Deck Contour Checklist

A deck contour sheet shall be included in the contract plans for all new structures and should be considered for wide widenings. It is desirable that these sheets be completed early in the design stage so they may be adequately checked and used by design personnel.

A. Checklist for Detailing

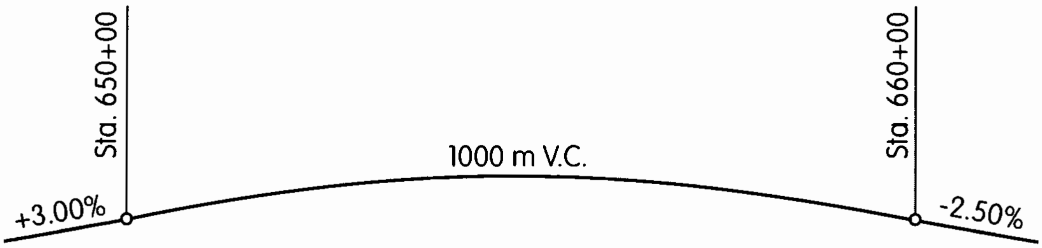
1. Computer plot should be placed at top of sheet, oriented the same as the General Plan.
2. Show North arrow.
3. If continuation is needed, identify match line or repeated station.
4. Scale: 1:250 usually adequate. Very small structures may be shown at 1:125. Do not attempt to fill up the sheet with smaller scales (i.e., 1:80).
5. Show and identify station lines and edges of decks. These should be done by computer plot.
6. Extend contour limits to include wingwalls or retaining walls and approach slabs.
7. Do not show alignment data.
8. Detail and identify centerlines of support and add dimension to edges of deck, even 100 meter station and match lines.

B. Other Sections and Details

1. Variable superelevation data and profile grade data should be shown on this sheet when space is not available on the General Plan.
2. Place deck contours on a bridge detail sheet to allow space for any notes applicable to design and for the index to plans if space is not availabe on the General Plan.
3. For structures that are to receive a deck overlay such as A/C/ Surfacing, the contours should be plotted at the top of concrete deck and so noted on the Deck Contour Sheet.
4. "50 Scale" contours shall be handled as described in Memo to Designer 2-2.
5. Deck Contour note is available as a CADD Pattern in Bridge Standard Cell Library.

Rate of Change of Vertical Curves

Elevations on vertical curves should ordinarily be calculated by the electronic computer. On the General Plan and other sheets which show vertical curve data, the Rate of Change (R/C) should be calculated and given as indicated:



Rate of Change = R/C = -0.55%/ Station

Calculate the Rate of Change from the formula $R/C = \frac{G_2 - G_1}{L}$

Where

G_1 = Grade at first point on curve (%).

G_2 = Grade at last point on curve (%).

+G ascending

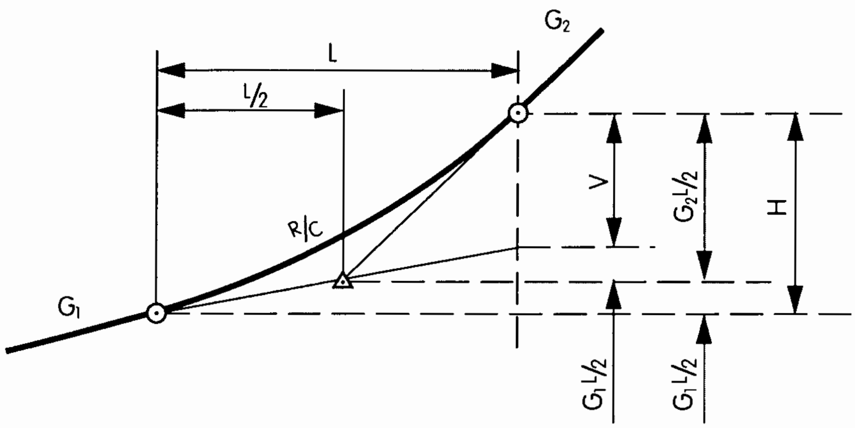
-G descending

L = Length of vertical curve in stations.

$$R/C = \frac{-2.50 - (+3.00)}{10} = \frac{-5.50}{10} = -0.550\%/\text{Station}$$

Vertical Curve Formula

Rate of Change of Grade per Station Method



Fundamental Equations:

$$R/C = \frac{G_2 - G_1}{L} \quad ; \quad V = \frac{L}{2}(G_2 - G_1) \quad ; \quad H = \frac{L}{2}(G_2 + G_1)$$

From them or combinations of them, any problem in vertical curves can be solved.

R/C = Rate of Change of Grade per Station (% per Station).
Expresses sharpness of curve.
Constant throughout length of curve.
$+R/C$ turns upward, $-R/C$ turns downward.

G_1 = Grade at first point on curve. (%)

G_2 = Grade at second point on curve. (%)

L = Distance between the two points on the curve (Sta's).

V = Tangent offset from first point to second (m).
+V measured upward, -V measured downward.

H = Difference in elevation from first point to second (m).
+H measured upward, -H measured downward.

