Footing Size Calculations in Post Frame Structures

A guide for understanding footing size calculations in post-supported structures

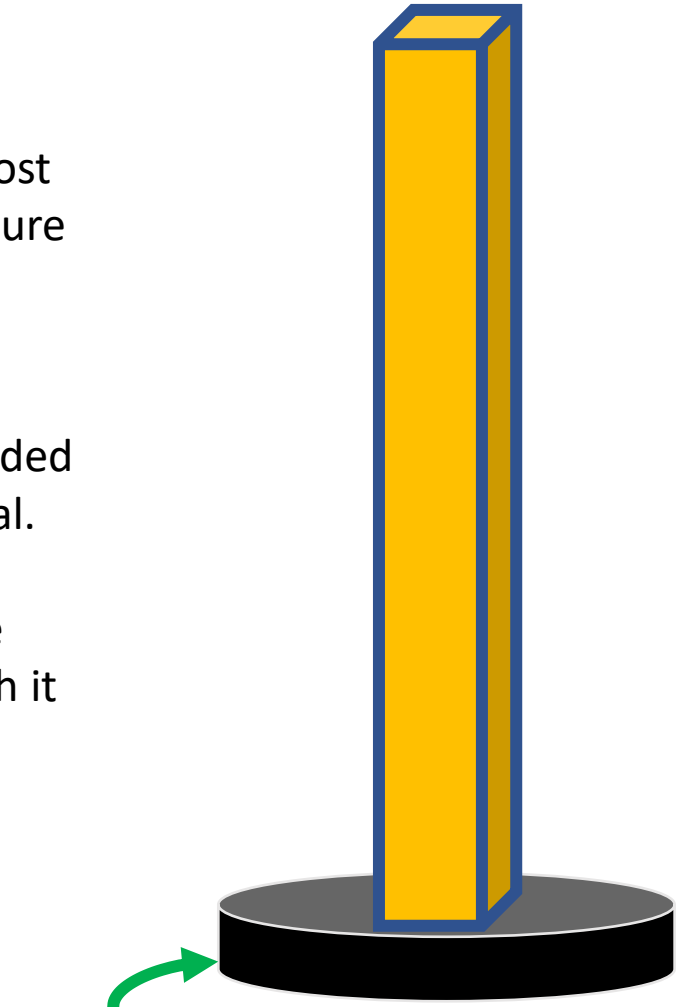
with details on how the FootingPad® calculator works

I. Introduction

Footings are an important structural component of any post supported structure. Some simple math is needed to ensure the footing is the correct size.

Armed with the knowledge in this guide, anyone can understand and comfortably discuss the footing sizes needed for their project with an inspector or other building official.

The methodology in this guide applies to determining the footing size needed, regardless of the material from which it is made.



Isolated Footing

II. Determining the footing size needed for post-in-the-ground structures

Isolated footings describe a foundation type that supports a post or column that is not part of a continuous footing. The footing is "isolated", and therefore it is straight-forward to calculate the load capacity of this footing type because there is no shared weight. All the weight carried by one post is transferred to one footing.

Regardless from what material an isolated footing is made, it functions by spreading the load carried by the post over a larger surface area. As long as the footing is stronger than the soil on which it sits, the larger the surface area of footing, the larger the load it will carry. If stronger than the soil AND overloaded, a footing will simply sink into the ground.

By knowing two things:

1) Weight on the footing
2) Load capacity of the soil

You can determine the footing size needed to support the load by using this formula:

$A = B/C$

Where
A = Surface area of the footing
B = Load on the footing in pounds
C = Load carrying capacity of the soil in pounds per square foot (psf)

Please Note: Because each post is sitting on an individual footing, we use "post" and "footing" interchangeably throughout this guide.

