| Revision | Author | Checked by | Date |
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# Flagpole Footing Design

Compliant with International Building Code (IBC) 2018

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| | | Approved by: | |
| | | Approved by (Client): | |
| | | Date: | 17th April 2021 |

Revision

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| Rev A | First release | 16th January 2021 |
| Rev B | Updated fracture check | 17th April 2021 |

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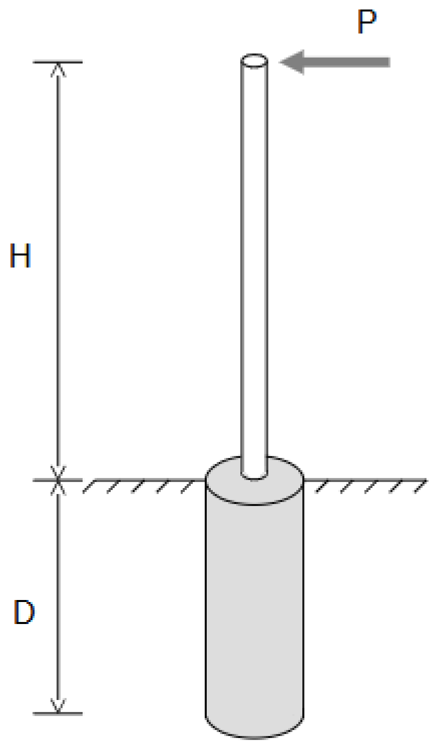
## Introduction

This calculation sheet determines the diameter of a footing, according to Chapter 18 of IBC 2018 (1807.3 Embedded posts and poles)




## Parameters

Restrained at grade — constrained := "yes"

Lateral force at top of pole — $P := 30 \times 10^{3}\ \mathrm{lbf}$

Height of pole above grade — $H := 3\ \mathrm{ft}$

Diameter of pole footing — $B := 4.5\ \mathrm{ft}$

Lateral soil capacity — $S := 0.35 \times 10^{3}\ \mathrm{lbf \cdot ft^{-3}}$

Isolated pole factor IBC 2018 (1806.3.4) — $F := 2$

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## Analysis

Moment in the post at grade $M_g := P \cdot H = 9.00 \times 10^4\ \mathrm{lbf \cdot ft}$

Constant
IBC 2018 (1807.3.2.1)

$$eq1 := A = \frac{2.34 \cdot P \cdot \mathrm{lbf}^{-1}}{B \cdot \mathrm{ft}^{-1} \cdot S_1 \cdot \mathrm{lbf}^{-1} \cdot \mathrm{ft}^2}$$

In these equations
- d is the depth of embedment in earth
- S1 and S3 are the allowable lateral soil-bearing pressures

Lateral bearing @ bottom $eq2 := S_3 = F \cdot S \cdot \min(d, 12\ \mathrm{ft})$

Lateral bearing @ d/3 $eq3 := S_1 = F \cdot S \cdot \min(d/3, 12\ \mathrm{ft})$

Diameter of round post
IBC 2018 (1807.3.2.1 eq 18-1
and 1807.3.2.2 eq 18-3)

$$eq4 := d = \mathrm{ft} \cdot \begin{cases} \frac{A}{2} \cdot \left(1 + \sqrt{1 + \frac{4.36 \cdot H \cdot \mathrm{ft}^{-1}}{A}}\right) & constrained = \text{"no"} \\ \sqrt{\frac{4.25 \cdot M_g \cdot \mathrm{lbf}^{-1} \cdot \mathrm{ft}^{-1}}{B \cdot \mathrm{ft}^{-1} \cdot S_3 \cdot \mathrm{lbf}^{-1} \cdot \mathrm{ft}^2}} & constrained = \text{"yes"} \end{cases}$$

Iterative solution of equations

$$res := \mathit{fsolve}\left(\{eq1, eq2, eq3, eq4\}, \left\{A = 1, S_1 = 1\frac{\mathrm{lbf}}{\mathrm{ft}^2}, S_3 = 1\frac{\mathrm{lbf}}{\mathrm{ft}^2}, d = 1\ \mathrm{ft}\right\}\right)$$

Hence the dimensions and
soil pressures are

$$\mathrm{convert}(res, Vector) = \begin{bmatrix} A = 13.501 \\ S_1 = 5.532 \times 10^4\ \mathrm{Pa} \\ S_3 = 1.660 \times 10^5\ \mathrm{Pa} \\ d = 1.509\ \mathrm{m} \end{bmatrix}$$