA marker .BLM Marker	Survey Nan T_NOAA ma T_BLM Mark	ned Symbology rker_1 ter_1 tomer_1	Surface Named T_NOAA marker T_BLM Marker	Help Symbology er	
Numeric Code 082 083 084 085	Name T_NOAA T_BLM M T_Witnes T_Towns	Description NOAA marker BLM Marker Witness Comer	Survey Nan T_NOAA ma T_BLM Mark T_Witness C T_Township	ned Symbology rker_1 cer_1 comer_1 Comer_1	Surface Named T_NOAA marker T_BLM Marker T_Witness Come T_Township Com	Help Symbology er ner	
Numeric Code 082 083 084 085 086	Name T_NOAA T_BLM M T_Witnes T_Towns T_Control	Description NOAA marker .BLM Marker .Witness Comer .Township Comer	Survey Nan T_NOAA ma T_BLM Mark T_Witness C T_Township . T_Control Me	ned Symbology rker_1 ter_1 comer_1 Comer_1 on.>Secondary	Surface Named T_NOAA marker T_BLM Marker T_Witness Come T_Township Com	Help Symbology er ner Secondary	
reference File: Numeric Code 1082 1083 084 085 086 086 086 087 088	Name T_NOAA T_BLM M T_Witnes T_Towns T_Control T_Control	Description NOAA marker BLM Marker Witness Comer Township Comer Control Monument-Seco	Survey Nan T_NOAA ma T_BLM Mark T_Witness C T_Township . T_Control Mo T_Control Mo	ned Symbology rker_1 ker_1 comer_1 Comer_1 comer_1 on.>Secondary on.>Federal_1	Surface Named T_NOAA marker T_BLM Marker T_Witness Come T_Township Con . T_Control Mon.>	Help Symbology er ner Secondary Federal	

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.

🧱 Edit Style			
Name:	Description: BLM Marker Include Definition For Include Definition For Include Definition For Include Definition Feature Geometry Point Feature Geometry Arc Feature Geometry Spiral Feature Include Definition Survey Feature Include Definition For Survey Feature		
		Apply	Close Help

• 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.

Review Tags	Value:	
type	Do Not Contour	-
group	12345SURVFieldbook01	Ξ
name	3154_2	
preference	T_ROW Marker	
description	Right of Way Marker	_
•	III	F
	<u>O</u> K	

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

🔣 Edit Style		
Name: T_BLM Marker General Symbology Survey Feature Survey Feature Survey Feature Symbology Codes Attributes Custom Operations	Feature Type: Breakline	
		Apply Close Help

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**.

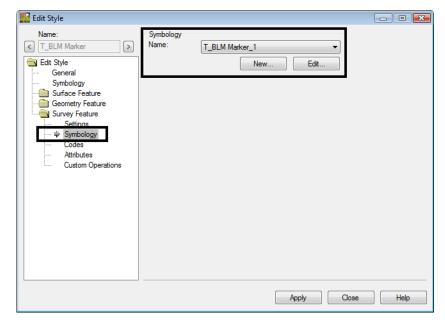
• Draw Connecting Line

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

🧱 Edit Style		- • •
Name:	Alpha Codes Selected: Add Delete Numeric Code: 1083	
	Apply Close	Help

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

🔣 Edit Style				
Name: T_BLM Marker	Name ROT	Type Numeric Add.	Description ROTATION	
		Арр	ly Close	Help

- 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						
Edit Style	Symbology Name:	T_BLM Mar	ker_1	Edit		
				Apply	Close	Help

Edit Style dialog

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

🔣 Edit Nam	ed Symbo	blogy	
Name:	T_BLM N	Marker_1	Apply
Description:	T_BLM N	/larker_1	Close
Symbology			
Use		Level	
Default Line	•	Not Initialized	
Default Tex	t	Not Initialized	
Default Poir	nt	Not Initialized	
Plan Line		TOPO_MONUMENT_BLM-MaBYL	Copy
Plan Text		TOPO_MONUMENT_BLM-MaBYL	Help
Plan Point		TOPO_MONUMENT_BLM-MaBYL	нер
Profile Line		Not Initialized	
Profile Text		Not Initialized	
Profile Point		Not Initialized	
Cross Section	on Line	Not Initialized	
Cross Section	on Text	Not Initialized	
Cross Section	on Point	Not Initialized	
		Uninitialize Edit	

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.

