
Chapter 13

Horizontal Alignment Generator

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13.1 Objectives

Create and store horizontal alignment elements using COGO based graphical tools.

13.2 Definitions

The **Horizontal Alignment Generator** enables the user to create or modify horizontal alignments elements and automatically stores them in the active coordinate geometry (COGO) database. Because of this, a GEOPAK COGO session must be active before the generator can be used. Spirals, curves, tapers, and ramps can all be placed according to user-defined parameters.

As the tools in the generator are presented in the rest of the chapter the required mouse clicks will be described as follows:

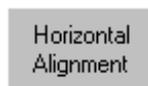
- Data point**—a regular mouse click, which is the left button on a standard mouse configuration
- Accept**—a regular mouse click, which is the left button on a standard mouse configuration
- Reject**—an alternate mouse click, which is the right button on a standard mouse configuration
- Reset**—an alternate mouse click, which is the right button on a standard mouse configuration
- Snap**—a center button click

13.3 Accessing

The **Horizontal Alignment Generator** can be accessed from the Road tool frame, from the MicroStation Application pull down menu, or from the Road Project flowchart. To access it from the Road tool frame, click on the third icon in the Horizontal & Vertical Geometry tools shown below.

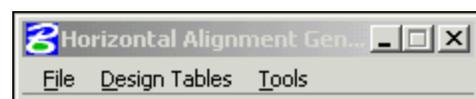


Or select **Applications > GEOPAK Road > Geometry > Layout Alignments Horizontal** from the MicroStation menu bar. To access it from the **Road Project** flow chart, click on the **Horizontal Alignment** button shown below.



If the user attempts to activate Graphical COGO without an active session of coordinate geometry, a warning dialog appears advising the user that a coordinate geometry session must be started.

13.4 Menu Bar



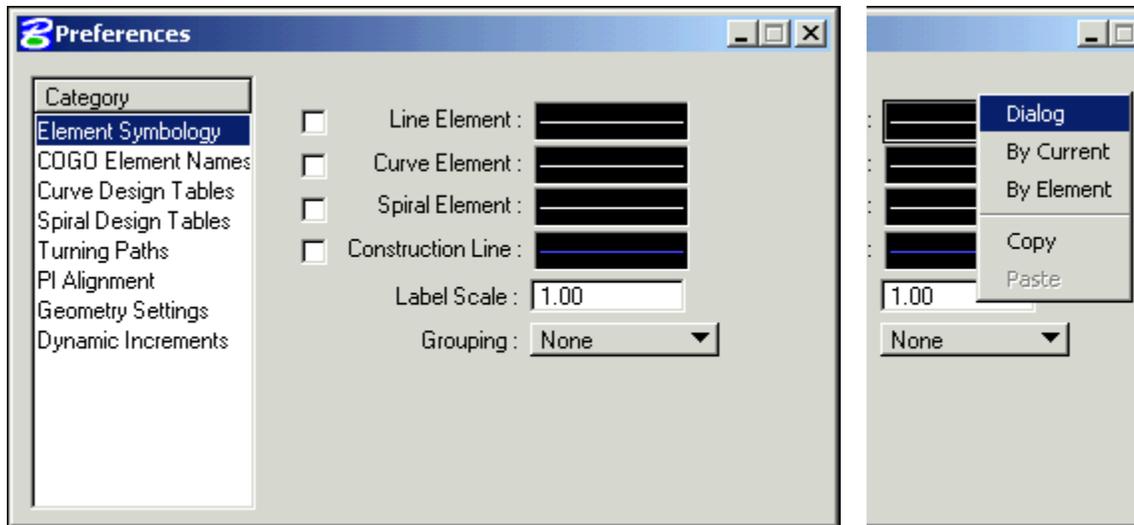
When the Horizontal Alignment Generator is started, the menu bar shown above will open. The **Horizontal Alignment Generator** menu bar has three items: **File**, **Design Tables**, and **Tools**.

13.4.1 File Menu

The **File** menu has one option: **Preferences**, which allows the user to change the following items.

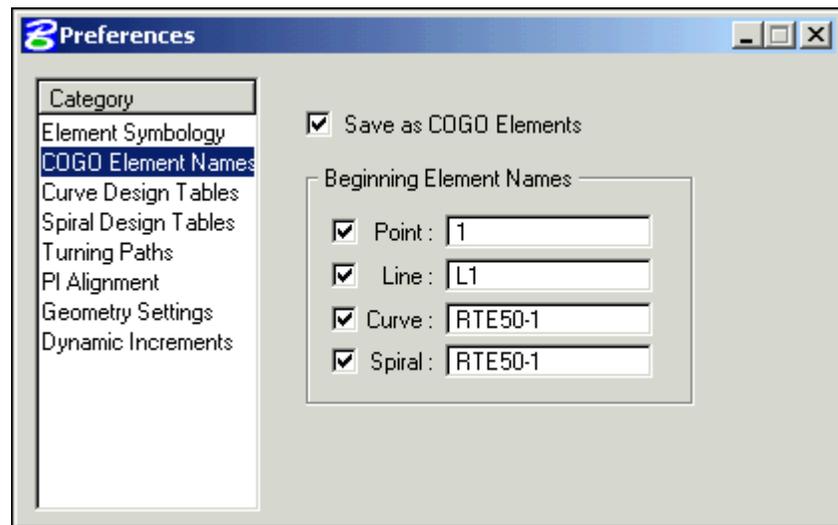
13.4.1.1 ELEMENT SYMBOLOGY

The Element Symbology section of the dialog, as shown below, allows the user to set the MicroStation symbology of NOT stored to the GPK. If the items are stored as COGO elements the settings in the MoDOT.smd file override any of these settings. To set the symbology for an item, do an alternate mouse click on the picture of the elements symbology, which brings up the menu shown below to the right. From the menu, the symbology can be set using the standard dialog, the current MicroStation symbology, the attributes of a selected element, or the symbology copied and pasted from another element. The **Label Scale** is applied to any text labels. The **Grouping** options are None and Graphic Group.



13.4.1.2 COGO ELEMENT NAMES

If the **Save as COGO Elements** toggle is activated, the Element Symbology settings described in the previous section are ignored. Default **Beginning Element Names** can be set by activating the type of element and entering a name for the first item of each type. For example, using the settings shown below, the first curve stored would be RTE50-1, the second would be RTE50-2, etc.



13.4.1.3 CURVE AND SPIRAL DESIGN TABLES

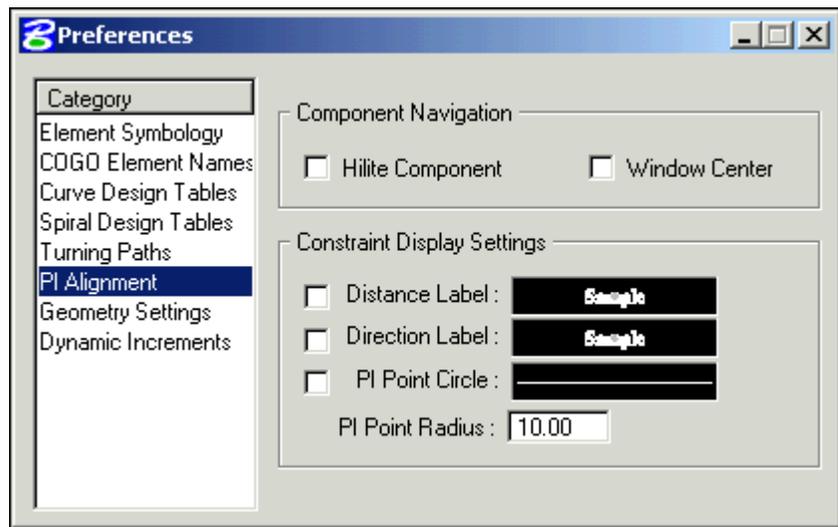
These two sections of the preference dialog set the design tables to be used for curves and spirals. The tables are used to calculate the required geometry parameters based tool settings. CADD Support has configured GEOPAK to make use of the current standard curve tables being utilized by MoDOT and the user does not need set these standards. Since MoDOT uses two super elevation max e values (8 and 4%) the user needs to select the appropriate table.

