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Analysis of The Supporting Capacity of The Stake Foundation on Soekarno Hatta Airport Accessibility Project

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Abstract

The construction of a foundation is very large function in a construction. In general the foundation is defined as an underground building that passes on the load derived from the weight of the building itself and the outer load that works on the building to the surrounding land. The foundation of the stake is a relatively long and slim rod that is used to channel the foundation load through the soil layer with a low support capacity of hard soil layer that has a high carrying capacity that is relatively deep compared to the shallow foundation. The carrying capacity of the stake is derived from the end bearing capacity obtained from the pressure of the end of the pole and the friction bearing capacity obtained from the carrying capacity of the friction or adhesion force between the stake and the surrounding soil. This research uses an analytical research method in which in the calculation of the planning of the foundation of the stake using the calculation of the capacity of carrying capacity with the method of bagemann and mayerhoff. From the calculation of vertical style carrying capacity based on sondir data using bagemann method at the first stake point of 1059.50 kN and at the second point of 1015.95 kN, and the result of SPT data using mayerhoff method at the first stake point of 663.88 kN and at the second point of 498.76 kN. Qultimate single pole horizontal carrying capacity calculation of 216 kN, Single Qizin amounted to 72 kN, Group of 228 kN.The result of the calculation of vertical carrying capacity of the group stake is 734.1732 kN.The result of the calculation of tuggal pole reduction is 11.62 mm, The stake group is 10.77 mm, so the calculation result for the drop of a single pole is smaller than the permit drop which is smaller than 100mm.

Keywords :
Stake, Stake Carrying Capacity, Struktur Foundation Structure.

1. Introduction

The construction of a construction, first carried out and carried out in the field is the work of the foundation (bottom structure) and then carrying out the work of the upper structure. The construction of a foundation is very large function in a construction. In general the foundation is defined as an underground building that passes on the load derived from the weight of the building itself and the outer load that works on the building to the surrounding land.

The bottom structure as a foundation can also generally be divided into two types, namely shallow foundation and deep foundation. The selection of this type of foundation depends on the type of upper structure, whether it includes light load construction or heavy load and also the type of soil. For light load construction and surface soil layer conditions are quite good, usually the shallow foundation type is adequate. But for heavy load construction usually the type of deep foundation is an option, and in general the issue of deep foundation planning is more complicated than shallow foundations.

For this, the author tries to concentrate this Final Task on the deep foundation problem, namely the stake. The foundation of the stake is a relatively long and slim rod that is used to channel the foundation load through the soil layer with a low support capacity of hard soil layer that has a high carrying capacity that is relatively deep compared to the shallow foundation. The carrying capacity of the stake is derived from the end bearing capacity obtained from the pressure of the end of the pole and the friction bearing capacity obtained from the carrying capacity of the friction or adhesion force between the stake and the surrounding soil.

In general, stakes can be classified among others: in terms of materials there are reinforced stakes, pretekan stakes, steel stakes, and wooden stakes. In terms of cross-sectional spans, square-length poles, triangles, hexagons, solid rounds, pipes, letters H, letters I, and specific shapes. In terms of mounting techniques, it can be done with drop hammer, diesel hammer, and hydrolic hammer.

The stake interacts with the ground to produce a carrying capacity that is able to carry and provide security to the upper structure. To produce accurate carrying capacity, an accurate soil investigation is required

as well. There are two methods commonly used in determining the carrying capacity of the stake, namely by using static methods and dynamic methods. (Tambunan, 2012)

Soil investigation using static methods is sondir investigation and standart penetration test (SPT). Sondir's investigation aims to determine the resistance of konus penetration and soil ration resistance which is indicative of the strength of the carrying capacity of the soil layer using empirical formulas.

Standardized penetration test (SPT) investigation aims to get an idea of soil layer based on soil type and color through visual observation, soil properties, soil characteristics. Standardized data penetration test (SPT) can be used to calculate carrying capacity. (Princess, 2017)

The planning of the stake foundation includes a series of activities carried out with various stages including feasibility studies and technical planning. All of this is done to ensure the end result of a strong, safe and economical construction.