🔣 Line Syn	nbology	23
Level:	TOPO_MONUMENT_BLM-Ma 👻	ОК
Color:	ByLevel	Cancel
Line Style:	(0) ByLevel 🔹	Help
Scale:	1.0000	
Weight:	(1)ByLevel -	
🔲 Fill		

• Text Symbology

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

🔣 Text Symbolo	ду		×
Text Style:			• ОК
Level:	TOPO_MONU	IMENT_BLM-Ma	 Cancel
Color:	ByLevel		Help
Weight:		-(1)ByLevel	▼
Font:	🔑 Engineerin	ig .	•
Justification:	Left Top		•
Height:	0.07		
Width:	0.07		_ _
Line Spacing:	0.04		
View Independ	ent		
Rotation	e to Object	Offsets Ø After Rotation	n
Absolute Ang	le	Before Rota	tion
Angle: 0^0	0'00''	Horizontal:	0.00
		Vertical:	0.00

• Point Symbology

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

Point Syr	mbology				
	Symbol			Cell	ОК
Display:	Symbol	-			Cancel
Level:	TOPO_MONUMENT_BLM-Ma	-			Help
Color:	ByLevel				
Weight:	(1)ByLevel	-	Display:	Fnd BLM mon	
Font:	🔑 Engineering - Monospaced	-	Level:	TOPO_MONUMENT	[_BLM-Ma 👻
Character:	÷		X Scale:	1.0000	
Height:	0.14		Y Scale:	1.0000	- - -
Width:	0.11		Z Scale:	1.0000	
Rotation Angle R	elative to Object		Rotation C Angle F	Relative to Object	
Absolute Angle			Absolut	e Angle	
Angle:	0^00'00''		Angle:	0^00'00''	

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.

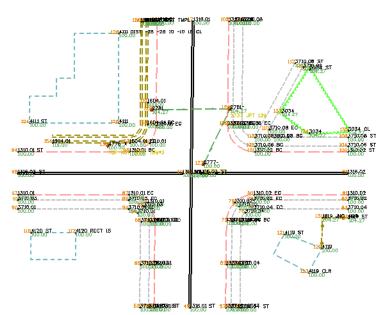
A symbol is a custom font character, similar to a True Type Font Wingdings. Symbols can be used in addition to any cells being placed. CDOT does not currently use any Symbols.

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	ОК
Start	ST	1	
Close	CL	2	Save
Point of Curvature	BC	3	Cancel
Point of Tangency	EC	4	
Exclude from Triangulation	×	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	

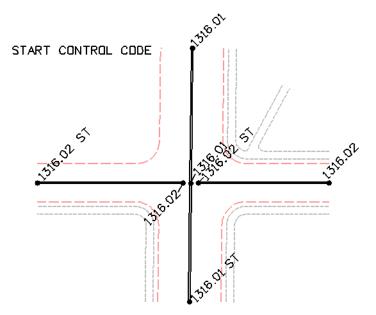
Intersection Control Code example



• 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)

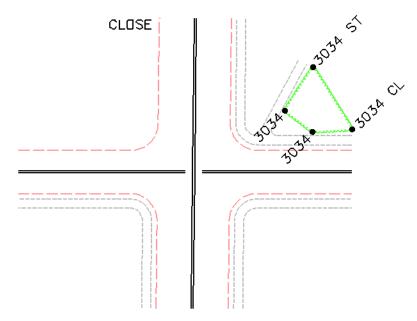


Note: It is not mandatory that string identifiers be used. This is only necessary if you wish to collect data using identical feature codes and need to develop multiple strings simultaneously. Examples of this may be when surveying in a crisscross fashion and wish to collect multiple 1310 (edge of oil) 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

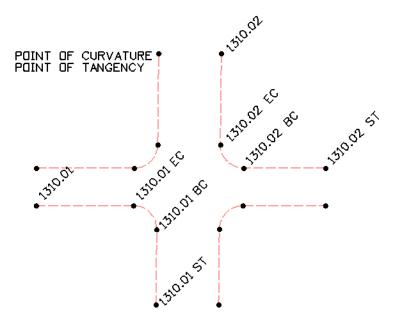
Alpha *BC* | Numeric *3*

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

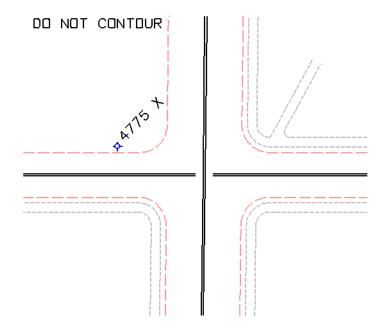


- **Note:** If a single point on arc is taken then the tangent lines are ignored and the curve is generated by the three points PC, POC, and PT.
- **Note:** If more than one point is taken on the arc then the tangent lines are used when calculating the PC and PT of the curve. CDOT has standardized using 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

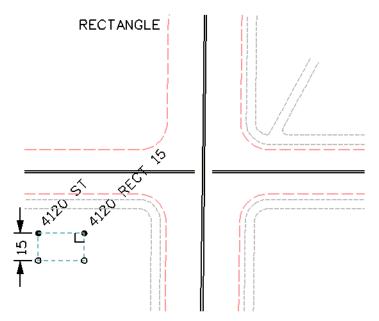
Alpha *RND* | Numeric *6*

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.