13.4.1.4 TURNING PATHS

Turning Paths is a new tool that has been added to GEOPAK and may be utilized by MoDOT at some point in the future. Because MoDOT currently uses Auto Turn, which is more versatile, the GEOPAK Turning Paths tool is not supported.

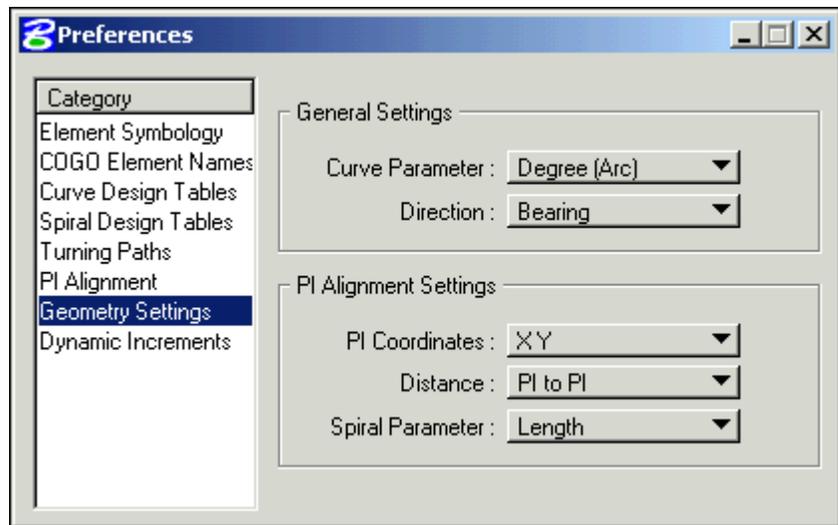
13.4.1.5 PI ALIGNMENT

The PI Alignment tool allows the user to create or modify a chain in a table format. See Section 7.9 to learn about the functionality of the tool. The **Component Navigation** part of the dialog controls whether or not the element corresponding to the line in the PI Alignment Table is hilited or centered in the active MicroStation window. The **Constraint Display Settings** controls whether or not the items listed are displayed and the attributes of the items if they are displayed.



13.4.1.6 GEOMETRY SETTINGS

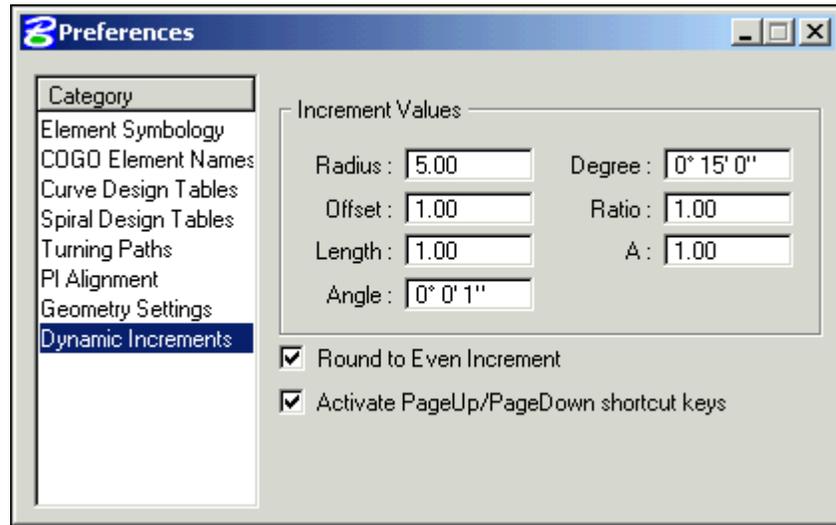
Geometry Settings controls the parameters for individual design elements. The **Curve Parameter** may be set to *Radius*, *Degree (Arc)*, or *Degree (Chord)*. The **Direction** may be displayed in *Bearing* or *Azimuth*. **PI Coordinates** may be given in *XY* or *NE* format. The straight **Distance** may be displayed as the distance form *PI to PI* or as the length of the *Tangent Segment*. The **Spiral Parameter** may be *Length* or *A*. Consult the MoDOT Project Development Manual for the current parameters to be used.



13.4.1.7 DYNAMIC INCREMENTS

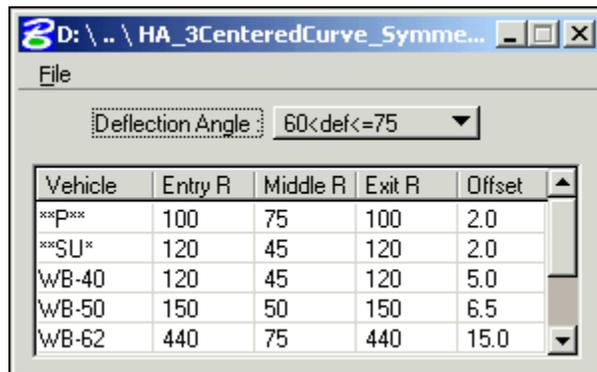
Dynamic Increments allows the user to set **Increment Values** for various design parameters.

The **Round to Even Increment** toggles controls whether the increment is rounded to the next even value (on) or applied to the current value without rounding to the next even value (off). **Activate PageUp/PageDown shortcut keys** allows the user to use the keyboard up and down arrow keys as shortcut keys for clicking on the increment up or down arrows in the individual tool dialog boxes.



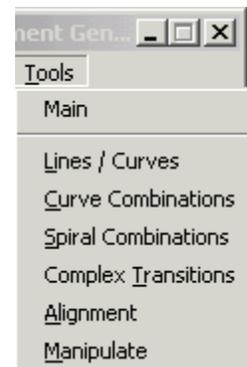
13.4.2 Design Tables

This pull down menu allows the user to view and/or set the Design Tables for a **Symmetrical 3 Centered Curve**, an **Asymmetrical 3 Centered Curve**, a **Symmetrical Taper Curve**, an **Asymmetrical Taper Curve**, and a **Spiral Curve**. Default design parameters are provided for various vehicle types and deflection angles. Users should not vary these values since they are based on the current AASHTO standards utilized by MoDOT.



13.4.3 Tools

The **Tools** menu (shown to the right) allows access to the Main Alignment tool frame (shown below) or to any of the individual Horizontal Alignment tool pallets. The rest of the chapter discusses the individual tool pallets.



13.5 Lines/Curves Tools

The **Line/Curves** tools allow the user to place line and curve elements by various methods. The **Line/Curves** toolbox (shown to the right) contains the following tools.



13.5.1 Store Line By 2 Points

Stores a line and its endpoints. It functions like its Graphical COGO counterpart except that the name of the line is determined by the COGO Element Names preference discussed above.



13.5.2 Store Tangent Line

Stores a line tangent to a curve and the endpoints of a line. It functions like its Graphical COGO counterpart except that the name of the line is determined by the COGO Element Names preference discussed above.



13.5.3 Store Curve By 3 Points

Stores a circular curve by selecting the beginning point, the ending point of the curve, and a point on the curve. It functions like its Graphical COGO counterpart except that the name of the line and the curve design parameter are determined respectively by the COGO Element Names and the Geometry Settings preferences discussed above.



13.5.4 Store Curve By Center

Stores a circular curve by defining the center point, radius, and delta angle. It functions like its Graphical COGO counterpart except that the name of the line and the curve design parameter are determined respectively by the COGO Element Names and the Geometry Settings preferences discussed above.



