

Exercise 14-4

With the information from the previous two exercises, it is possible to layout the eastbound bridge. This group exercise will use COGO to store and plot needed locations.

1. Open the MicroStation file **t:\br-proj\a_geopak\d5\j5p0100\data\plan_50_j5p0100.dgn**. Attach as a reference **t:\br-proj\a_geopak_\d5\j5p0100\data\plan_bh_j5p0100.dgn**. Window in on the intersection of the two alignments so Route 50 stations 465+00 to 468+00 are visible.

2. Open the project **t:\br-proj\a_geopak\d5\j5p0100\project\j5p0100.prj**.

Enter the as user **userc**.

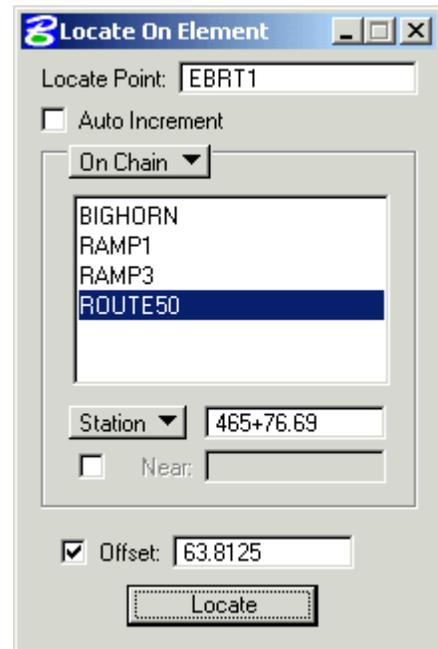
Switch the Working Alignment to **Route50**.

3. Enter **Coordinate Geometry**.

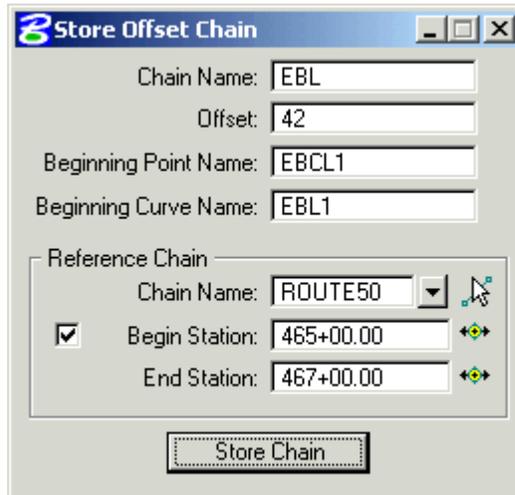
Go to **Tools > Locate > On Element** to bring up the dialog shown to the right. It is used to store a point on a curve, a spiral, or a chain. Choose the **On Chain** option. The **Station** option will be used to store points on chain **ROUTE50**.

Store the points listed in the table below. They are based on information obtained in Exercise 14-2 and locate where the fill slope intersects the profile EB-RT-SLP, which determines the minimum distance from the front face one end bent to the front face of the other end bent. The stationing is for Route 50. The dialog box for storing the first point is shown to the right.

<u>Location</u>	<u>Pt. Name</u>	<u>Station</u>	<u>Offset</u>
Bent 1 Front Face	EBRT1	465+76.69	63.8125
Bent 4 Front Face	EBRT4	466+85.79	63.8125



4. The location of the bents is based on layout lengths along the centerline of the eastbound lane. Storing a chain at this location will ease the calculation of lengths along this line. Since this line is located 42' to the right of chain **ROUTE50**, the store chain from offset chain command will be used. The dialog for this command is located in the COGO menu **Element > Chain > Store > Offset Chain** and is depicted below.



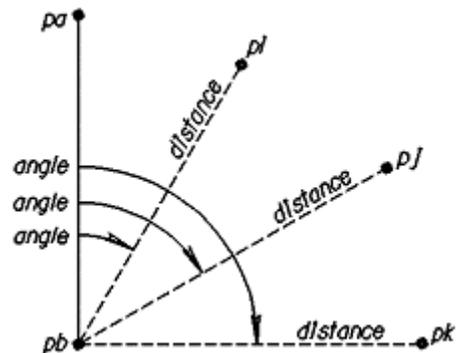
Fill out the top of the dialog box as shown, select **ROUTE50** as the Reference Chain, and press **Store Chain**.

