Estimation of Rebar Length

**Calculation of the Length of Spiral Rebar**

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Submitted for: Shuvo Khadem

Submitted by: Sheikh Muhammad Muhtashim Abid [ID: MN-HC-001]



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A Report Document

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# Preface

The following document was a report analysis assigned for Sheikh Muhammad Muhtashim Abid by Shuvo Khadem, students of North South University. The document was created after analyzing numerous sources through Internet. Readers are highly requested to consider any sort of mistake (if found, please mail via analyst.education@yahoo.com) as the document was a material of personal study. Copy-pasting for assignments is strongly prohibited. The document is only for educational purpose. Students are requested to learn and understand the theory and practice them personally.

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# Theory

The spiral reinforcement is generally used in piles and columns. The spiral bar is either attached to the main bars from inside or outside to form a cage. There are two methods to determine the length of this continuous spiral bar. One is the direct tape measurement and the other one is the mathematical calculation. Here, we will discuss about the mathematical calculation.

## Determination of the Diameter

d

D

Top View of a spiral cage

Here, d = Inner Diameter and D = Outer Diameter.

To determine the approximate length, we often use the mean diameter i.e. MD = (d+D)/2

But in practical field the engineers may use the outside diameter to avoid shortage of materials and maintain adequate supply. It is a genuine assumption of the cost estimation.

## Determination of Circumference

Next step is to determine the circumference (also pronounced as Mean Circumference) of the circle i.e. MC = πMD

## Determination of Helix or Spiral Pitch

The helix or the spiral pitch is the distance between two spirals.

a

b

Either ‘a’ or ‘b’

## Determination of the Length of One Spiral

This is a picture of a spiral on a cylindrical sphere. If we turn the cylinder into a plane form, it will look like a rectangle and the spiral will be its diagonal.



Pitch

Circumference

Now let us consider the right angle triangle, Spiral Length = √ (Pitch2 + Circumference2)

## Number of Spirals

Number of spirals = Total height of the pile or column / Pitch

## Formula

So, the formula stands,

L = N x {√ (P2 + MC2)}; P is the pitch and N is the number of spirals.

If the diameter of the rebar is given then we can simply add its radius with the inner diameter of the cage and determine the accurate mean diameter, MD.

Note: In case of piles, there will be two additional circular ring shaped edges at two end points of the spiral cage. The length of these rings can be calculated separately.

# Mathematical Example

Problem No 01:

Let, we have to estimate the length of a 40’ pile for 20mm φ Rebar and 1’ pitch. The inner diameter of the cage is 1’.

**Solution:** The diameter of the spiral rebar is 20mm i.e.

The considering diameter of the spiral cage, SD = 0.06265 + 1 = 1.06562 ft.

So, circumference, SC = πSD = 3.34774 ft.

Number of spirals, N = 40/1 = 40

So, length of the spiral rebar, L = N x {√ (P2 + SC2)} = 40 x {√ (12 + 3.347742)} = 139.7562 ft.

Let consider the two end rings attached with the spiral rebar.

So, the length of the two rings = 2 x (Circumference) = 2 x 3.34774 = 6.69548 ft.

So, the total length of the rebar needed for the pile cage = 6.69548+139.7562 = 146.45168 ft.

## Problem No 02

Given, a 20” φ pile, 55' in height, and has 10mm φ rebar, 6" loops/ pitch. Find the spiral length for this problem?

**Solution:** Considering 3” clear cover. So, the outer diameter of the spiral cage is 14”.

The cage is made of 10mm (0.39370”) φ rebar.

So, the considering diameter of the spiral cage is, SD = (14 – 0.39370) = 13.6063” = 1.13386’

The circumference, SC = πSD = 1.13386 x π = 3.56212’

Number of the spirals, N = Total height of the pile or column / Pitch = 55/0.5 ft. = 110

So, the length of the spiral rebar, L = N x {√ (P2 + SC2)} [P = pitch]

L = 110 x {√ (0.52 + 3.56212 2)} = 395.67443’

If we consider the two edges, we get,

The length of the two edge rings = 2 x (Circumference) = 2 x 3.56212 = 7.12424’

So, the total length of the rebar (to make the pile cage only, which means, the vertical bars are not taken into count) is, (7.12424 + 395.67443) = 402.79867’

[Note: The following problem is just an example; the dimensions are not considered in real life. Rather than it totally depends on the design.]

# Reference

1. Apprenticemath. (2014, March 30). *Length of a helix - vengeful circles disguised as trigonometry*. Retrieved November 23, 2015, from Youtube: https://www.youtube.com/watch?v=zUHFChQdXOk