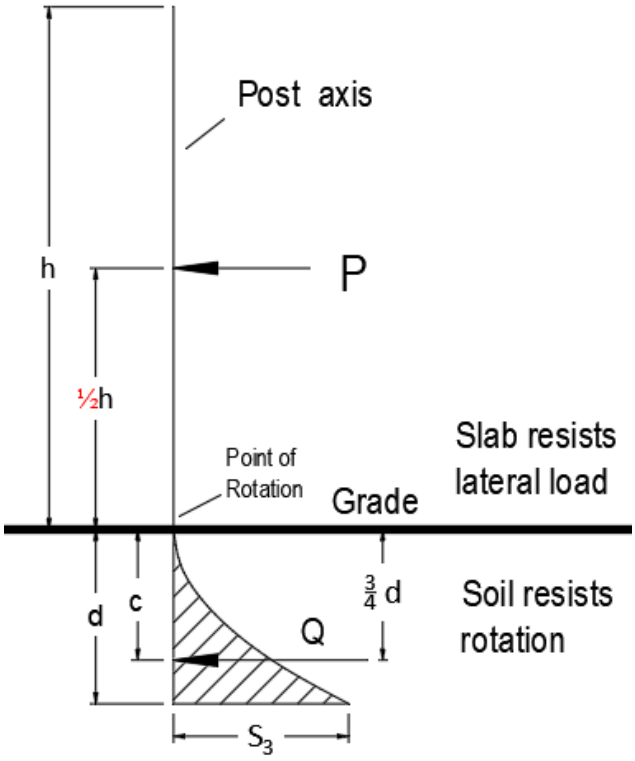
Derivation of the Minimum Depth Formula for Constrained Posts

Variable	Units
P is the horizontal wind force	lbs
h is the overall fence height	ft
½h 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 ≥ d is OK)	ft



Q = ⅓ S_3 d b (Area of the parabolic spandrel times the post width)

Taking the moment about the point of rotation P ½h = Q c

Replace Q with formula P ½h = ⅓ S_3 d b c

c = ¾ d (Centroidal depth of a side opening parabolic spandrel)

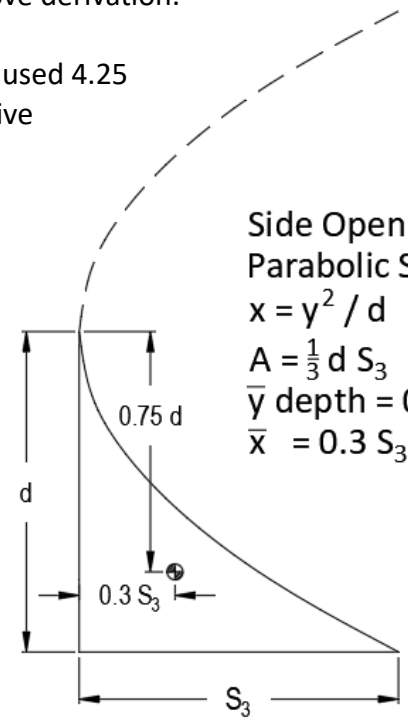
P ½h = ⅓ S_3 d b ¾ d = S_3 b ¼ d^2

Rearrange the formula to find d $d^2 = \frac{P ½h}{S_3 b \, ¼}$ $d^2 = \frac{4.0 \, P ½h}{S_3 b}$ $d = \sqrt{\frac{4.0 \, P \, ½ \, h}{S_3 \, b}}$

This result is within 3% of the IBC Equation 18-2 modified for fencing $d = \sqrt{\frac{4.25 \, P \, ½ \, h}{S_3 \, b}}$

EP486.1 also uses 4.0 per the above derivation.

It is thought that the IBC formula used 4.25 to make it a little more conservative than the actual derived formula.



Side Opening Parabolic Spandrel

$x = y^2 / d$ per EP486.1

A = ⅓ d S_3

$\bar{y}$ depth = 0.75 d

$\bar{x}$ = 0.3 S_3