5. The skew of the bents is based on a radial line to Route 50 running through the intersection of the Route50 and BigHorn alignments so that the bents are roughly parallel to Big Horn Dr. Determine the angle between this radial line and Big Horn Dr. where it crosses Route 50 chain by using the angle command:

ANGLE pa pb pi-pk,

where the point numbers are used as defined in the figure and referenced to the job as follows:

- pa = PT BIGHORN-1**
- pb = 10 (Point at alignment intersection)**
- pi = CC ROUTE50-1**



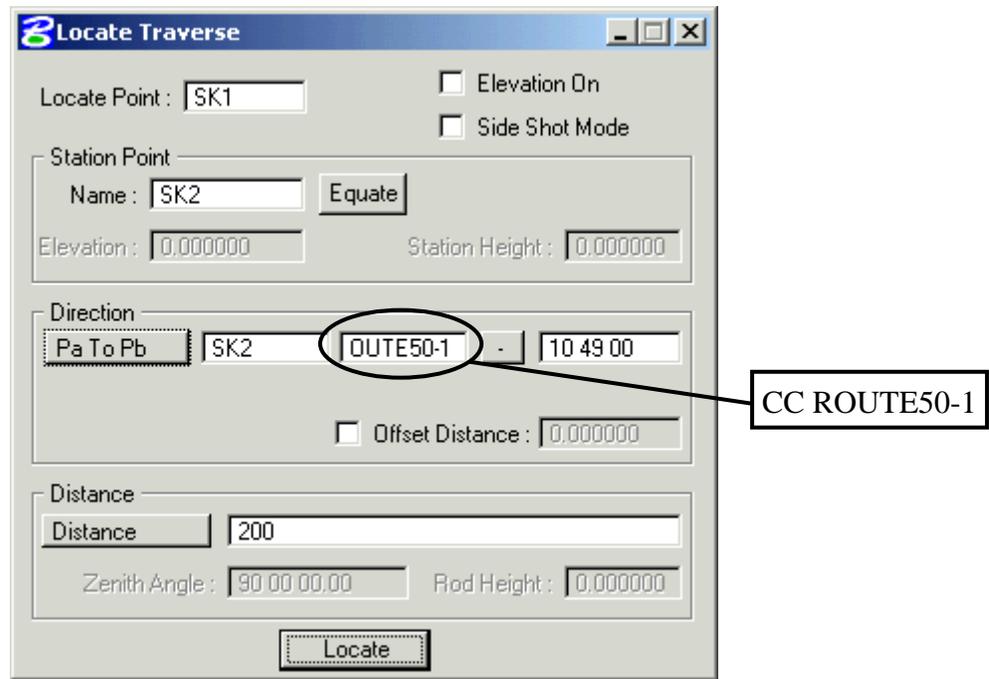
Key in the COGO command: **ANGLE PT BIGHORN-1 10 CC ROUTE50-1**

The returned value is rounded to a right advance skew of 10° 49'.

- Store two points (SK1 and SK2) to define the direction of the bents from left to right.

Locate point SK2 at the intersection of the BIGHORN and EBL chains (Tools > Intersect).

Locate point SK1 200' from SK2 on a direction 10° 49' to the left of a line from SK2 to the center of curve Route50-1 (Tools > Locate > Traverse). The dialog box is shown below:



The circled field in the dialog to show all of the text for the field. Use the value in the text box to the right of the dialog for that field. After filling in the information click on **Locate** to store the point.

- Determine the minimum distance between centerlines of bearing at the end bents and point SK2 as measured along the centerline of the eastbound lane.

To locate the points, use the intersect tool (**Tools > Intersect**) to project points **EBRT1** and **EBRT4** onto chain **EBL** using the direction from **SK2** to **SK1** with an offset of 15" (1.25'), which is one half of the width of the end bent beams. Call the new points **BT1** and **BT4**. The COGO Key-in commands are:

LOCATE BT1 INTERSECT LINE EBRT1 SK2 TO SK1 OFF -1.2500 CHA EBL

LOCATE BT4 INTERSECT LINE EBRT4 SK2 TO SK1 OFF 1.2500 CHA EBL

The dialogs for storing these points are shown on the following page.

7. (Continued)

Intersect Tool

Locate Point

Auto Increment By

Intersect Element

Point

Direction

Offset

Distance

With Element

Offset

Distance

Direction Qualifier

Intersect Tool

Locate Point

Auto Increment By

Intersect Element

Point

Direction

Offset

Distance

With Element

Offset

Distance

Direction Qualifier

7. (Continued)

To measure the distance along the EBL chain for the points **BT1**, **SK2**, and **BT4**, us the inverse command (**Tools > Inverse**), as shown in the following dialog. Be sure to **toggle on Distance Along Chain** and enter **chain EBL**.



