


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

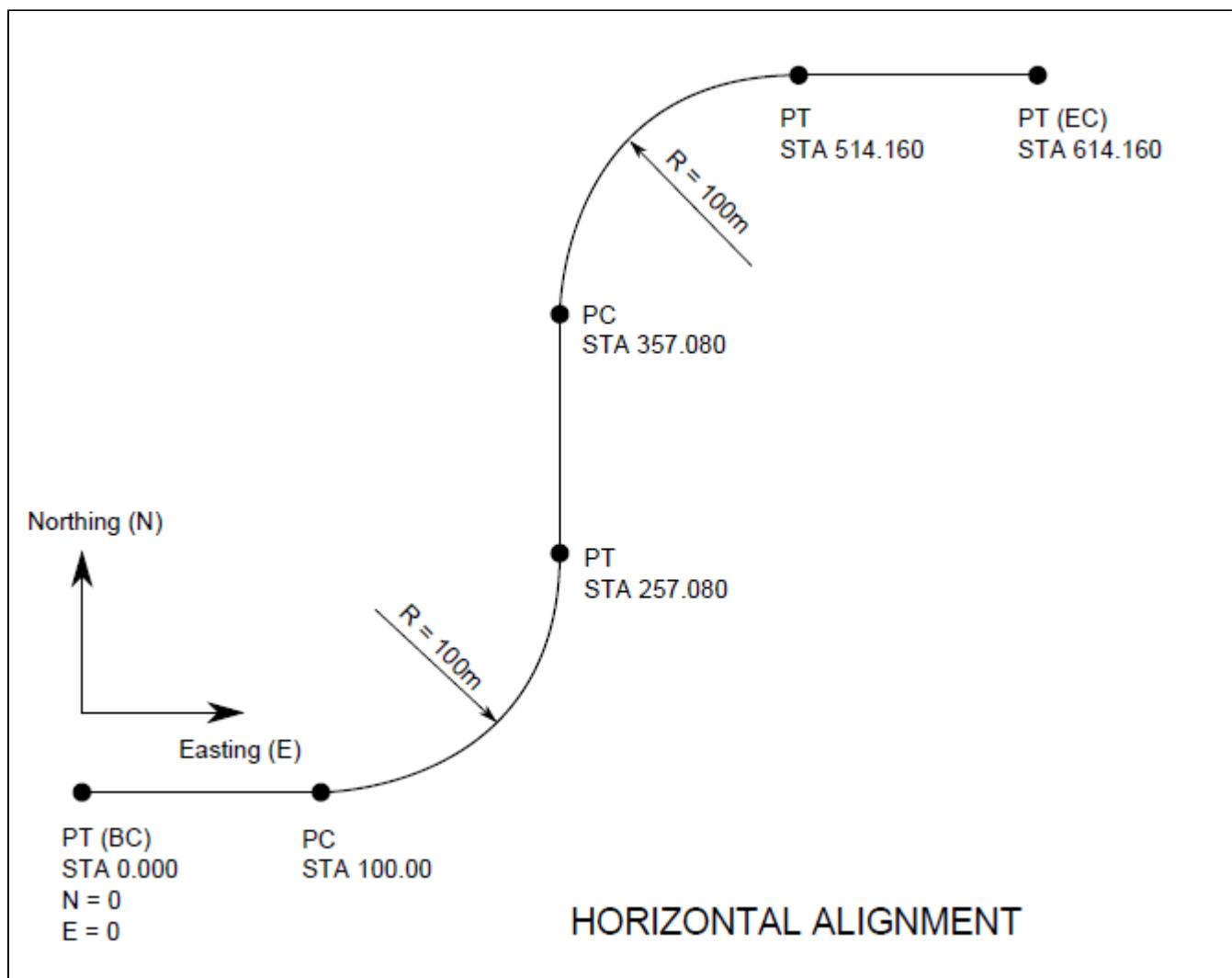


Figure 1 - Layout line plan view

Horizontal Alignment									
(all dimensions are in [m] units)									
Point No.	Point Type	Station	Northing (N)	Easting (E)	Curve Name	Radius	Northing of Center	Easting of Center	Sense
1	PT	0.000	0	0					
2	PC	100.000	0	100	C1	100	100	100	left
3	PT	257.080	100	200					
4	PC	357.080	200	200	C2	100	200	300	right
5	PT	514.160	300	300					
6	PT	614.160	300	400					

