

Derivation of the Minimum Depth Formula for Constrained Posts

Variable	Units
P is the horizontal wind force	lbs
h is the overall fence height	ft
$\frac{1}{2}h$ is the force application height for fencing	ft
b is the diameter of the footing	ft
S_3 is the lateral soil pressure at Footing Depth, D	psf
Q is the resultant of the lateral soil pressure	lbs
d is the minimum embedment depth	ft
D is the Footing Depth being checked ($D \geq d$ is OK)	ft

$Q = \frac{1}{3} S_3 d b$ (Area of the parabolic spandrel times the post width)

Taking the moment about the point of rotation $P \frac{1}{2}h = Q c$

Replace Q with formula $P \frac{1}{2}h = \frac{1}{3} S_3 d b c$

$c = \frac{3}{4} d$ (Centroidal depth of a side opening parabolic spandrel)

$$P \frac{1}{2}h = \frac{1}{3} S_3 d b \frac{3}{4} d = S_3 b \frac{1}{4} d^2$$

Rearrange the formula to find d $d^2 = \frac{P \frac{1}{2}h}{S_3 b \frac{1}{4}}$ $d^2 = \frac{4.0 P \frac{1}{2}h}{S_3 b}$ $d = \sqrt{\frac{4.0 P \frac{1}{2}h}{S_3 b}}$

This result is within 3% of the IBC Equation 18-2 modified for fencing $d = \sqrt{\frac{4.25 P \frac{1}{2}h}{S_3 b}}$