The COGO output is:

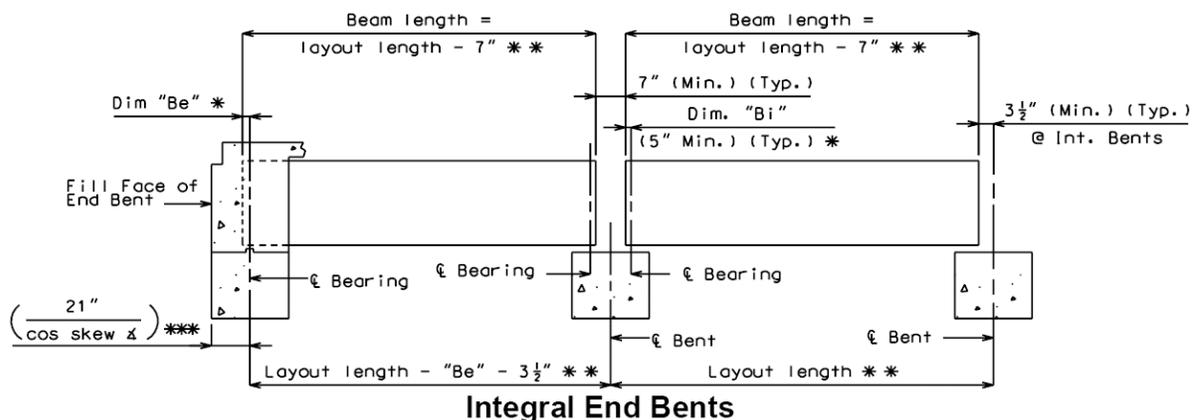
Point	X	Y	Station/Region	Offset	Distance
BT1	1,700,122.1665	999,252.1784	465+71.97 1	0.0000	
SK2	1,700,179.1964	999,247.5093	466+29.19 1	0.0000	57.2216
BT4	1,700,235.9706	999,243.9813	466+89.07 1	0.0000	56.8846

Consequently, the distance as measure along the centerline of the east bound lane between the centerline of Bent 1 and SK2 must be at least 57.23', 56.89' between SK2 and the centerline of the last bent, and 114.1' for the whole bridge.

8. Calculate the overall **Design Layout Length** for the bridge.

Based on **BM 3.55.3.1-3** (shown below), overall layout length for the bridge is:

$$\Sigma (\text{CL Bent to CL Bent}) + 2 * (B_e + 3 \frac{1}{2}'').$$

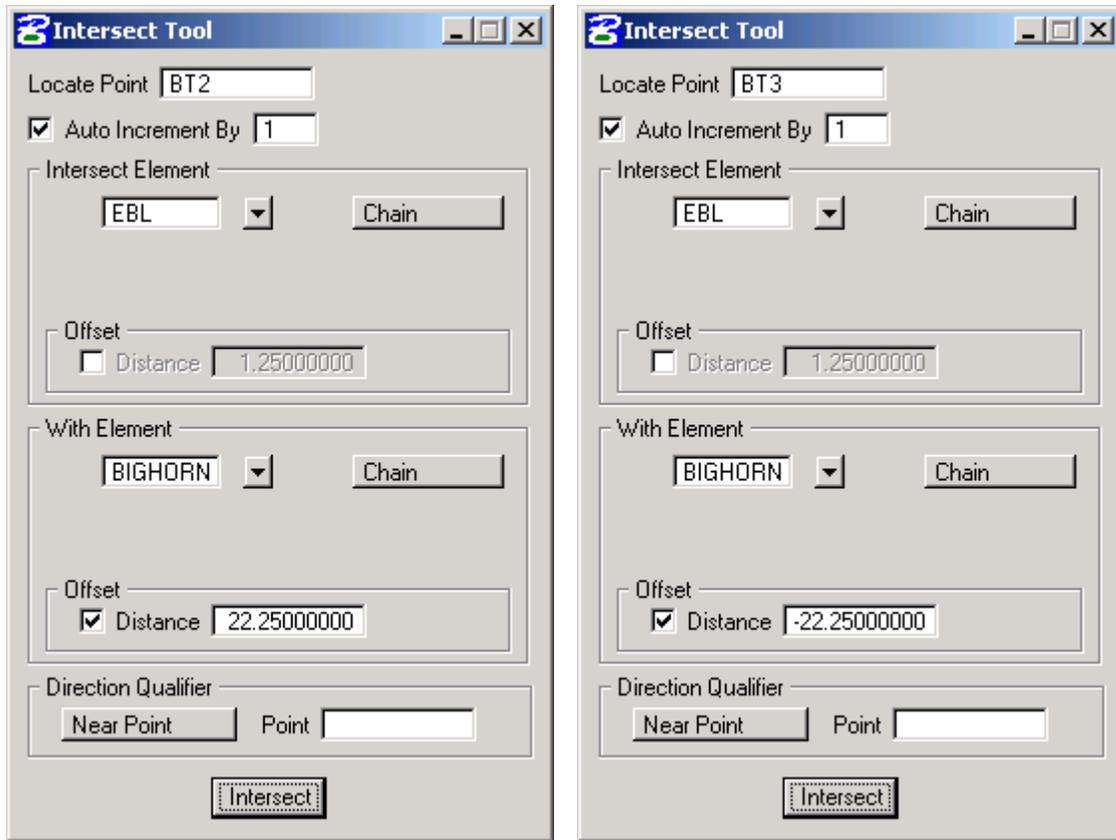


For this bridge $B_e = 5 \frac{1}{2}''$ and $B_e + 3 \frac{1}{2}'' = 9'' = 0.75'$. Thus, the minimum layout length:

- for the whole bridge = $114.1' + 2 (0.75' = 114.1' + 1.5' = 115.6'$ **Use 116'**
- from Bent 1 to SK2 = $57.23' + (5 \frac{1}{2} + 3 \frac{1}{2})'' = 57.23' + (0.75') = 57.98'$ **Use 58.0'**
- from SK2 to Bent 4 = $56.89' + (9)'' = 56.89' + 0.75' = 57.64'$ **Use 58.0'**

9. Determine the layout length for each span.

According **LRFD 2.4.1.2-1**, the minimum clearance between the front of the curb (offset of 18.5') and Bents 2 and 3 needs to be 2.0'. Assuming a maximum bent width of 3.5', the offset for the centerlines of Bents 2 and 3 from the BigHorn chain needs to be at least $18.5' + 2.0' + 3.5'/2 = 22.25'$. Use the intersect tool to **store point BT2 at the intersection of chain EBL & chain BigHorn offset 22.25' to the right** and **store point BT3 at the intersection of chain EBL & chain BigHorn offset 22.25' to the left**. The dialog settings for storing the two points are shown below.



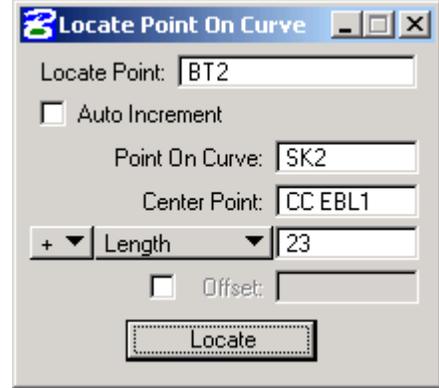
Use the **Inverse** command to find the distance along chain EBL for points BT2, SK2, and BT3. The results are:

Point	X	Y	Station/Region	Offset	Distance
BT2	1,700,156.6040	999,249.2238	466+06.53 1	0.0000	22.6575
SK2	1,700,179.1964	999,247.5093	466+29.19 1	0.0000	22.6243
BT3	1,700,201.7685	999,245.9731	466+51.81 1	0.0000	

Rounding these values up to the nearest 0.5', use the following **layout lengths: Span 1-2 = 35.0'** (58.0 – 23.0'), **Span 2-3 = 46.0'** (23.0' + 23.0'), and **Span 3-4 = 35.0'** (58.0' – 23.0').

10. Determine the bridge's tie station, which will be at Bent 2.

Use **Tools > Locate > Point on Curve** to **relocate point BT2 at the centerline of Bent 2 where it crosses chain EBL** using one half of the length of span 2-3 from SK2. The dialog is shown to the right.



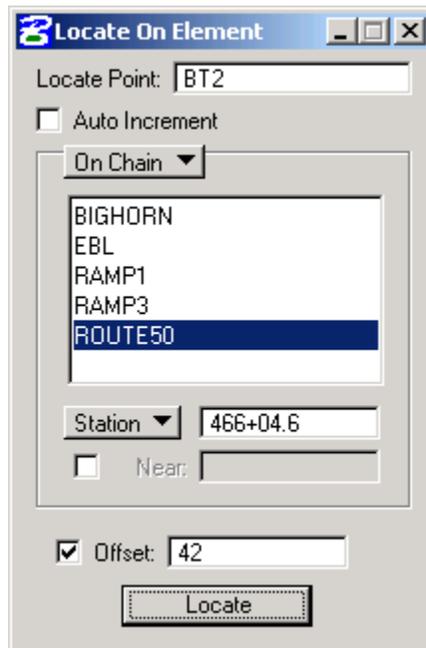
Use the **Inverse** tool to find the station and offset of point BT2 relative to chain Route50. Since the inverse tool requires more than one point, some dummy points are included in the following dialog:



Base on the COGO output information shown below and rounding to the nearest tenth, the **tie station is 466+04.6**.