Middle Ordinate

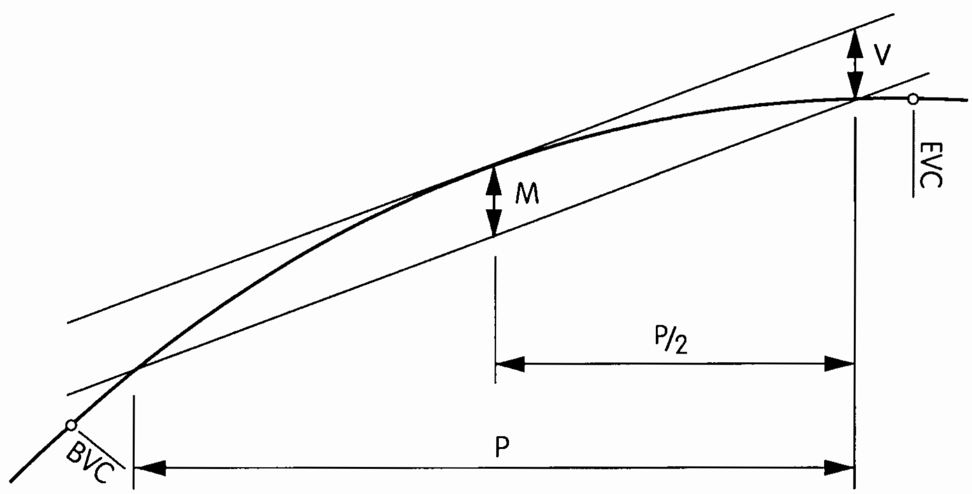
Requests have been received for an expression which will give the middle ordinate of a portion of a vertical curve. The answer is simply $\frac{R/C\,P^2}{8}$, in which P is the length of the portion in stations and R/C is the rate of change of grade per station.

Solution:

Combining the fundamental equations

(1) $R/C\,L = (G_2 - G_1)$ and (2) $V = \frac{L(G_2 - G_1)}{2}$ gives $V = \frac{R\,L^2}{2}$

Applying this general equation to figure below.



V is equal to M

L becomes equal to the part of the curve $P/2$

Substituting these values $M = \frac{R/C\,(P/2)^2}{2}$

Simplified $M = \frac{R/C\,P^2}{8}$

P is measured horizontally

M is measured vertically

Locate high or low point: $L = \frac{-G_1}{R/C}$

Vertical Curve Calculations

To find an elevation at any given station on a vertical curve use data given on the General Plan Profile Grade.

Given:

2000 m V.C.
R/C = -0.190%/Sta.

Sta. 12 + 60.00 Bent 2

Formula:

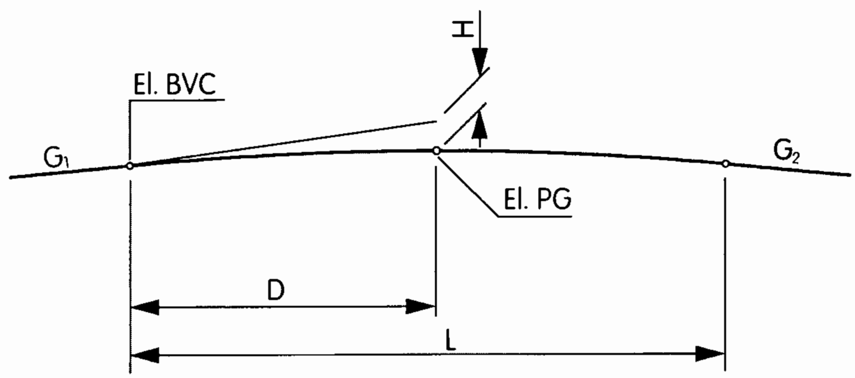
D (Distance from BVC to point in stations)

$$R/C = \frac{\text{Grade at EVC - Grade at BVC}}{\text{Length at vertical curve}}$$

El. tan. = El. BVC + (D)(Grade at BVC)

H (Rise from profile to El. tan.)

$$H = \frac{(D^2)(R/C)}{2}$$



Thus:

$$\text{El. PG} = \text{El. BVC} + (D)(G_1) + \frac{(D^2)(R/C)}{2}$$

$$\text{El. PG} = 122.63 + (8.60)(2.00) + \frac{(8.60)^2(-0.19)}{2}$$

El. PG = 122.63 + 17.20 - 7.03

El. PG = 132.80

Vertical Curve data (cont.)

The "Brownell" method for calculating elevations at given stations along a vertical curve. Use data given on the General Plan Profile Grade.

Given:

2000 m V.C.
R/C = -0.190%/Sta.

Sta. 11 + 50.00 Abut. 1

Sta. 12 + 60.00 Abut. 2

Sta. 13 + 70.00 Abut. 3

Stationing	L	R/C	R/C x L	G	Avg. G	L x Avg.G	Elevation
	In Station		Change in Grade	Grade at Station	Between Stations	Change in Elevation	At Station
4 + 00.00 BVC				+2.00			122.63
	7.50		-1.4250		+1.2875	+9.6562	
11 + 50.00 Abut. 1				+.5750			132.2862
	1.10		-.2090		+.4705	+.5175	
12 + 60.00 Bent. 2		-0.190%/Sta.		+.3660			132.8037
	1.10		-.2090		+.2615	+.2876	
13 + 70.00 Abut. 3				+.1570			132.0913
	10.30		-1.9750		-.8215	-8.4614	
24 + 00.00 EVC				-1.80			124.6299
						Check	124.63