Layout-line geometry

Tutorial

Name:	Layout-line geometry
Description:	Guidelines for defining vertical and horizontal layout lines, also known as baselines.
Program:	SAP2000
Version:	14.2.0
Model ID:	na

This tutorial was written for SAP2000, but the same concept applies also to CSiBridge.

This tutorial explains how to define horizontal and vertical **layout-line geometry**. Layout lines are broken into a number of segments between transition points, including point of tangent (PT), point of curvature (PC), point of vertical tangent (PVT), and point of vertical curvature (PVC). Each segment is defined using the parameters in the relevant menu.

Layout line geometry

Plan and elevation views of the sample layout line used in this tutorial are presented with corresponding data sets below:

Plan view

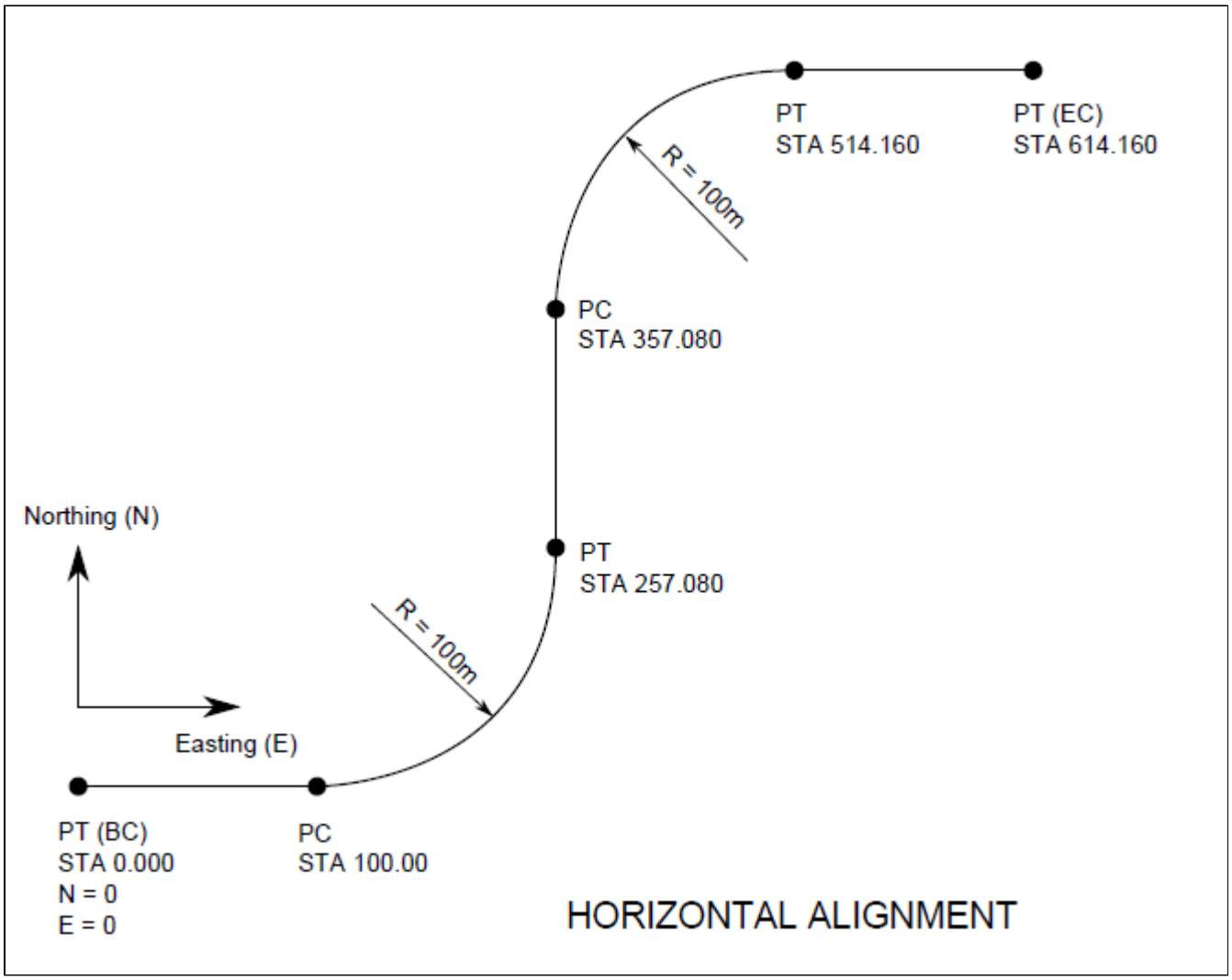