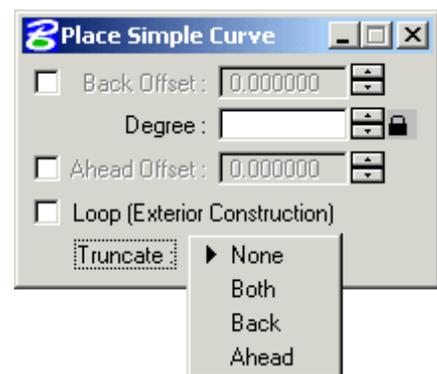
13.5.5 Store Tangent Curve Unconstrained

Places a curve tangent to a line or curve, and through a specified point. It functions like its Graphical COGO counterpart except that the name of the line and the curve design parameter are determined respectively by the COGO Element Names and the Geometry Settings preferences discussed above.



13.5.6 Place Curve Between Two Elements

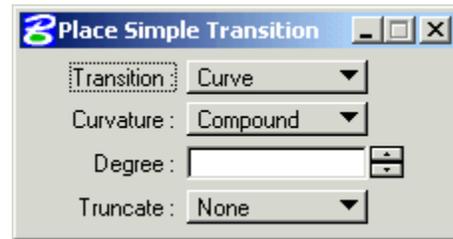
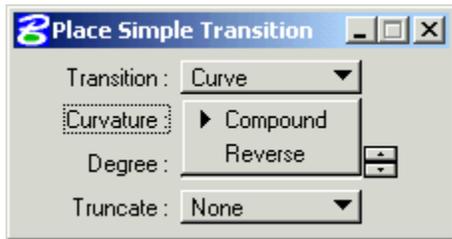
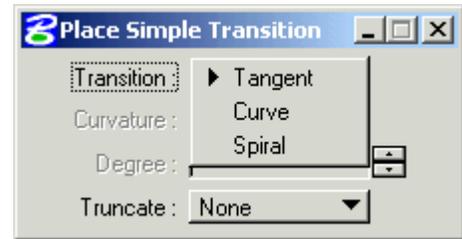
Places a circular curve between two elements. A **Back** and **Ahead Offset** may be specified as well as the curve design parameter (**Degree** or **Radius** of curve) set in the Geometry Settings preferences. The user may increment the values in these and similar fields by using the adjacent up and down increment buttons or up and down arrow keys if that option has been enabled. An exterior **Loop** can be constructed by activating that option. There are four **Truncate** options for the intersecting elements: **None**, **Both**, **Back**, and **Ahead**.



To use the tool, specify the curve design parameter value (Degree or Radius) and the optional offset values. Following the prompt in the lower left hand corner of the MicroStation window: identify (data point) and accept/reject the first element; identify the second element with a data point; move the cursor to view the possible solutions; and data point with the desired solution displayed to initiate construction or reset to reject all solutions. **Note:** See Section 7.2 for the definition of a data point, accept, reject, and the other mouse clicks used in this chapter.

13.5.7 Place Simple Transition

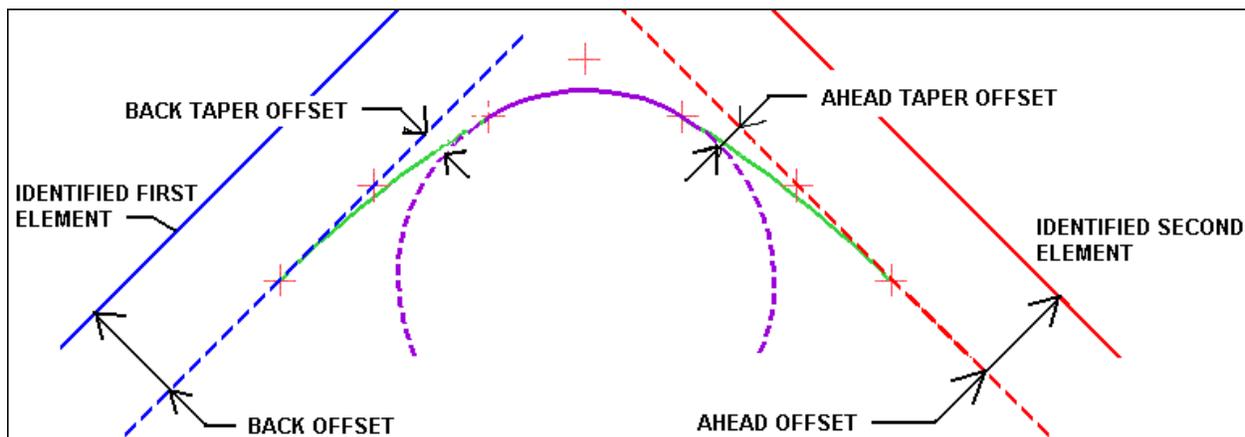
Draws a transition element between two arcs or a line and one arc. The **Transition** element may be *Tangent*, a *Curve*, or a *Spiral* as shown to the right. If a Curve transition element is chosen, the resulting **Curvature** combination can be set to *Compound* or *Reverse* and the value of the defining the amount of curvature needs to be specified, as shown below. The curvature must be flat enough so the transition can span the two elements at either end of the transition.



If the transition element is a spiral, the beginning and ending radius are determined by the elements at each end of the transition. The Truncate options are **None**, **Both**, **Back**, and **Ahead**.

13.6 Curve Combination Tools

The **Curve Combination Tools** allows the user to define simple turning paths and to place compound, three centered, tapered, and reverse curves, using the tools shown to the right. Many of the tools utilize the definitions shown in the following figure.



13.6.1 Place Turning Paths

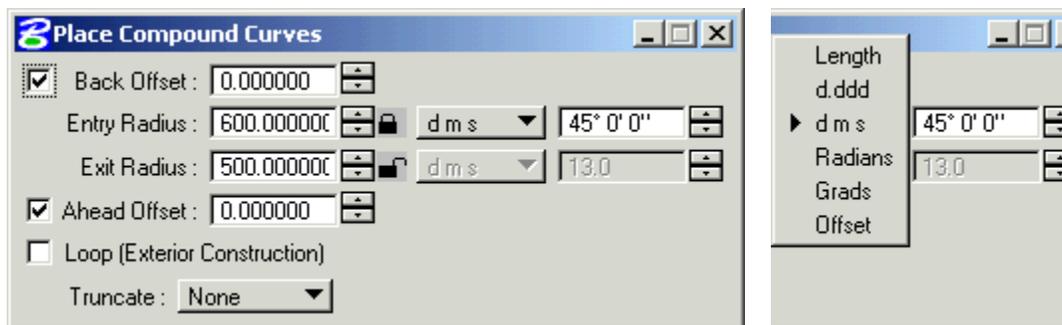


MoDOT currently uses Auto Turn to define turning paths because that tool is more versatile than the GEOPAK tool. For this reason Place Turning Paths is not supported.

13.6.2 Place Compound Curves



Places a compound curve between two elements using the dialog shown below. Optional **Back** and **Ahead Offsets** to the two elements may be specified. The **Entry Radius** and **Exit Radius** must be specified. A parameter to define the length of either the entry or exit curve must be supplied, which may be the **Length**; the deflection angle in decimal degrees (**d.ddd**), degrees-minutes-seconds (**d m s**), **Radians**, or **Grads**; or the **Offset**, as shown in below in the figure to the right. A **Loop** for **Exterior Construction** may be constructed by checking that option. The standard **Truncate** options of **None**, **Both**, **Back**, and **Ahead** are supported.

