From: 20
To: 25
☐ Name

DX:
DY: 5 ft.
DZ:

☑ Bend
☐ Rigid
☐ Expansion Joint

☑ Restraints
☐ Hangers
☐ Nozzles

Restraints

Node: 24   CNode:
Type: Y ▾   Gap:
Stif: Mu:

Node: 23   CNode:
Type: X ▾   Gap:
Stif: Mu:

Vertical Dummy Leg on Bends

You can model dummy legs on bends in several ways. The three most common methods used to model dummy legs are outlined below.

Near/Far Point Method

- Easy input
- Dummy leg acts along centerline of vertical run
- Dummy leg does not act at the proper place on the bend curvature

On Curvature Method

- Easy input
- Dummy leg acts at the proper place on the bend curvature
- Dummy leg does not act along the centerline of the vertical run

Offset Element Method

- Difficult input
- Dummy leg acts at the proper place on the bend curvature
- Dummy leg acts along centerline of vertical run

NOTE The element immediately after the bend must define the downstream side of the bend. Do not define dummy legs on the element immediately following a bend.

Dummy legs and/or any other elements attached to the bend curvature should be coded to the bend tangent intersection point. The length of the dummy leg is taken directly from the **DX**, **DY**, and **DZ** properties defined for the dummy leg of the pipe. There is no automatic alteration of the dummy leg length due to the difference between the bend tan\-gent intersection point and the actual point on the bend curvature where the dummy leg acts. Enter the true length of the dummy leg in the **DX**, **DY**, and **DZ** boxes in the **Classic Piping Input** dialog box.

Input and output plots of the dummy leg always show it going to the bend tangent intersection point.

During error checking, the software generates a warning message for each dummy leg/bend model. Verify that the warning message description of the bend is accurate.

Vertical Dummy Leg on Bend

BEND GEOMETRY

The bend shown on the left enters from the top left corner of the control station nodes 80 to 85 and exits horizontally to the right (nodes 85 to 90). The dummy leg is attached near the 45⁰ point on the bend. The centerline of the dummy leg should line up with the centerline of the vertical run of pipe.

From: 80
To: 85
☐ Name
DX:
DY: -10 ft. 9.000 in ...
DZ:

Bends
Radius: 15.000
Type:

Angle 1: alpha   Node 1: 84
Angle 2: 0.000   Node 2: 83
Angle 3:   Node 3:

From: 85
To: 90
☐ Name
DX: 8 ft. 6.000 in
DY: ...
DZ:

NOTE Coding the bend is the same for all three methods except alpha is not required for the Near/Far Point Method.

Figure 15: Near Point Method

From: 205
To: 83
☐ Name

DX:
DY: 8 ft. 6.000 in ...
DZ:

Restraints

Node: 205   CNode:
Type: Y ▼ Gap:
Stif: Mu: 0.300

Dummy leg length is equal to the distance from its base to the bend tangent intersection point plus the bend radius.

Figure 16: On Curvature Method

From: 205
To: 84
☐ Name

DX:
DY: 7 ft. 7.390 in ...
DZ:

Restraints

Node: 205   CNode:
Type: Y ▼ Gap:
Stif: Mu: 0.300

- Calculate α from the relation shown on the following page.

- Enter α on the bend specification instead of the midpoint.

- Calculate the offset distance y = R(1-sinα).
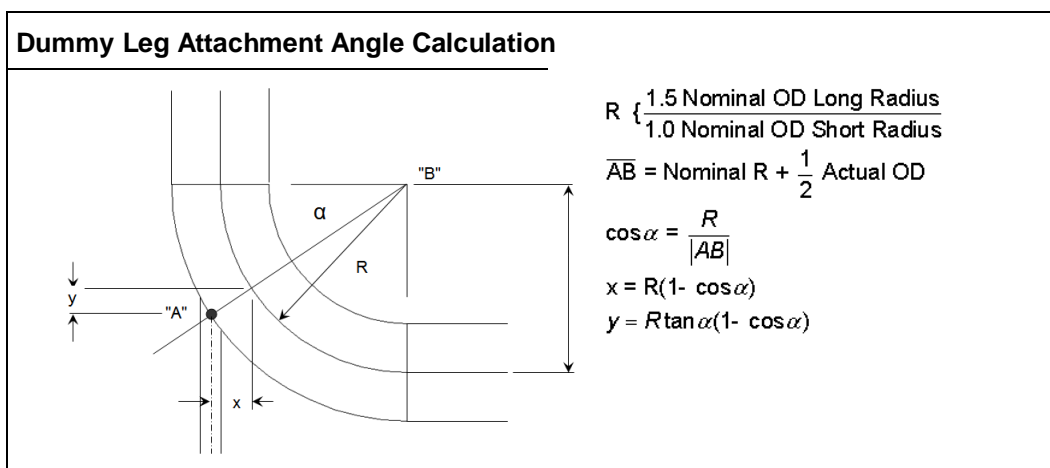
- Add the distance y to the dummy leg length.

Figure 17: Offset Element Method

Offsets

Offset To:
X: -4.390 in
Y: -4.390 in
Z:

From: 205
To: 84
☐ Name

DX: 4.390 in
DY: 7 ft. 7.390 in ...
DZ:
☑ Offsets

Offset From:
X:
Y:
Z:

- Calculate α and the offset distance x and y from the figure on the following page.

