IN ANY VERTICAL CURVE:

\[ m = \frac{(G' - G)L}{8} \]

\[ m = \frac{1}{2} \left( \frac{\text{ELEV. B.V.C.} + \text{ELEV. E.V.C.} - \text{ELEV. V}}{2} \right) \]

\[ d = m \left( \frac{D}{L/2} \right)^2 = \frac{4m}{L^2}D^2 \]

\[ d = \frac{D(G'-G)}{2L} \]

\[ X = \frac{100 (H-P')}{(G-G')} \]

\[ S = G - D \left( \frac{G-G'}{L} \right) \]

\[ D_0 = \frac{LG}{G-G'} \]

WHERE:

- \( L \) = LENGTH OF CURVE IN 100 FT. UNITS OR STATIONS
- \( G \) AND \( G' \) = GRADE RATES IN PERCENT
- \( m \) = MIDDLE ORDINATE IN FT.
- \( d \) = CORRECTION FROM GRADE LINE TO CURVE IN FT.
- \( D \) = DISTANCE FROM B.V.C. OR E.V.C. TO ANY POINT ON CURVE IN STATIONS
- \( S \) = SLOPE OF THE TANGENT TO THE CURVE AT ANY POINT IN PERCENT
- \( X \) = DISTANCE FROM P' TO V IN FT.
- \( H \) = ELEVATION OF GRADE G PRODUCED TO STATION OF P'
- \( P \) AND \( P' \) = ELEVATION ON RESPECTIVE GRADES
- \( D_0 \) = DISTANCE TO LOW OR HIGH POINT FROM EXTREMITY OF CURVE IN STATIONS
- \( V \) = ELEVATION OF INTERSECTION POINT OF APPROACH GRADES

NOTES:

1. VERTICAL CURVE IS REQUIRED WHERE DIFFERENCE IN ROAD GRADE IS GREATERT THAN 0.5%, OR WHERE SUM OF GRADE BREAKS WITHIN 200' EXCEEDS 0.5%.
2. MINIMUM VERTICAL CURVE LENGTH "L" (IN FEET) SHALL BE 3 TIMES THE DESIGN SPEED (IN MPH). A RISING GRADE CARRIES A PLUS SIGN WHILE A FALLING GRADE CARRIES A MINUS SIGN. THUS IN A CREST VERTICAL CURVE AS ABOVE, G CARRIES A PLUS SIGN AND G' A MINUS SIGN WHEN PROGRESSING IN THE DIRECTION OF THE STATIONING. WHEN PROGRESSING IN THE OPPOSITE DIRECTION, G BECOMES A MINUS GRADE AND G' A PLUS GRADE.