Point	X	Y	Station/Region	Offset	Distance
BT2	1,700,156.2625	999,249.2511	466+04.65 1	42.0000	

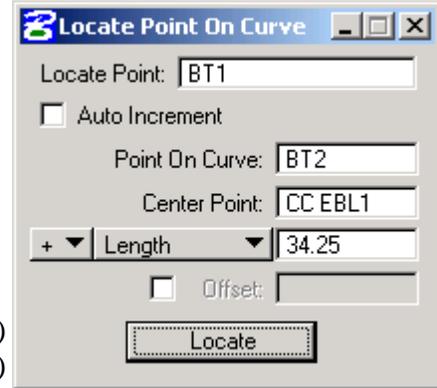
Use **Tools > Location > On Element** to **restore point BT2 at chain Route50 station 466+04.6 and a 42' offset**. The dialog with the proper settings is:



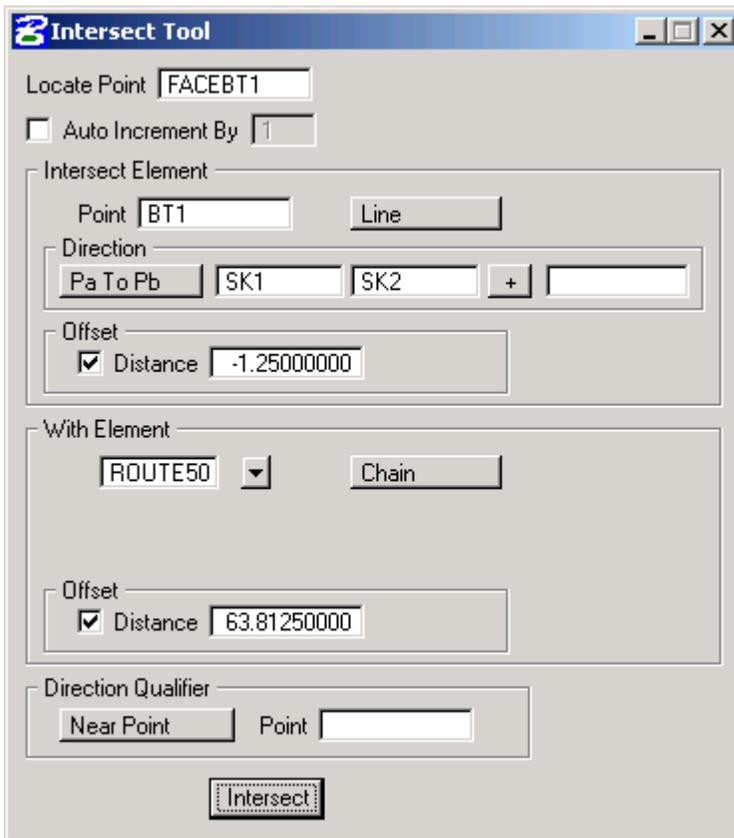
11. The intersection of the centerlines of the other bents with the centerline of the EBL can be located based on point BT2 and the span layout lengths.

Use **Tools > Locate > Point on Curve** to **relocate points, BT1, BT3, and BT4 where the centerline for each bent crosses curve EBL1**. The distances along the curve are given in the following table. The dialog for storing point BT1 is shown to the right.

Point	Dist. along EBL1 from tie	Direction
BT1	35' - 0.75' = 34.25'	+ (clockwise)
BT3	46.0'	- (counterclockwise)
BT4	46' + 35' - 0.75' = 80.25'	- (counterclockwise)



12. Check the location of Bents 1 and 4. To do this, store two points where the front face of each end bent crosses the outside face of the right exterior girders (Route 50 offset 63.8125', as determined in exercise 14-2) and compare the points to EBRT1 and EBRT4. Call the new points FACEBT1 and FACEBT4.



Use **Tools > Intersect** to store the two points. The dialog for storing **FACEBT1** is shown to the left. (**Note:** The 1.25' offset accounts for 1/2 of the beam width.)

Use **Tools > Inverse** to measure the distance along chain Route50 for the following list of points: **FACEBT1 EBRT1 EBRT4 FACEBT4**. If the station values relative to Route 50 are all increasing, the location of the end bents is okay.