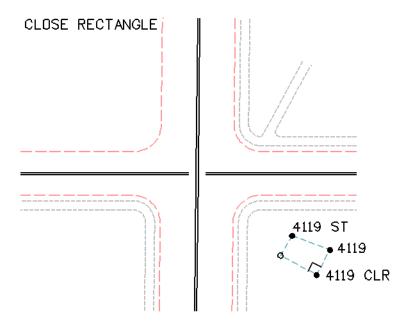


Note: Only a survey feature with a point type Breakline will honor the Rectangle control code when it is pushed to a surface.

• 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.

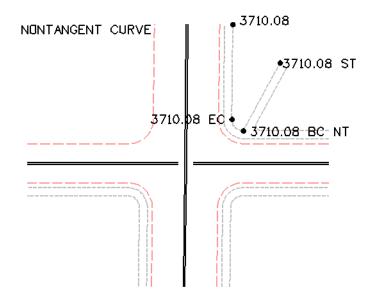


Note: Only a survey feature with a point type Breakline will honor the Close Rectangle control code when it is pushed to a surface.

• Nontangent Curve

Alpha *NT* | Numeric 8

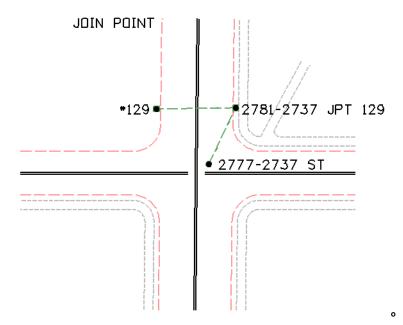
Control code Nontangent Curve identifies a curve that will be nontangent to either the incoming or outgoing tangent lines. This control code works in conjunction with BC or EC.



• Join Point

Alpha JPT | Numeric None

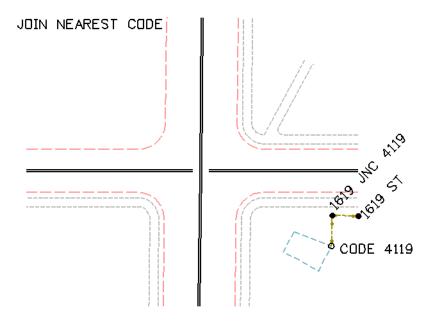
Control code Join Point will draw a connecting line to the specified point number in the fieldbook using the current feature style.



• 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.

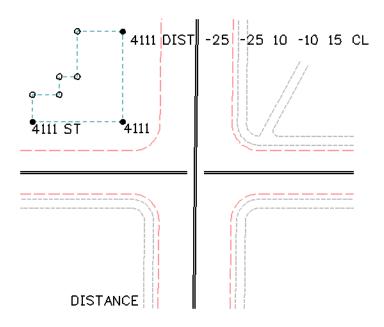


• Distance

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.

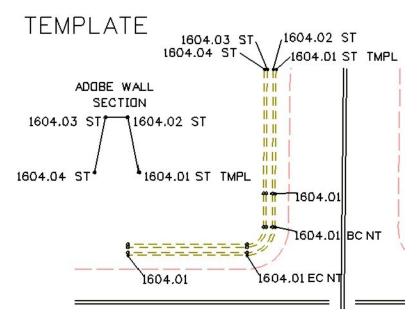


Note: Only a survey feature with a point type Breakline will honor the Distance control code when it is pushed to a surface.

• Template

Alpha *TMPL* | Numeric *None*

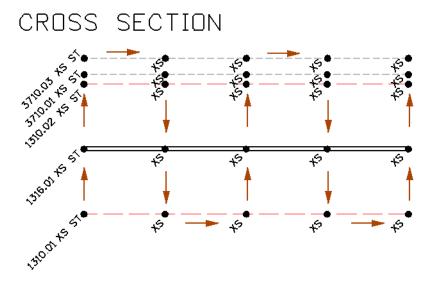
Control code Template defines multiple survey features that are uniform in distance and elevation from a baseline. Using the template control code will lessen the number of shots needed in the field.



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

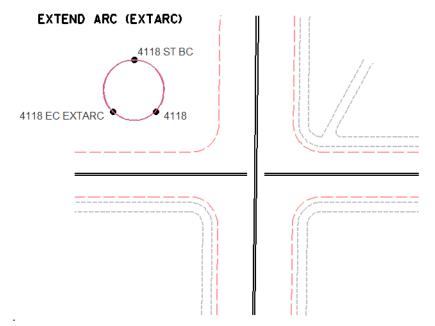
Alpha ADJ | Numeric None

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



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.