Figure 1 - Layout line plan view

Horizontal Alignment
(all dimensions are in [m] units)

Point No.	Point Type	Station	Northing (N)	Easting (E)
1	PT	0.000	0	0
2	PC	100.000	0	100
3	PT	257.080	100	200
4	PC	357.080	200	200
5	PT	514.160	300	300
6	PT	614.160	300	400

Curve Name	Radius	Northing of Center	Easting of Center	Sense
C1	100	100	100	left
C2	100	200	300	right

Figure 2 - Plan view data

Elevation view

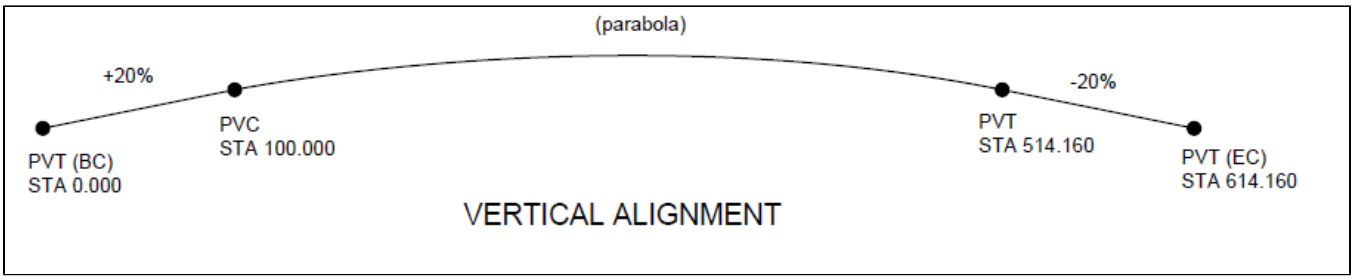

Figure 3 - Layout line elevation view

Vertical Profile

(all dimensions are in [m] units)

Point No.	Point Type	Station	Elevation	Comment
1	PVT	0	0	
2	PVC	100	20	
3	PVI	307.08	61.42	Elevation of PVI, not point on the curve
4	PVT	514.16	20	
5	PVT	614.16	0	

Figure 4 - Elevation view data

Data to be entered in SAP2000

Data is entered using the Bridge Layout Line Data menu, shown in Figure 5:

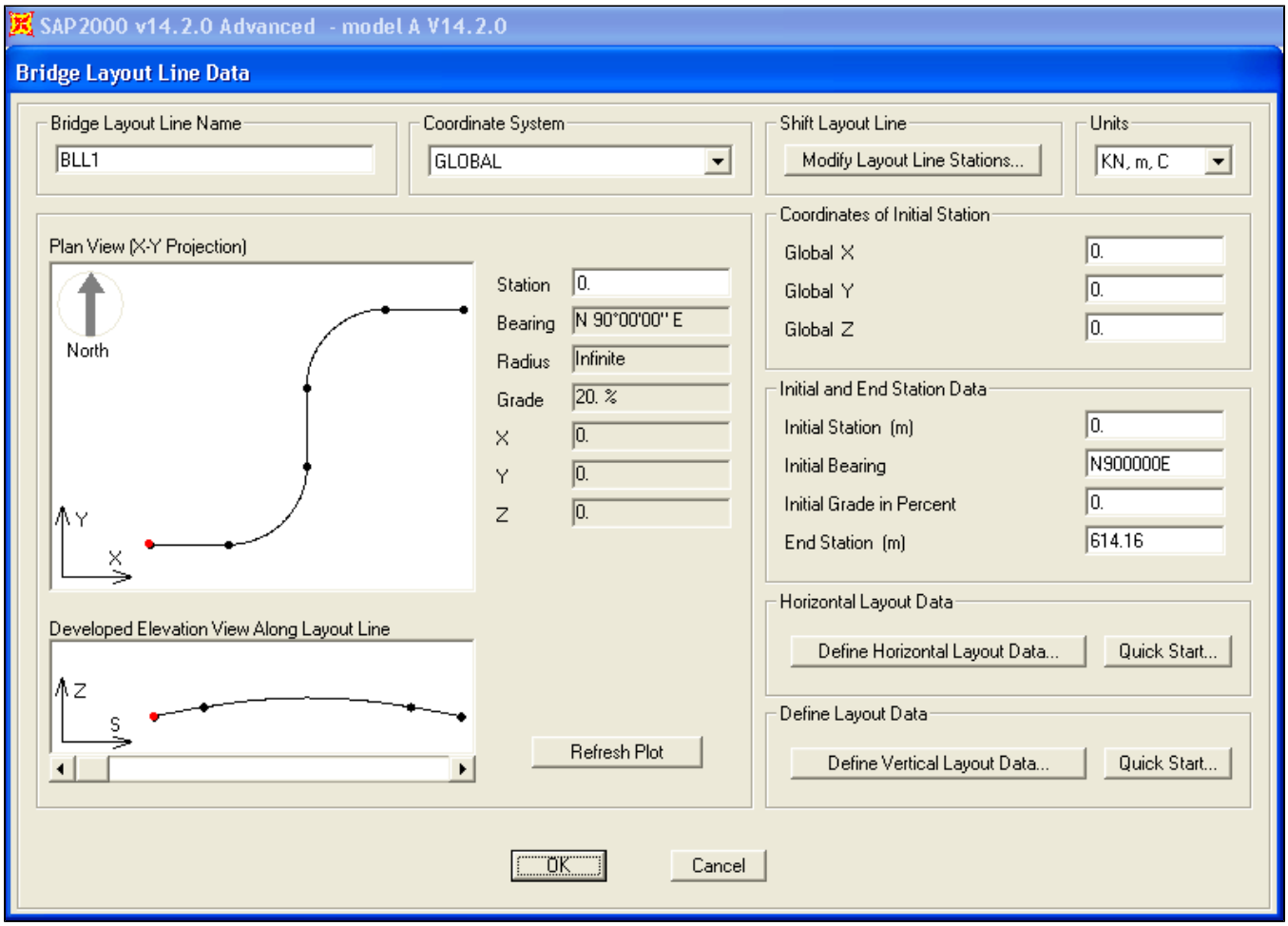

Figure 5 - Baseline geometry in SAP2000

Select Define Horizontal Layout Data to enter plan view geometry. Each row of the table in Figure 6 defines one segment of the layout-line plan as follows:

- Row 1 defines the initial bearing as N 90° 0 0 E.
- Row 2 defines a straight segment, 100m long, which extends from the previous bearing (N 90° 0 0 E).
- Row 3 defines the first curved segment, which has a constant radius of 100m. Since curvature is constant, there are no transition curves, meaning either radius or end bearing is sufficient for curve definition. If radius and end bearing do not represent a circular segment, the arc generated will be centered in the range specified. If this arc is shorter than the difference in stations, transition curves, varying linearly from *1 / R* to zero, will connect the arc to end points.
- Rows 4-6 follow the same procedure as the previous three rows.

