M = Mid-ordinate, in feet
Z = Any tangent offset, in feet
L = Horizontal length of vertical curve, in feet
X = Horizontal distance from PVC or PVT to any ordinate *Z*, in feet
G_1 and G_2 = Rates of grade, expressed algebraically, in percent

All expressions are to be calculated algebraically.

$$PVI\ Elev = PVC\ Elev + \frac{LG_1}{200}$$

$$PVT\ Elev = PVC\ Elev + \frac{L(G_1 + G_2)}{200}$$

$$M = \frac{L(G_2 - G_1)}{800}$$

For offset *Z* at distance *X* from PVC or PVT:

$$Z = M\left(\frac{2X}{L}\right)^2 \quad \text{or} \quad Z = \frac{X^2(G_2 - G_1)}{200L}$$

For slope *S*, in percent, of a line tangent to any point on the vertical curve at distance *X* measured from the PVC:

$$S = G_1 - \frac{X(G_1 - G_2)}{L}$$

Calculate location and elevation of the high or low point on the curve:

$$X_T = \frac{LG_1}{G_1 - G_2}$$

Where X_T equals the horizontal distance from the PVC to the high or low point on the curve in feet.

$$Elev = PVC\ Elev - \frac{L(G_1)^2}{200(G_2 - G_1)}$$

SYMMETRICAL VERTICAL CURVE EQUATIONS

Figure 44-3F