Figure 2 - Plan view data

Elevation view

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Bridge Layout Line Data

Bridge Layout Line Name

Coordinate System

Shift Layout Line

Units

Plan View (X-Y Projection)

Station
Bearing E
Radius
Grade
X
Y
Z

Coordinates of Initial Station

Global X

Global Y

Global Z

Initial and End Station Data

Initial Station (m)

Initial Bearing

Initial Grade in Percent

End Station (m)

Horizontal Layout Data

Define Layout Data

Developed Elevation View Along Layout Line

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.

SAP2000 v14.2.0 Advanced - model A V14.2.0

Bridge Layout Line - Horizontal Layout Data

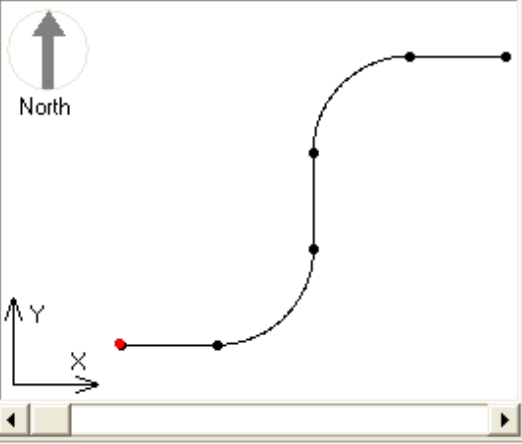
Bridge Layout Line Name: Coordinate System: Quick Start Templates:

Layout Line Segment Data

	Layout Line Segment Type	Station m	Radius m	Bearing PI to EC	
	<input type="text"/>	<input type="text" value="0."/>	<input type="text"/>	<input type="text" value="N900000E"/>	
1	Initial Station and Bearing	0.		N900000E	<input type="button" value="Insert Above"/>
2	Straight at Previous Bearing To Station	100.		N900000E	<input type="button" value="Insert Below"/>
3	Curve Left to New Bearing at Station	257.08	100.	N000000E	<input type="button" value="Modify"/>
4	Straight at Previous Bearing To Station	357.08		N000000E	<input type="button" value="Delete"/>
5	Curve Right to New Bearing at Station	514.16	100.	N900000E	<input type="button" value="Delete All"/>
6	Straight at Previous Bearing to End	614.16		N900000E	

For quick editing of an existing segment right click either a table row or a segment in the sketch below.

Layout Line Plan View (X-Y Projection) (Double Click Picture for Enlarged View)



Units:

Station: Bearing: Radius: Grade: X: Y: Z:

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.

SAP2000 v14.2.0 Advanced - model A V14.2.0

Bridge Layout Line - Vertical Layout Data

Bridge Layout Line Name
Coordinate System
Quick Start Templates

Layout Line Segment Data

	Layout Line Segment Type	Station m	Elevation Z m	Grade Percent
		614.16	0.	-20.
1	Initial Station, Elevation Z and Grade	0.	0.	0.
2	Constant At New Grade to Station	100.	20.	20.
3	Parabolic to New Grade at Station	514.16	20.	-20.
4	Constant at Previous Grade to End	614.16	0.	-20.

For quick editing of an existing segment right click either a table row or a segment in the sketch below.

Developed Elevation View Along Layout Line (Double Click Picture for Enlarged View)

Station
 Bearing
 Radius
 Grade
 X
 Y
 Z

Units

Figure 7 - Elevation view data

This procedure generates the layout line diagrammed and described in the [Layout line geometry](#) section.