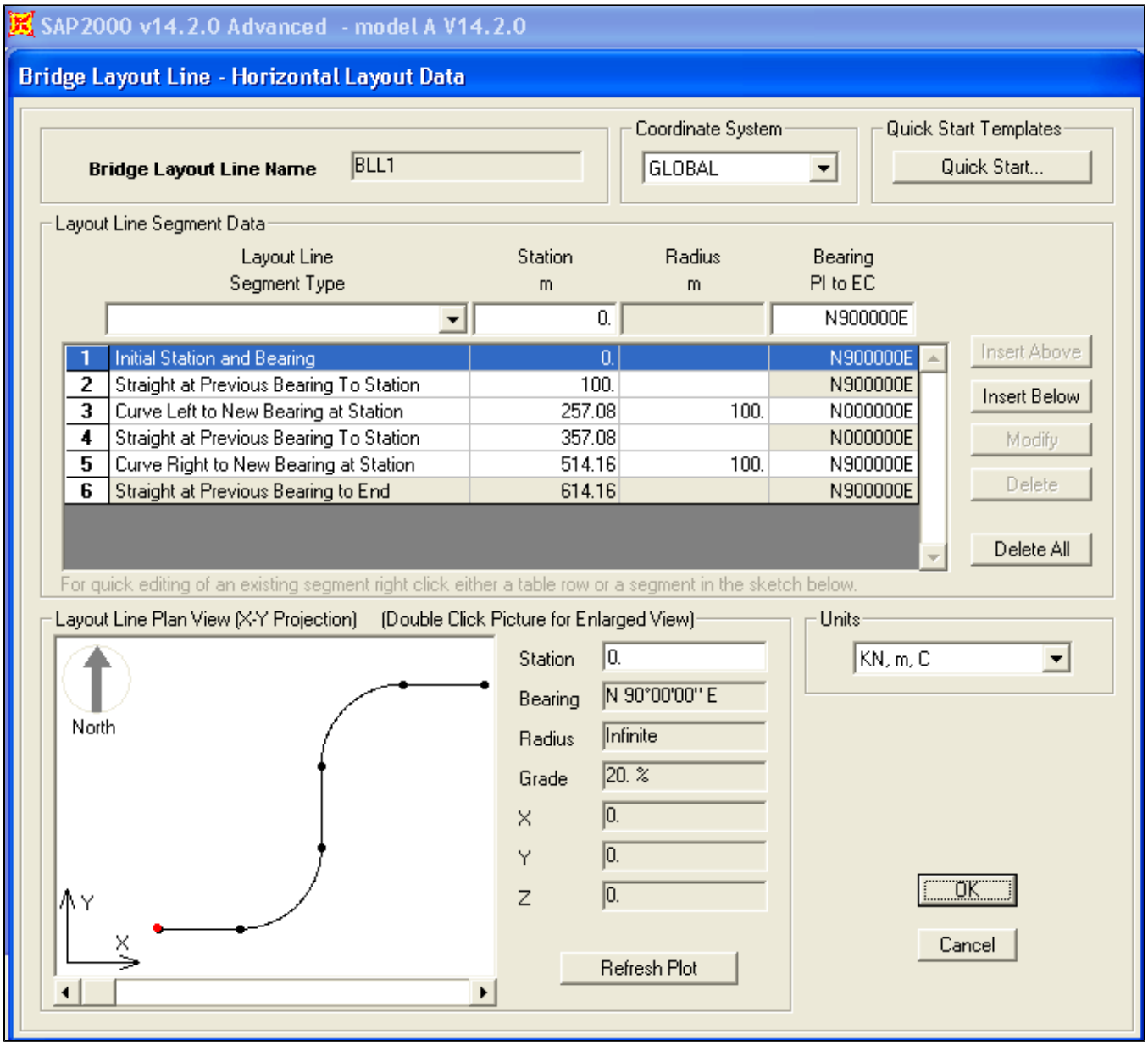

Figure 6 - Plan view data

Select Define Vertical Layout Data to enter elevation view geometry. Each row of the table in Figure 7 defines one segment of the layout-line elevation as follows:

- Row 1 defines the initial elevation and the initial grade.
- Row 2 defines a constant slope of 20% up to station 100.
- Row 3 defines a parabolic segment with an initial slope of +20% and an end slope of -20%.
- Row 4 defines a constant slope of -20% to station 614.16.