III. Surface area of FootingPad and other round footings

FootingPad diameter	Surface area of FootingPad (sq. ft)
10”	.545
12”	.785
16”	1.39
20”	2.18
24”	3.14

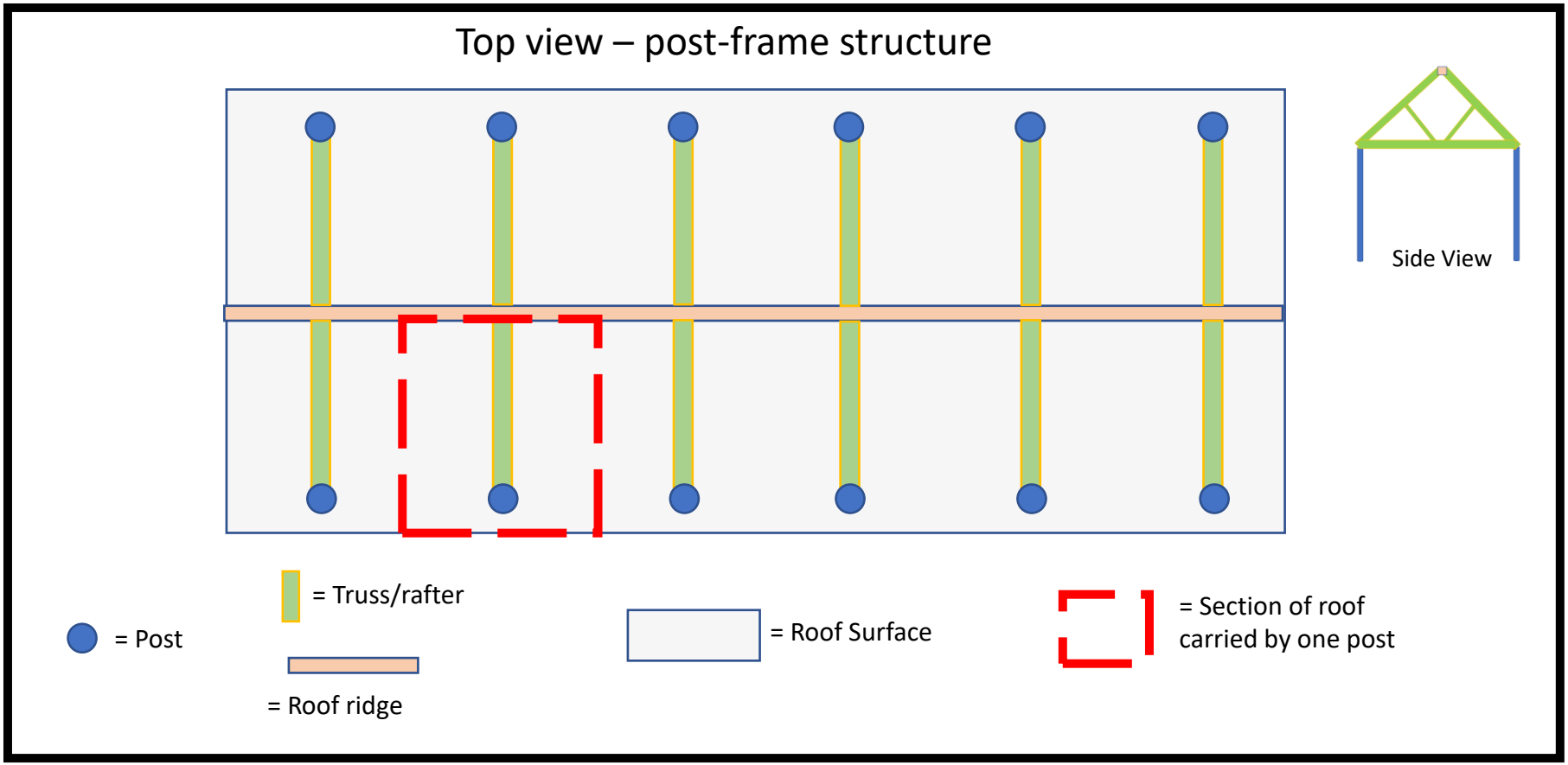
FootingPad post foundations are round, and the surface area of any circle is determined by the formula:

pi r^2 = 3.14 x (radius x radius)

The surface area of a square or rectangle is determined by length x width. For example, a 12” x 12” square has a surface area of 1 sq. foot.

IV. Load calculation formula applied to post-frame (pole barn) construction

Post frame construction footing size calculations are easily determined because of its simple load bearing structure. Typical post frame construction involves a series of posts opposite each other with a truss or rafters spanning the distance. The ultimate load is the defined by area of the roof carried by each post.