2. Methodology

The Analysis Method is a way of knowingtheu-turn to find the supporting capacity of the foundationsystemically, logically and empiris using the analysis method.So in this study the authors useda method of analysis.

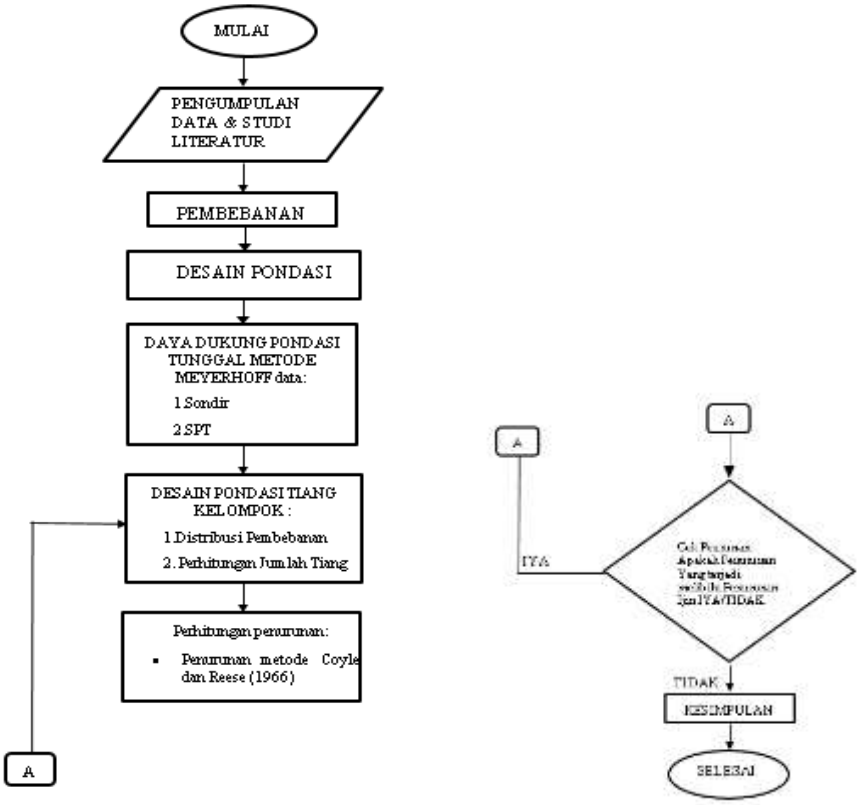

Figure1.
Source : Processed Researcher

To review the calculation of stake foundation planning on the project, the authors obtained data among others obtained structural load data. From Sub Contractors is obtained in the form of data from sondir, SPT results, and structural drawings. The data is as follows:

1. Stake Length : 16 m
2. Poledimensions : D60cm
3. Concrete Quality Stake : fc'35
4. Steel Quality : fy' 35

3. Result and Discussion

3.1. Calculation of Stake Carrying Capacity From Sondir Data (Bagemann Method) Metode

a. Prisoner Tip

Table 1. Prisoner Tip

Diameter Tiang Pancang	D =	0,60	m
Panjang Tiang Pancang	L =	16,00	m
Kuat Tekan Beton Tiang Pancang	f_C'=	35	Mpa
Berat Beton Bertulang	w_c =	24	kN/m^3

Pb = w * Ab * qc : 0.50x0.2827x5300 : 749,270 kN (Titik Point S-1 and S-2)

b. Swipe Prisoner

Table 2. Swipe Prisoner

No	Kedalaman Z1 (m)	Kedalaman Z2 (m)	L_1 (m)	A_s (m^2)	Q_f (kN/m^2)	P_s (kN)
1	0,00	5,00	5,0	9,4248	6,00	56,55
2	5,00	10,00	5,0	9,4248	30,80	295,00
3	10,00	15,00	5,0	9,4248	55,40	522,13
4	15,00	16,00	1,0	1,8850	78,30	147,59
				$P_s = \sum [A_s{}^* q_f] =$		1016,56

