Bridge Design Details 2D October 2019

To find the elevation at any given station on a vertical curve, use data given on the PROFILE GRADE and the following equation:

\[
(5) \quad (Elev\_PG)_{D} = (Elev\_BVC) + (D \times G_1) \times \frac{D^2 + \frac{R}{C}}{2}
\]

Where:

D = Distance from BVC to a point in stations

H = Rise from Profile Grade to (Elev_tan): \[ H = \frac{D^2 + \frac{R}{C}}{2} \]

Example:

\[
(6) \quad (Elev\_tan) = (Elev\_BVC) + (D \times G_1)
\]

\[
Find: \quad \text{Elevation at Sta 12 + 60.00}
\]

\[
\text{Thus:} \quad \text{Elev PG (12 +60.00)} = 122.63 + (8.60)(2.00) + \frac{(8.60)^2(-0.19)}{2}
\]

\[
= 122.63 + 17.20 - 7.03
\]

\[
= 132.80
\]
Example:

The "Brownell" method for calculating elevations at given stations along a vertical curve.

Given:

![Vertical Curve Diagram]

\[ R/C = -0.1900\% / \text{Sta} \]

**PROFILE GRADE**

**Figure 2A.D.3 Vertical Curve “Brownell” Example Calculations**

Find elevations at:
- Abutment 1 at 11+50
- Bent 2 at 12+60
- Abutment 3 at 13+70

<table>
<thead>
<tr>
<th>Station</th>
<th>( R/C ) (% / Station)</th>
<th>G (Grade at Station)</th>
<th>L (Length - Stations)</th>
<th>( R/C \times L ) (Change in Grade)</th>
<th>L × Avg G (Change in Elevation)</th>
</tr>
</thead>
<tbody>
<tr>
<td>4+00.00 BVC</td>
<td>-0.1900</td>
<td>+2.00</td>
<td>7.50</td>
<td>-1.4250</td>
<td>+9.6562</td>
</tr>
<tr>
<td>11+50.00 Abut 1</td>
<td>-0.1900</td>
<td>+0.5750</td>
<td>1.10</td>
<td>-0.2090</td>
<td>+0.5175</td>
</tr>
<tr>
<td>12+60.00 Bent 2</td>
<td>-0.1900</td>
<td>+0.3660</td>
<td>1.10</td>
<td>-0.2090</td>
<td>+0.2876</td>
</tr>
<tr>
<td>13+70.00 Abut 3</td>
<td>-0.1900</td>
<td>+0.1570</td>
<td>10.30</td>
<td>-1.9750</td>
<td>-8.4614</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Station</th>
<th>Elevation</th>
</tr>
</thead>
<tbody>
<tr>
<td>4+00.00 BVC</td>
<td>122.63</td>
</tr>
<tr>
<td>11+50.00 Abut 1</td>
<td>132.28</td>
</tr>
<tr>
<td>12+60.00 Bent 2</td>
<td>132.80</td>
</tr>
<tr>
<td>13+70.00 Abut 3</td>
<td>133.09</td>
</tr>
<tr>
<td>24+00.00 EVC (Calculated)</td>
<td>124.63</td>
</tr>
<tr>
<td>24+00.00 EVC (Given)</td>
<td>124.63</td>
</tr>
</tbody>
</table>