TO PASS A VERTICAL CURVE THROUGH A GIVEN POINT P

G_1	=	Grade In, %
G_2	=	Grade Out, %
A	=	Algebraic difference in grades, %
Z	=	Vertical curve correction at point P, feet
X	=	Distance from point P to PVC, feet
D	=	Distance from point P to PVI, feet
L	=	Length of vertical curve, feet

Given: G_1, G_2, D

Find: Length of vertical curve

Solution:

1. Find algebraic difference in grades:

$$A = G_2 - G_1$$

2. Find vertical curve correction at point P at distance x measured from PVC:

$$Z = X^2\left(\frac{G_2 - G_1}{200\,L}\right)$$

3. From inspection of the above diagram:

$$\frac{L}{2} = X + D \text{, or } \quad L = 2(X + D)$$

Substituting $2(X+D)$ for L and A for (G_2-G_1) yields:

$$AX^2 = (-400ZX) + (-400DZ) = 0$$

4. Solve for *X* given the quadratic equation as follows:

$$X = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a} = \frac{400Z \pm \sqrt{160{,}000\,Z^2 + 1600\,ADZ}}{2A}$$

Solving for *X* will result in two answers. If both answers are positive, there are two solutions. If one answer is negative, it can be eliminated and only one solution exists.

5. Substitute *X* and *D* into the equation shown in Step 3 and solve for *L*.

Note: Two positive *X* values will result in two solutions for *L*. Desirably, the solution that results in a longer *L* should be used provided that it satisfies the stopping sight distance criteria based on the selected design speed and algebraic difference in grades. See Figures 44-3A and 44-3C).

VERTICAL-CURVE COMPUTATIONS

Figure 44-3I