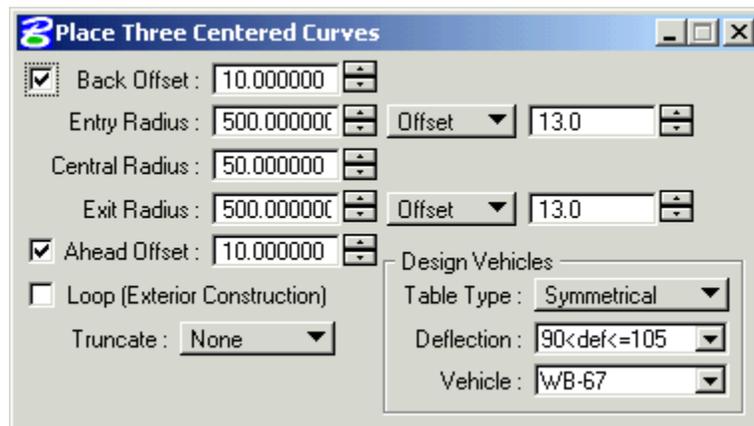


After entering the values in the dialog, construction is begun by selecting and accepting the two elements. Once a tentative solution is shown, the up and down arrows to the right of each of the fields can be used to dynamically adjust the solution. It is also possible to change the quadrant of the solution by movement of the cursor. A data point confirms the desired solution.

13.6.3 Place Three Centered Curves



Stores a three-centered curve between two elements. In addition to specifying the offsets and curve radii, as was possible with the previous tool, this tool allows the user to fill in some of the parameters using the **Design Vehicles** section in the bottom right corner of the dialog.



Selecting the **Table Type** (**Symmetrical** or **Asymmetrical**) and the **Deflection** range determines which of the Design Table is used. The default design tables are based on the AASHTO Green Book. Which set of tables is used is part of the determined by the user preferences (Horizontal Alignment Generator pull down menu File > Preferences.) The individual tables can be viewed by selecting the desired set of tables from the Horizontal Alignment Generator Design Tables pull down menu.

After completing the desired portions of the dialog, construction is begun by selecting and accepting the back and ahead elements. If the deflection angle between the elements does not match the one selected in the dialog, GEOPAK displays an alert and adjusts the deflection range to match the two elements. Once a tentative solution is shown, the up and down arrows to the right of each of the fields can be used to dynamically adjust the solution. It is also possible to change the quadrant of the solution by movement of the cursor. A data point confirms the desired solution. The **Truncate** options are **None**, **Both**, **Back**, and **Ahead**.



13.6.4 Place Taper Curves

Places a curve and tapers between two elements. This tool has the same options as the previous one plus the ability to add a **Back and Ahead Taper** at the beginning and ending of the curve. The tapers are defined by specifying the taper **Ratio** and the either its **Offset** or **Length** using the pull down toggle for each taper.

As with the previous tool, the user may fill in some of the parameters using the **Design Vehicles** section in the bottom right corner of the dialog.

The screenshot shows the 'Place Taper Curves' dialog box with the following settings:

- Back Offset: 10.000000
- Back Taper: Offset, 3.000000, Ratio: 15.000000
- Intermediate Curve Radius: 115.000000
- Ahead Taper: Offset, 3.000000, Ratio: 15.000000
- Ahead Offset: 10.000000
- Loop (Exterior Construction)
- Truncate: None
- Design Vehicles:
 - Table Type: Symmetrical
 - Deflection: 90<def<=105
 - Vehicle: WB-67

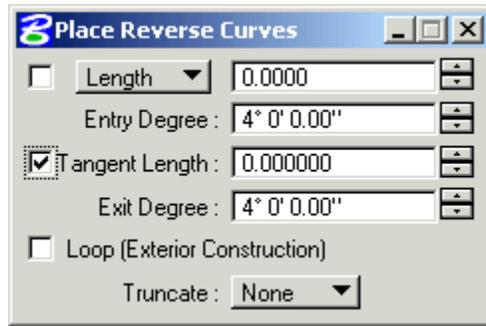
After completing the desired portions of the dialog, construction is begun by selecting and accepting the back and ahead elements. If the deflection angle between the elements does not match the one selected in the dialog, GEOPAK displays an alert and adjusts the deflection range to match the two elements. Once a tentative solution is shown, the up and down arrows to the right of each of the fields can be used to dynamically adjust the solution. It is also possible to change the quadrant of the solution by movement of the cursor. A data point confirms the desired solution. The Truncate options are **None**, **Both**, **Back**, and **Ahead**.



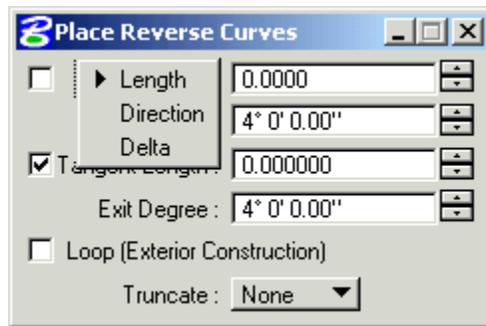
13.6.5 Place Reverse Curves

Stores reverse curves between two elements. A tangent section between the curves can also be stored. To use this option, activate it (as show by the check mark in the figure below) and provide the **Tangent Length**.

The user must specify the **Entry** and **Exit** curve parameter and has the option to set the start of the reverse curves by activation the top toggle in the dialog below.



If the back element is a line, only the **Length** option is available, which specifies the distance from the start of the back element to the start of the reverse curve. However, if the back element is curved the user may determine the start of the reversed curve by specifying the back Length, Direction, or Delta angle, as shown in the following figure.

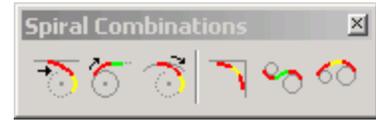


The option to create a Loop (Exterior Construction) can be chosen by activating that toggle. The standard **Truncate** options (**None**, **Both**, **Back**, and **Ahead**) are also available.

After completing the desired portions of the dialog, construction is begun by selecting and accepting the back and ahead elements. If it exists, the tentative solution is displayed. The user may modify the solution by using the up and down arrows to the right of each value field. If the first option has not been locked, movement of the cursor determines where the entry curve begins. A data point confirms the desired solution.

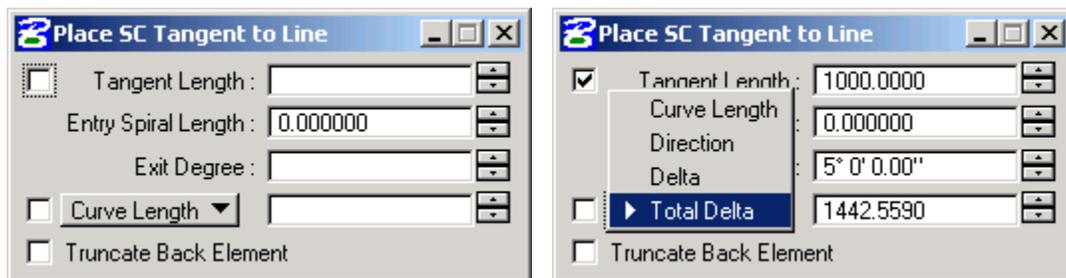
13.7 Spiral Combinations

The **Spiral Combinations** tools in the toolbox to the right allow the user to place spirals with curves, tangents, and other spirals. Since MoDOT typically places only spiral-curve-spiral combinations between tangents, only that tool is discussed in detail.



13.7.1 Place SC Tangent To Line

Stores a **spiral-curve** combination tangent to a specified line using the parameters shown below in the figure on the left. The optional **Tangent Length** is the distance from the start of the specified line to the start of the spiral. The pull down, expanded in the figure on the right below, lets the user specify the length of curve using the parameters shown.