The farther apart the posts are spaced, both in building width and side wall post spacing, the more load on each post. As typical post frame construction will have sidewall posts spaced equally, each post carries approximately the same weight. There is little weight on the end walls, so to calculate the load on the footing, the only data points needed are the building width and post spacing. The FootingPad calculator pre-fills the dead weight load of a common steel-roofed at 5 lbs. per square foot.

V. Example – Post-frame footing calculation

If the following data is entered into the FootingPad calculator, the footing size recommended is a 16" diameter FootingPad. Here's how we get there:

Building Width:	40 feet
Soil Capacity:	3000 psf
Post Spacing:	8 feet
Snow Load	20 lbs. / square foot

Surface area of footing (in sq. ft) = Total load (in lbs.) on footing / Soil Capacity (lbs/sq ft)

Total load = (½ building width x Post spacing) x (5 lbs. dead load[1] + snow load[2])
= 20' x 8' x (5 + 20 lbs. / square foot)
= 160 square feet x 25 lbs. / square foot
= 4000 lbs.

Surface area of footing (in sq. ft) = 4000 / 3000
Surface area of footing (in sq. ft) = 1.33

(continued next page)

[1] 5 lbs. per square foot of roof surface is used for a simple structure with a sheet metal roof and siding and no sheathing, shingles, etc

[2] Snow loads are measured in pounds per square foot (psf). Snow load information can be found from your local building officials of from maps on the internet.

In this example, the necessary surface area of the footing calculates to 1.33 square feet. More accurately, this formal describes the MINIMUM surface area of the footing. A larger footing will work, but also means digging a larger hole.

Using the chart below, any footing larger than 1.33 square feet will work.

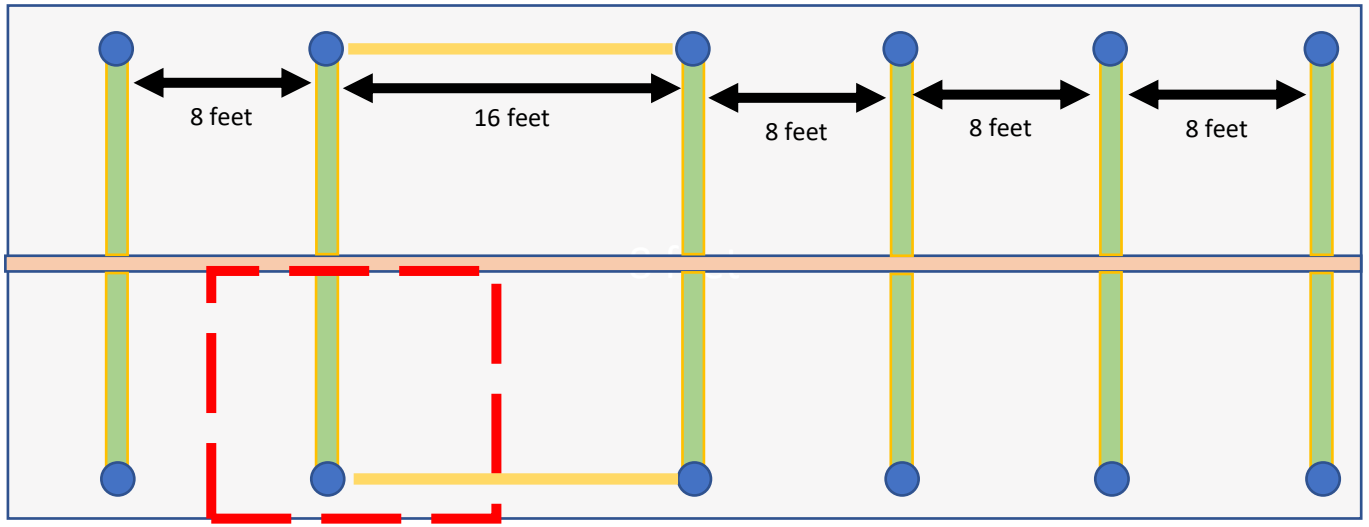
The 16” FootingPad will be recommended by our calculator using the data supplied in this example

FootingPad diameter	Surface area of FootingPad (sq. ft)
10”	.545
12”	.785
16”	1.39
20”	2.18
24”	3.14

Appendix 1: Load calculation formula for post frame door on SIDE wall

Many post frame buildings have overhead or other large doors on the end walls, which carry little structural weight. If your post frame building has a door on the SIDE wall, and that door is WIDER than your post spacing, you will have extra weight on the posts on either side of the door. This will require a separate footing size calculation.