- Add x and y to the dummy leg length.

- Activate the offsets to subtract them from the dummy leg.

Vertical Leg Attachment Angle

Dummy Leg Attachment Angle Calculation

$$R \left\{ \frac{1.5 \text{ Nominal OD Long Radius}}{1.0 \text{ Nominal OD Short Radius}} \right.$$

$$\overline{AB} = \text{Nominal R} + \frac{1}{2} \text{ Actual OD}$$

$$\cos\alpha = \frac{R}{|\overline{AB}|}$$

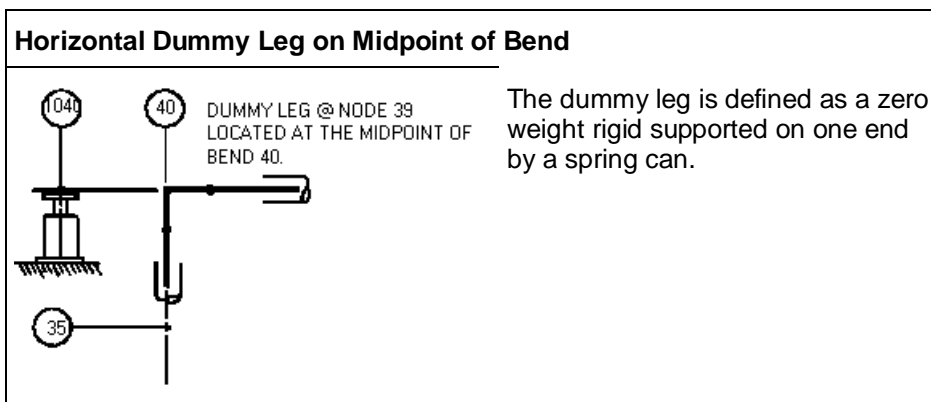$$x = R(1 - \cos\alpha)$$

$$y = R\tan\alpha(1 - \cos\alpha)$$
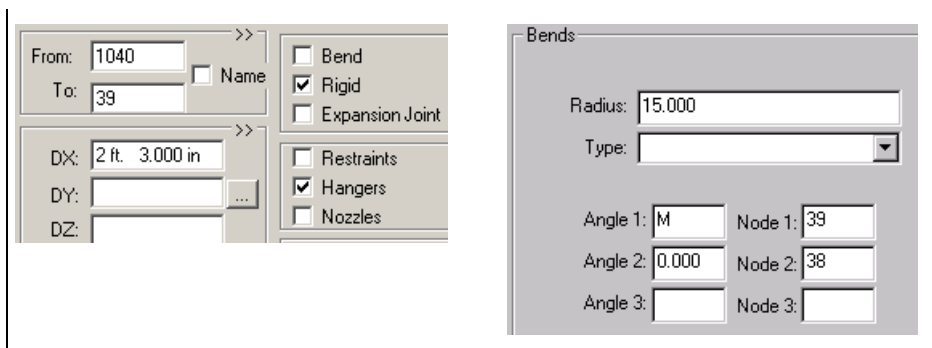
Horizontal Dummy Leg on Bends

The element leaving the bend must define the downstream side of the bend. Do not define dummy legs on the element immediately following a bend.

Enter the true length of the dummy leg in the **DX**, **DY**, and **DZ** boxes in the **Classic Piping Input** dialog box.

Input and output plots of the dummy leg always show the dummy leg going to the bend tangent intersection point.

During error checking, the software generates a warning message for each dummy leg/bend model. Verify that the warning message description is accurate.

Horizontal Dummy Leg on Midpoint of Bend

DUMMY LEG @ NODE 39 LOCATED AT THE MIDPOINT OF BEND 40.

The dummy leg is defined as a zero weight rigid supported on one end by a spring can.

Large Rotation Rods - Basic Model

Large rotation rods are used to model relatively short rods where large orthogonal movement of the pipe causes shortening of the restraint along the original line of action.

Large rotation rods can be entered in any direction. Use the **Type** list on the **Classic Piping Input** dialog box, to select the rotation rod: **XROD**, **YROD**, or **ZROD**. After the rotation rod is selected, the restraint options change as follows:

- **Gap** changes to **Len**, which is the length of large rotation swing.

- **Mu** changes to **Fi**, which is the initial load on the restraint if used to model variable support spring hanger. (Imagine the large rotation rod as providing a bowl in which the pipe node is free to move.)

Enter large rotation rods only where they are needed. Repeatedly using large rotation rods when they are not necessary can cause the system to become unstable during the nonlinear iteration. First, analyze the system without the large rotation rods, and then add large rotation rods where horizontal movement at support points is greatest. Usually, you should add only one rod in an area at a time.

The rod angle tolerance is currently set at 1°.

Large rotation is generally considered to become significant when the angle of swing becomes greater than 5° degrees.

As for any other support, connecting nodes can be used for large rotation rods. Graphically, the connecting nodes and the restraint node do not have to be at the same point in space. There is no plot connectivity forced between large rotation rod nodes and connecting nodes.

The plus or minus signs (+/-) on the large rotation rod determine the orientation of the swing axis. A positive YROD (+YROD) is equivalent to an YROD and indicates that the concave side of the curvature is in the positive Y-direction.