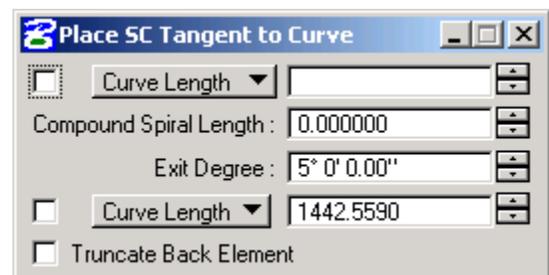
13.7.2 Place ST Tangent To Curve

Stores a **spiral-tangent** combination tangent to a curve using the parameters shown below in the figure on the left. The pull down, expanded in the figure on the right below, lets the user specify the location of the spiral-tangent combination using the parameters shown



13.7.3 Place SC Tangent To Curve

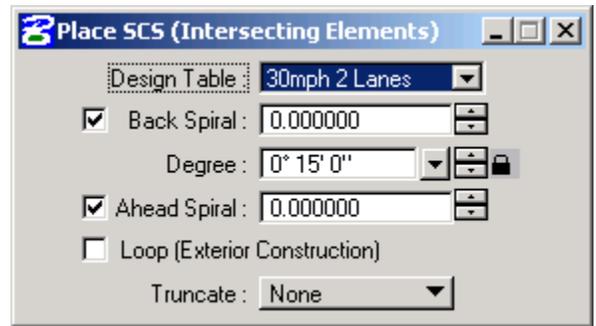
Stores a compound **spiral-curve** combination tangent to a curve. The spiral will be placed between the curves. The two pull downs contain the same options: **Curve Length**, **Direction**, **Delta**, and **Total Delta**. The top one can be used to control where the spiral starts and the bottom one can be used to control the length of the new curve.





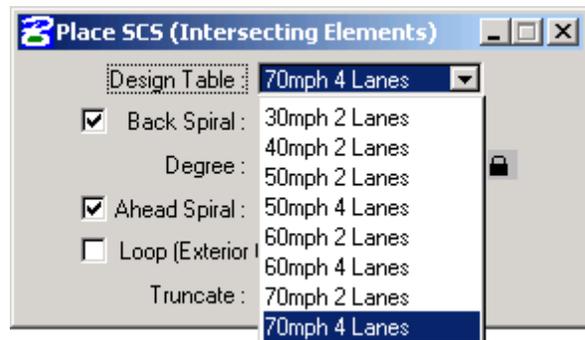
13.7.4 Place SCS (Intersecting Elements)

Stores a **spiral-curve-spiral** combination tangent to two intersecting elements. The standard truncate options for the existing elements are available. A major enhancement to this tool is the ability to have the spiral length calculated based on the design speed, the number of lanes, and the curvature of the new curve to be placed between the spirals. As described in section 7.4.1.3, the design table is set in the **Spiral Design Tables** section of the horizontal alignment preferences (Horizontal Alignment pull down menu **File > Preferences**). The available tables are:

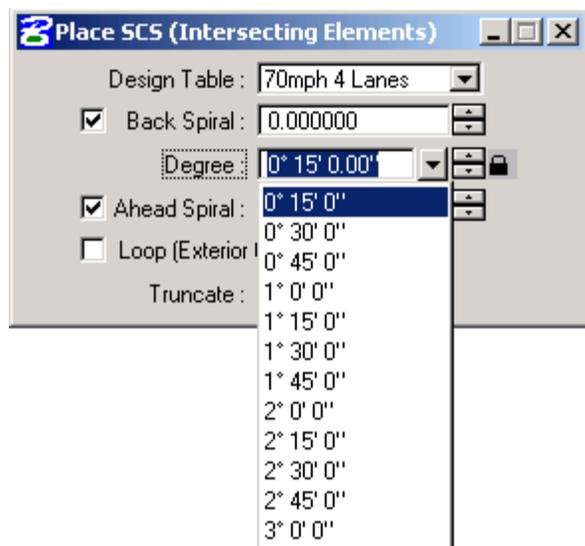


Curve Parameter	Max e	File to be used
Degree (arc)	8%	HA_SpiralCurve_eMax8_2002MoDOT.tbl
Degree (arc)	4%	HA_SpiralCurve_eMax4_2002MoDOT.tbl
Radius	8%	HA_SpiralCurve_eMax8_2001english.tbl
Radius	4%	HA_SpiralCurve_eMax4_2001english.tbl

To use the tool, select the design speed and number of lanes (2 lanes for undivided and 4 lanes for divided) from the pull down options available in the **Design Table** field. The available options for rural projects with a max e of 8% are shown in the figure to the right. These conform to those shown in MoDOT Standard Plans 203.20 and 203.21.



After setting the design speed and number of lanes, the next step is to select the desired curvature for the curve from the pull down options available in the **Degree or Radius** field. The available options for rural projects with curve parameter (**Geometry Settings** section under **File > Preferences**) set to Degree (Arc) are shown to the right.



Select and accept the two intersecting elements to initiate construction. A tentative solution will be shown if it exists. Cursor location determines solution quadrant. The up and down next to the field define the curve may be used to increment its curvature. With the tentative solution at the desired location, data point to initiate construction of the SCS combination. The Truncate options are **None, Both, Back, and Ahead.**



13.7.5 Place STS (Disjoint Curves)

Stores a **spiral-tangent-spiral** combination between two curves using the parameters shown below. The **Tangent Length** is the length of the optional tangent between the two curves. If no tangent is desired, set the distance to zero (0). The Truncate options are **None**, **Both**, **Back**, and **Ahead**.

The screenshot shows the 'Place STS (Disjoint Curves)' dialog box. It contains the following fields and controls:

- Back Spiral: 100.000000
- Tangent Length: 0.000000
- Ahead Spiral: 0.000000
- Truncate: None (dropdown menu)



13.7.6 Place SCS (Disjoint Curves)

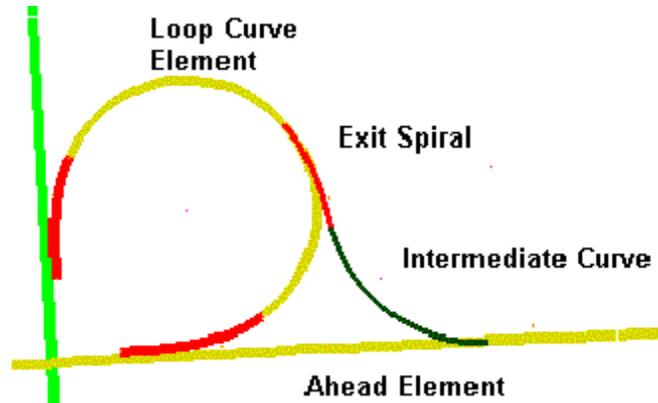
Stores a **spiral-curve-spiral** combination between two curves. The length of the spirals may be set from the design tables by selecting the appropriate **Design Table** (speed and number of lanes) and the curve parameter. The Truncate options are **None**, **Both**, **Back**, and **Ahead**.