Top View – Post Frame Structure with side wall door



= Post

= Truss/rafter

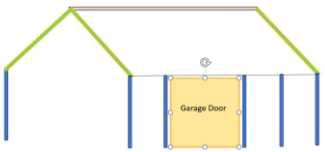
= Roof ridge

= Roof Surface

= Section of roof carried by one post

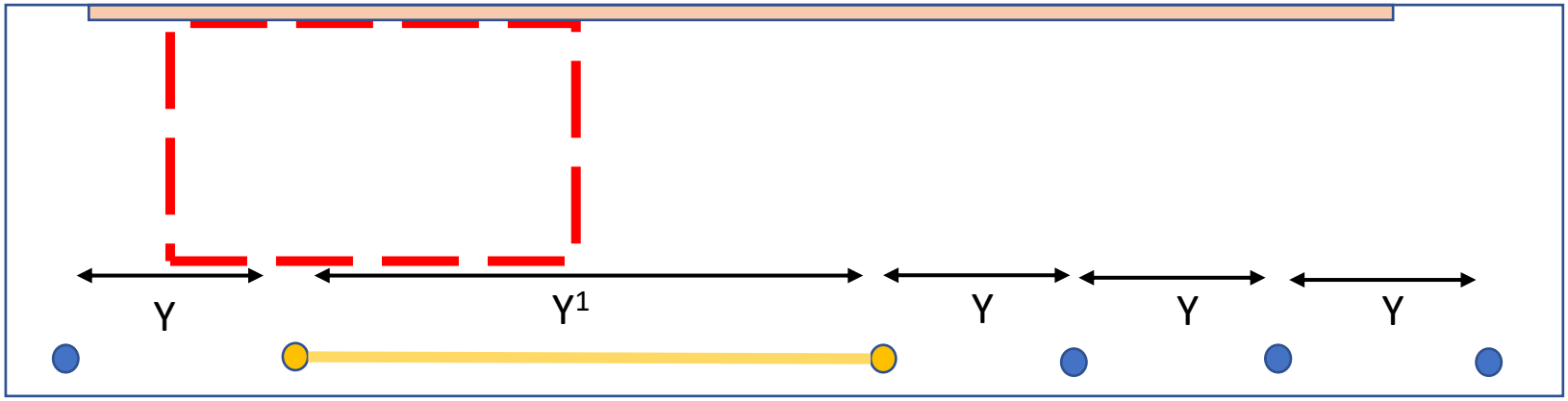
= Garage Door on side wall

Side View



Because of the wider spacing of the posts on either side of the wide garage door, there is more roof carried by those posts which increases the load. Therefore the calculation changes slightly. See next page.

Top view – one side



Using the same data from the earlier post frame example:

Building Width:	40 feet
Soil Capacity:	3000 psf
Post Spacing (Y):	8 feet
Post Spacing – door (Y^1):	16 feet
Snow Load	20 lbs. / square foot

Surface area of footing (in sq. ft) = Total load (in lbs.) on footing / Soil Capacity

Total load = (½ building width x (½ Y + ½ Y^1 Post spacing) x (5 lbs. dead load[1] + snow load[2])
= 20’ x (1/2 of 8’ + ½ of 16’) x (5 + 20 lbs. / square foot)
= 20’ x (4’ + 8’) = 240 square feet x 25 lbs. / square foot
= 6000 lbs.

Surface area of footing (in sq. ft) = 6000 / 3000
Surface area of footing (in sq. ft) = 2.0

As the 20” FootingPad is larger than the required 2.0 square feet, this size is needed for those posts on either side of the door.

FootingPad diameter	Surface area of FootingPad (sq. ft)
10”	.545
12”	.785
16”	1.39
20”	2.18
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