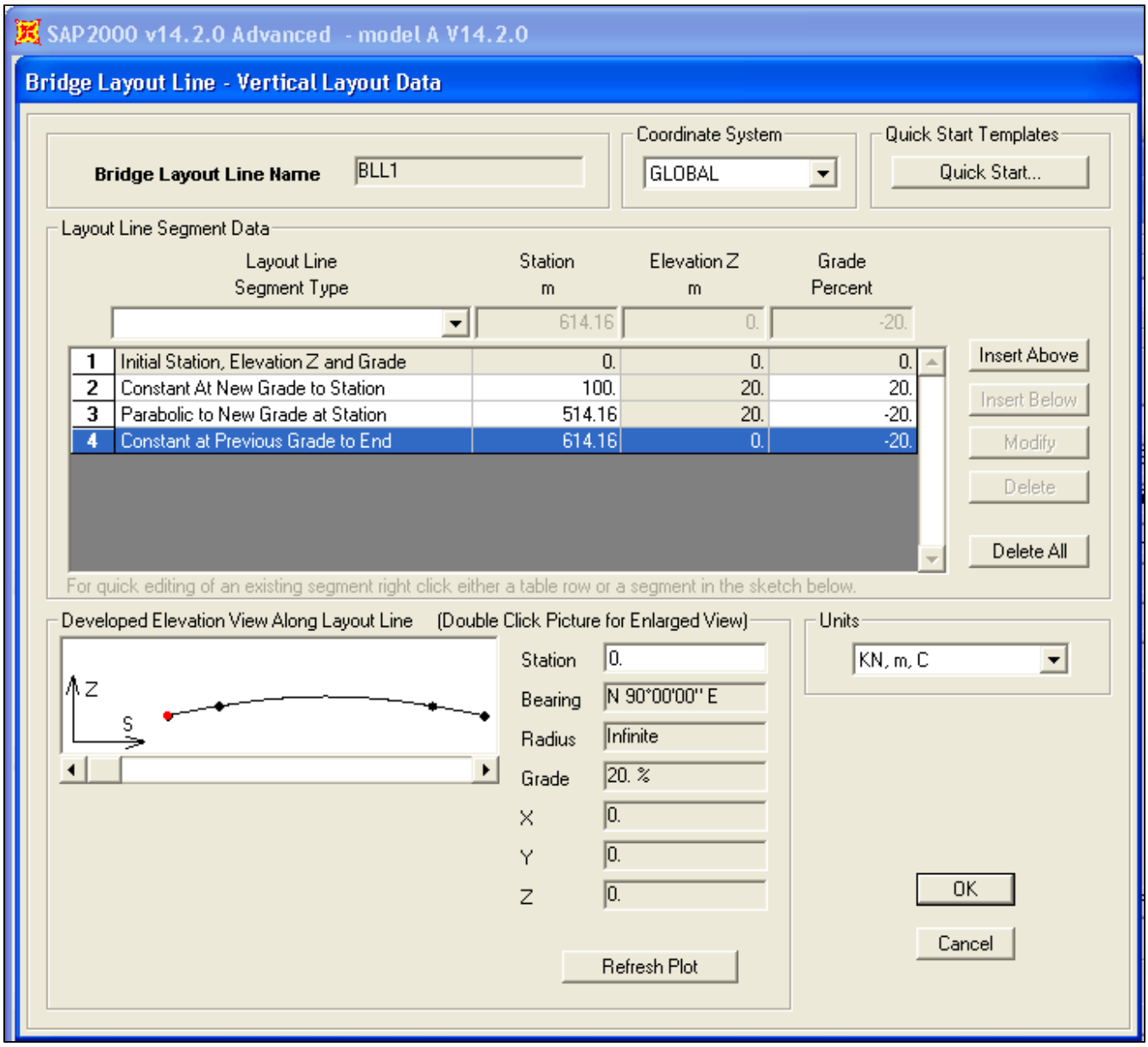

Figure 7 - Elevation view data

This procedure generates the layout line diagrammed and described in the Layout line geometry section.