The screenshot shows the 'Place SCS (Disjoint Curves)' dialog box. It contains the following fields and controls:

- Design Table: 30mph 2 Lanes (dropdown menu)
- Back Spiral: 0.000000
- Degree: 0° 15' 0" (dropdown menu)
- Ahead Spiral: 0.000000
- Truncate: None (dropdown menu)

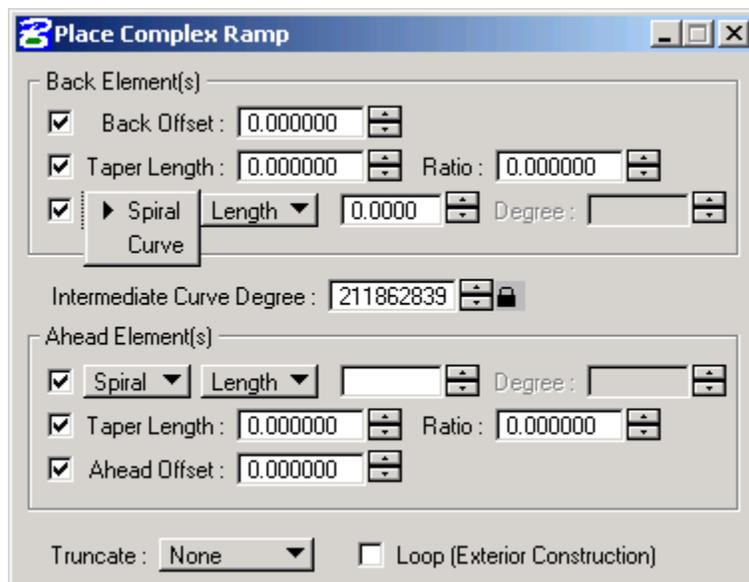
13.8 Complex Transitions

The two **Complex Transitions** tools allow the user to place simple to complex ramps and ramp connectors with a variety of options. Both tools support the four standard Truncate options are **None**, **Both**, **Back**, and **Ahead**. The curve parameter may be either Degree (Arc) or Radius, as set in the **Geometry Settings** section of the **File > Preferences** dialog. The following picture illustrates what can be constructed using these tools.



13.8.1 Place Complex Ramp

Places simple to complex ramp geometry using the parameters shown below. The back and ahead elements may be either a spiral or a curve. If a spiral is chose, the design parameter used by MoDOT is the spirals length. If a curve is used, the length of the ahead and back elements may be set using the curves length, as shown below, delta angle or offset from the intersecting elements.



The back and ahead elements may be offset from the intersection elements by toggling on the **Back** and **Ahead Offsets**, respectively, and entering an offset distance. Tangent tapers may also

be included before the back and after the ahead element by toggling on that feature and defining the **Taper Length** and **Ratio**. The **Intermediate Curve** parameter is defined in the middle of the dialog by either degree (as shown above) or radius. The ability to draw a **Loop (Exterior Construction)** ramp is activated using its toggle at the bottom of the dialog.

To initiate construction:

1. Select the tool.
2. Populate the dialog using the options described above.
3. Data point on the back element and accept it.
4. Data point on the ahead element and accept it.
5. The location of the cursor determines the quadrant for the tentative solution.
6. Modify the dialog settings as desired.
7. When the desired solution appears, data point to complete construction.



13.8.2 Place Ramp Connector

Places simple to complex ramp connector using the parameters shown below. Either an **Exist Spiral** or a **Connecting Tangent** is required in addition to the **Intermediate Curve**. The optional elements are a second transition element (exit spiral or connecting tangent), a back spiral, an ahead spiral, and a tangent taper. Although there is a pull-down for the exit, back, and ahead elements, only spirals are supported in this version. Additionally, an offset from elements being connected may be applied at the beginning and end of the ramp connector.

The steps to initiate construction are the same as those for the previous tool.

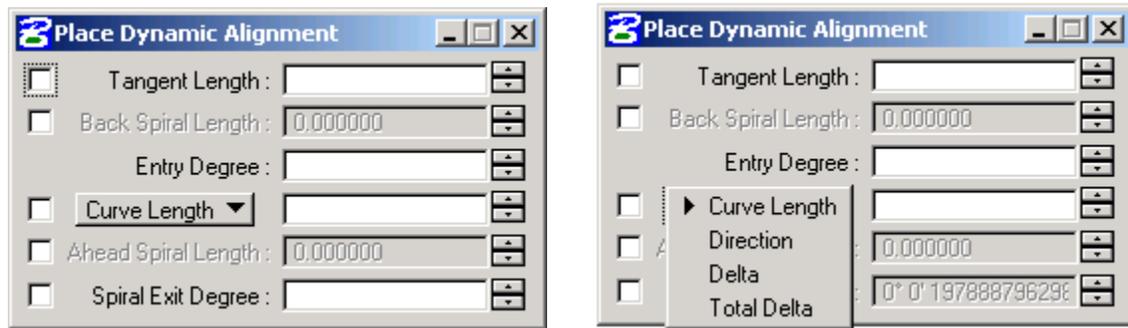
13.9 Alignment Tools

The **Alignment Tools** (shown to the right) allow the user to store an alignment dynamically, in a table format, or from existing COGO elements.



13.9.1 Place Dynamic Element

Places an alignment dynamically. The user needs to select a starting element and then specify the length of curves and length of tangents to create the alignment. The user determines the length of the tangent element either graphically by a data point on screen or numerically by activating the **Tangent Length** field and enter the desired length. Likewise, either dynamic or numerical inputs maybe used or the curve parameters. If numerical inputs are desired, activate that option and choose the desired parameter: **Curve Length**, **Direction** ahead, curve **Delta** or **SCS** combination **Total Delta**, as shown below in the figure on the right. The degree of curvature can be changed, and spirals can be added as the user moves along the alignment.



13.9.2 Place PI Alignment

Enables the user to create or modify chains in table form based on the points of intersection (PI's), as shown in the following dialog. To edit the table, double clicking in the desired field and changing the value. New PI points can be added or deleted as well as the curve or spiral-curve-spiral element at the PI.

PIX	PI Y	Station	Distance	Direction	Ls1	Degree	Ls2
1698102.3440	999551.4260	445+30.94	3216.6644	S 82° 41' 55.00" E	0.0000	0° 0' 0.00"	0.0000
1701292.9257	999142.6245	477+47.60	1489.5241	N 49° 10' 0.00" E	0.0000	2° 0' 0.00"	0.0000
1702419.9216	1000116.5660	490+84.82			0.0000	0° 0' 0.00"	0.0000

The chain to be loaded can be selected from the pull down or picked graphically using the icon to the right. The use of this and the other icons is given in the following table taken from the GEOPAK help.

	Graphically defines the chain / alignment. Click, then select one element of the visualized chain.
	After the chain has been specified, clicking this button loads the chain into the list box.
	Saves the chain.
	Insert a PI Point - Highlight a PI line in the list box, then click.
	Delete a PI Point - Highlight a PI line in the list box, then click.
	Clear Alignment Table - clears the list box.
	Move Element - click and dynamically move the highlighted PI point.
	Remove Overlap - If two curves or spirals are overlapping, the overlap is removed.



13.9.3 Store Chain

Stores an alignment by selecting graphical elements. It is the same as the corresponding Graphical COGO tool.

13.10 Manipulate Tools

The **Manipulate** tools allow the user to move/copy, rotate, extend, and delete elements.



13.10.1 Move Plan View Element

Moves or copies an element. It is the same as the corresponding Graphical COGO tool.



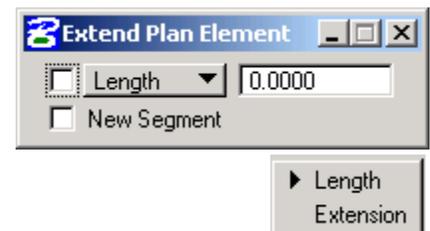
13.10.2 Rotate Plan View Element

Rotates the element about a specified point. It is the same as the corresponding Graphical COGO tool.



13.10.3 Extend Plan View Element

Extends or shortens a COGO element graphically or numerically by activating that option and entering the final **Length** of the **Element** or the extension length. Activate the **New Segment** option to leave existing element unchanged and create a new one.



13.10.4 Delete Element

Deletes an element from the coordinate geometry database (.gpk). It is the same as the corresponding Graphical COGO tool.

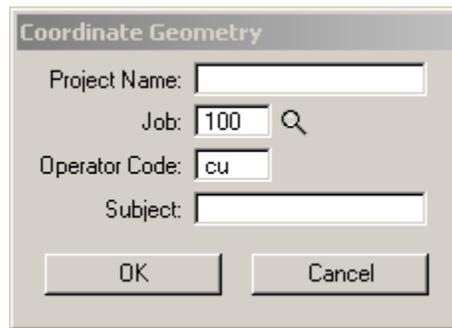
13.11 Individual Exercise, Route50 Project Alignments

This is an individual exercise to practice storing horizontal alignments. It is to be done outside of a GEOPAK project.