Results at Point S-1
Titik S-2 Point Result

c. Stake Axial Prisoners
Nominal prisoner stake : Pn : Pb + Ps :749,270 + 1016.56 : 1765.83 kN
Φ strength reduction factor : 0.60

Table 3. Stake Axial Prisoner

No	Kedalaman Z1 (m)	Kedalaman Z2 (m)	L_1 (m)	A_s (m^2)	Q_f (kN/m^2)	P_s (kN)
1	0,00	5,00	5,0	9,4248	6,0	56,55
2	5,00	10,00	5,0	9,4248	31,30	295,00
3	10,00	15,00	5,0	9,4248	47,20	444,85
4	15,00	16,00	1,0	1,8850	78,30	147,59
				$P_s = \sum [A_s{}^* q_f] =$		943,99

Axial prisoner stake Φ x Pn : 1059.50 (Titik S-1 Point Result)
Nominal prisoner stake : Pn : Pb + Ps :749,270 + 943.99 : 1693.26 kN

Φ strength reduction factor : 0.60
Axial Titik prisoner stake Φ x Pn : 1015.95 kN (S-2 Point Result)

3.2. Calculation of Stake Carrying Capacity From N-SPT Data (Mayerhoff Method)

Table 4. Calculation of Stake

No	Kedalaman Z1 (m)	Kedalaman Z2 (m)	Nilai SPT N	L1 (m)	L1 * N
1	0,00	5,00	5	5,0	25,0
2	5,00	10,00	18	5,0	90,0
3	10,00	15,00	37	5,0	185,0
4	15,00	16,00	41	1,0	41,0
				16,0	341,0

Pn =: 40 x Nb x Ab + Ň x As =40 x 41 x 0.2827 + 21.31 x 30.1593 =1106.468 kN
Pn < = 380 x Ň x Ab = 380 x 21.31 x 0.2827 = 2289.87 kN
Stake nominal capacity : Pn = 1106,468 kN
Φ strength reduction factor = 0.60

Axial prisoner stake Φ x Pn = 663.88 kN (S-1 Point Result).

Table 5. Point Result

No	Kedalaman		Nilai SPT N	L1 (m)	L1 * N
	Z1 (m)	Z2 (m)			
1	0,00	5,00	4	5,0	20,0
2	5,00	10,00	10	5,0	50,0
3	10,00	15,00	28	5,0	140,0
4	15,00	16,00	33	1,0	33,0
				16,00	243,0

Pn =: 40 x Nb x Ab + Ň x As = 40 x 33 x 0.2827 + 15,19 x 30.1593 = 831,265 kN
Pn < = 380 x Ň x Ab = 380 x 15.19 x 0.2827 = 1631.78 kN
Stake nominal capacity : Pn = 831,265 kN
Φ strength reduction factor = 0.60
Axial prisoner stake Φ x Pn = 498.76 kN (S-2 Point Result).

3.3. Horizontal Carrying Capacity (Meotde Brooms)

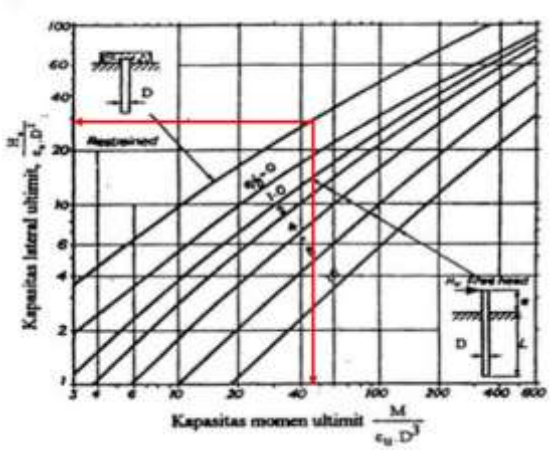

Figure 2. Horizontal Carrying

Hu = 15. Cu. D^2
Hu = 15 x 40 x 0.6^2
Hu = 216 *kN*
Hizin = 216 kN
3
Hizin = 72 kN or 7.2 tons