Open the following MicroStation file:

pw:\District CADD\Design\Cole\J2P0200\data\Plan_J5P0100.dgn.

Continue using GPK **100**, as shown in the following dialog.



The image shows a dialog box titled "Coordinate Geometry". It contains four input fields: "Project Name:" (empty), "Job:" (containing "100" with a search icon to its right), "Operator Code:" (containing "cu"), and "Subject:" (empty). At the bottom of the dialog are two buttons: "OK" and "Cancel".

Use **Coordinate Geometry** to create the alignments as shown on the following pages.

Do not worry about the graphics (stationing, curve data, etc.) being plotted. These items will be discussed in later chapters.

Route50

Beginning Point: X = 1698102.3440 Y = 999551.4260

Ending Point: X = 1702419.9216 Y = 1000116.5660

Intersect the PI point using the direction back and direction ahead of curve.

Direction Back of Curve = S 82° 41' 55" E

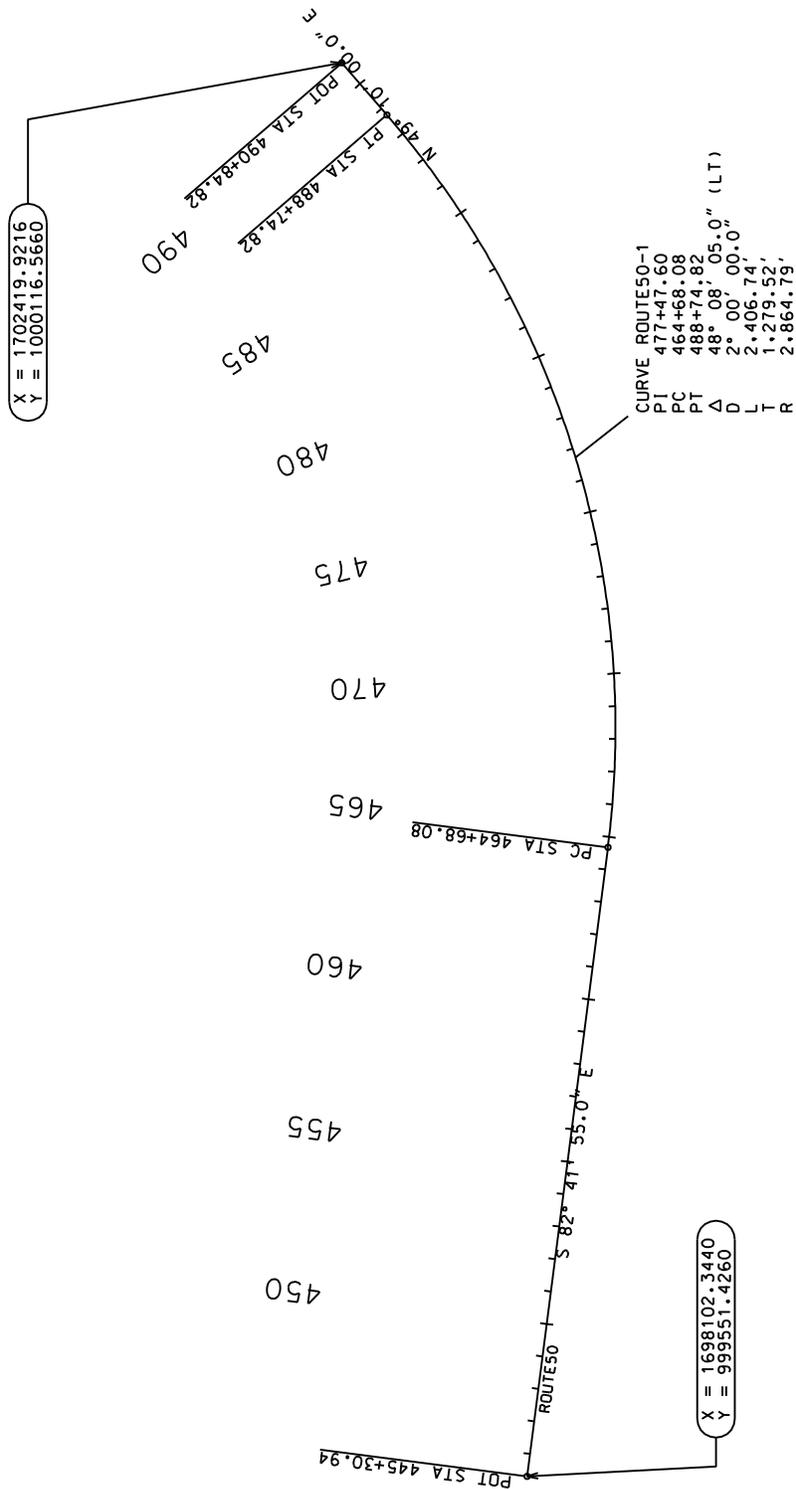
Degree of Curve = 2° 00' 00"

Direction Ahead of Curve = N 49° 10' 00" E

Station the chain beginning at 445+30.94

Name the alignment **Route50**.

Route 50



Big Horn

Beginning Point: X = 1700104.5480
Y = 1000188.1340

Ending Point: X = 1700092.3040
Y = 998143.9168

PI of the first curve is exactly 248.8954' from the beginning point on a bearing of S 1° 04' 27.8" W

Direction Back of first curve = S 1° 04' 27.8" W

Degree of Curve for first curve = 5° 00' 00"

Direction Ahead of first curve = S 6° 32' 27.3" E

The direction back of second curve matches the direction ahead of the first curve, which is S 6° 32' 27.3" E

Degree of Curve for second curve = 5° 00' 00"

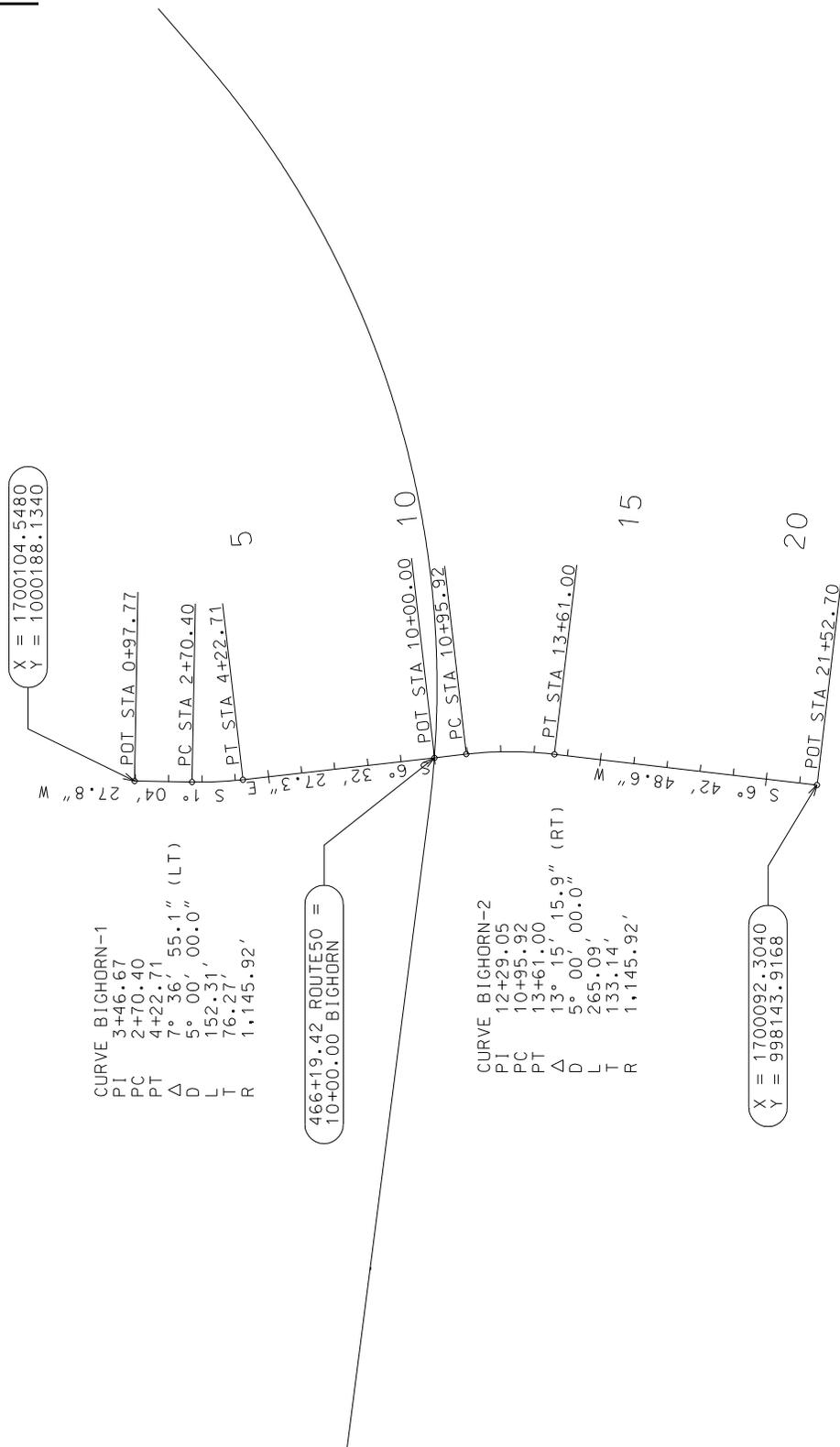
Direction Ahead of second curve = S 6° 42' 48.6" W

Intersect the alignment chain Route50 with a line segment between the PT of the first curve, and the PC of the second curve. **Note:** The Route 50 station value shown is approximate.

Store the alignment as BigHorn (be sure to include the Route50 intersection point)

Station the alignment with station 10+00 at the intersection point with the Route50 chain.

Big Horn



Ramp 1

Beginning Point is at station 452+56.52; offset 66' LT of Route 50

The PC of the curve is the Beginning Point

Direction Back of the curve is S 82° 41' 55" E

Degree of Curvature = 4° 00' 00"

Direction Ahead of the curve is N 83° 27' 28.56" E

Alignment ends at Big Horn, at **about** Station 6+55.32

Station the alignment beginning at 0+00

Name the alignment Ramp1

Ramp 3

Beginning Point is at station 479+48.31; offset 66' LT of Route 50

Ending Point is at end of Ramp1; however, use different point numbers for the ending point of each ramp. **Hint:** Element > Point > Equate.

PC of the first curve is the alignment beginning point.

Direction Back for the first curve is S 67° 41' 47.7" W

Degree of Curvature for first curve = 6° 00' 00"

Direction Ahead for the first curve is N 69° 50' 21.3" W

Point Back of the second curve is the PI of the first curve

PI of second curve is at the intersection of a line through the PI of the first curve with a bearing of N 69° 50' 21.3" W and a line through ending point of Ramp1 with a bearing of N 83° 27' 28.56" E. **Hint:** Do not use the same point number as the ending point for both ramps.

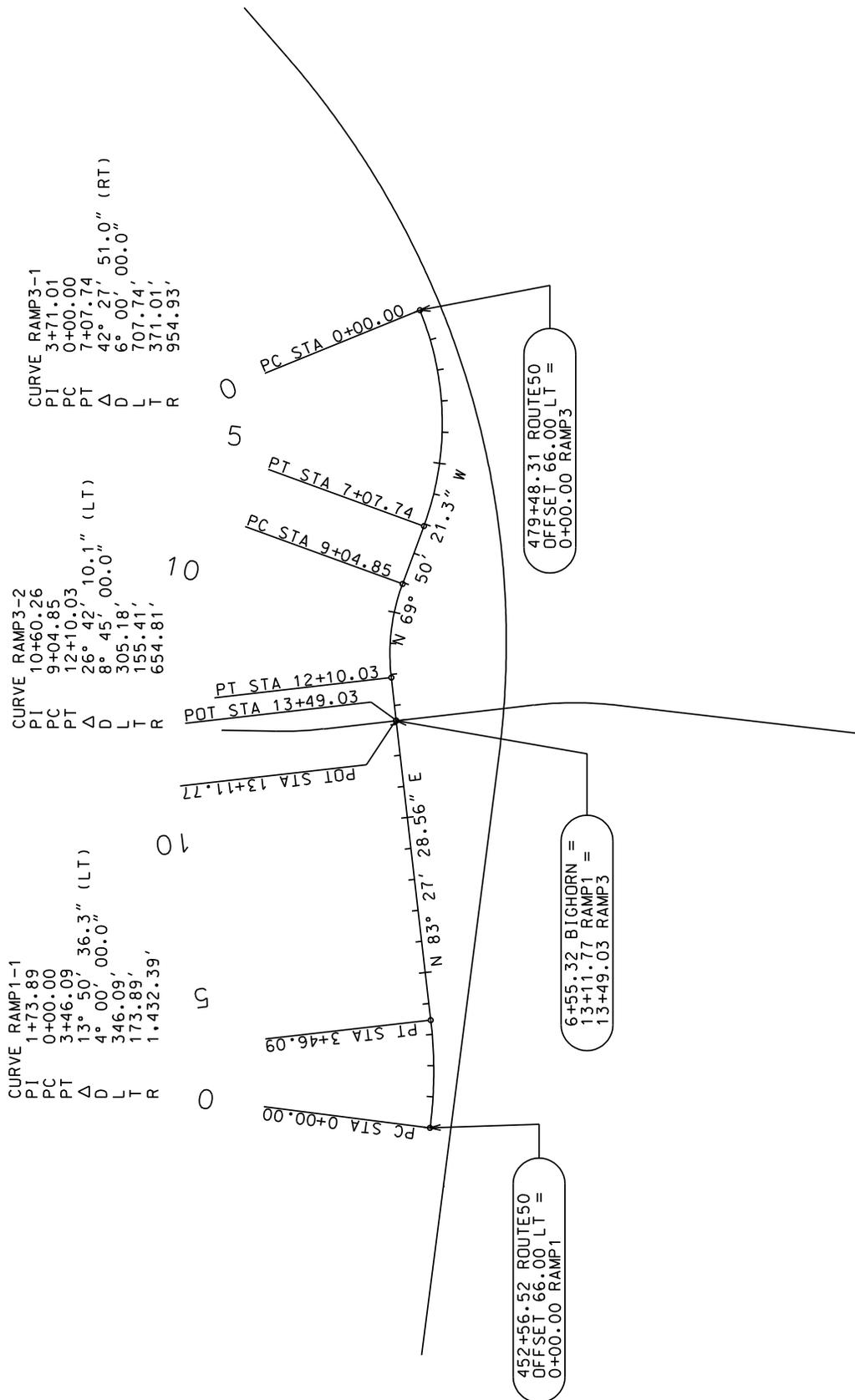
Degree of Curvature for the second curve = 8° 45' 00"

Point Ahead of the second curve is the alignment end point

Station the alignment beginning at station 0+00

Name the alignment Ramp3

Ramp 1 & 3



Upon completion of storing the alignments in coordinate geometry, close coordinate geometry.

Delete all of the graphics in the MicroStation drawing by going to **Edit > Select All**, and then selecting the Delete button.