Based on the calculation results, the horizontal carrying capacity of the foundation's single pole permit is obtained.. izin

3.4. Calculate Stake Group Capacity Based on Efficiency

$$\text{Eg} : \frac{1-\theta}{90.m.n''}\ (n'-\square 1).m\ \square\ (m-1).n''$$

$$\text{Eg} : 1 - 13{,}495.\frac{(3-1).1\square\ (1-1).3}{90.1.3}$$

: 0,9

3.5. Calculating Horizontal Carrying Capacity of Pole Groups

Qhorizontal.group = n.Qhorizontal

Qhorizontal.group = 3 x 76 kN
Qhorizontal.group = 228 kN

3.6. Calculating Single Pole Drop (Poulus and Davis Method)

Io : 0.065
Rk : 1.3
Rμ :0.94
Rh : 0.28
Rb :0.65

a) For floating poles or friction poles

$I : I_o . R_k . R_h . R_\mu$
: 0.065 . 1,3 . 0,28 . 0.94
: 0,022
$S : \frac{Q.I}{Es.D}$
: 150778kg . 0.022
159 kg/cm^2 . 60cm
: 0.347 cm
: 3.47 mm

b) For the end of the support

$I : I_o . R_k . R_b . R_\mu$
: 0.065 . 1,3 . 0,65 . 0.94
: 0,0516
$S : \frac{Q. I}{Es.D}$
: 150778kg . 0.0516
159 kg/cm^2 . 60 cm
: 0.815 cm 8.15 mm
Recap of The Decline Results..

Table 6.

No.	Form of decline	Pole drop (S)
1	For floating poles or friction poles For end support poles	3.47mm
2		8.15mm
	Estimated total decrease	m

3.7. Calculating The Drop Of The Group Pole

$Sg : \frac{q.Bg.I}{2.qc}$

Where:
$q : \frac{Q}{Lg.Bg}$
: $\frac{150778}{400 .300}$
: 1,256 kg/cm^2
$I : 1 - L \geq 0.5$
$\frac{}{8. Bg}$

: 1- $\frac{2500 \geq 0.5}{8.300}$

: 0.041 < 0.5

Then:

Sg : $\frac{q.Bg.I}{2.qc}$

Sg : $\frac{1,256,300.0,5}{2.53}$

: 1.77 cm

4. Conclusion

a. Based on the calculation results, then for the size of the vertical style that the foundation is able to accept is 2860.65 kN. While the size of the horizontal style that the foundation is capable of is 228 kN.

b. The results of the calculation of the reduction of a single pole and a pile group are:

Table 7. Single Pole and A Pile group

Single Pole Drop (mm)	Decline Pole Group (mm)	<Decrease in permits (mm)
11. 62, 2014 in New	10,77	65

From the above calculation results for the drop of a single pole is smaller than the decrease in permits so that it can be concluded the decrease is safe and qualified.

c. Differences in carrying capacity can be caused by different soil types and properties at even the closest distances that can affect the carrying capacity of the pole..

References

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Biography

Muhammad Wira Kaloka is a student from Mercubuana University Bekasi with civil engineering study program. Prior to majoring in civil engineering, at the previous level, SMK Negeri 1 Sukabumi,majoring in Building Drawing Engineering, penulis graduated from SMKN in 2016 in 2016 the author continued his education at Mercu Buana University Bekasi with a major in Civil Engineering, during which time the author had participated in seminar events as an event division. With this study the authors hope the research can be something of a learning and hope for further research can be well developed.