Cek Turnitin - Jurnal - Settlement and Capacity Analysis of Land Support Development on Flyover in Large City; Pekanbaru, Indonesia

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Settlement and Capacity Analysis of Land Support Development on Flyover in Large City; Pekanbaru, Indonesia

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Abstract

The study area located on the street of Soebrantas to Soekarno Hatta Street, with the coordinate position of 0 ° 30 ' 0.79 "N 101 ° 24 ' 57.88 "E - 0 ° 30 ' 0.16 "N 101 ° 24 ' 53.17 "E in Pekanbaru City, Indonesia. The development that will Conduct flyovers in this area became the basis of this research. The main study of this research is to find out how an Atterberg's boundaries, compressibility, and the likelihood of a ground decline in drill 1 use the value of N SPT to match with the purpose of this study. Which is (1) to know the large grain size of soil samples, (2) Knowing the value of the liquid limit, the plastic boundary, and the plastic index of the soil samples, (3) Knowing the possibility of land degradation in the research area, (4) Power capacity analysis of ground support (5) Knowing the decline of modeling using the Plaxis 2D method (6) knows the relationship of decreasing values based on NSPT and Plaxis (7) Knowing the relationship of sieve analysis and Attaberg limit with decreased results. Methods of data retrieval have done with soil testing in the field and soil testing in the laboratories. A comprehensive analysis of the grain has done with sieve analysis. Plastic boundary, liquid, and plastic boundary indices with method Attaberg limit. Decreased analysis and Power capacity analysis of ground support with NSPT value tests.

Keywords: Sieve Analysis, Atterberg Limit, the capacity of soil support and settlement, N-SPT, Plaxis 2D Modelling, Flyover

1. Introduction

To support the economic growth activities of the Government of Indonesia, planning various infrastructure development programs ranging from the construction of toll roads, bridges, airports, docks, ports, canals, and so on (Salim and Negara, 2018; Laksono et al., 2018; Persada et al., 2018; Hamid et al., 2018). The development of infrastructure increased the confortivity, and reduce the gap between each region. The need for development land continues to grow so that the construction is forcing to established on the area that is fewer conditions such as soft soil.

Construction of the flyover will be implemented in this area to be the basis of this research. To find out how the Atterberg boundaries, compressibility, and likelihood of falling ground using the value of N SPT count (Wafi et al., 2018; Kuzu et al., 2020; Bautista et al., 2019; Kumar et al., 2017).

2. Study Area and Background

Based On Regional Geological map of sheet Pekanbaru (Clarke et al., 1982). The research area lies in the Minas Formation, precisely located at coordinates 0 ° 30 ' 0.79 "N 101 ° 24 ' 57.88 " E-0 ° 30 ' 0.16 "N 101 ° 24 ' 53.17 " E

The Minas Formation is a quarter precipitate, precipitating in unaligned above the Petani formation, the formation consists of a coating that is in the dominance of the Batupasir and occasionally appears a thin layer of clay. The formation was from Miocene to the Plistosen and precipitated in the fluvial-alluvium environment.

3. Methodology

3.1 Research Object

To conduct all the research methodology, we summarize all the step of research follows:

1. The grain size of the ground (Sieve Analysis) is a test of filtering soil samples through a set of the sieve.
2. Liquid limit (liquid Limit) is the moisture content on the boundary between the liquid state and the plastic state.
3. Plastic limit is the moisture content at the lower limit with plastic.
4. The Atterberg limit relationship with carrying capacity.
5. Modelling power support using Plaxis 2D

3.2 Sieve Analysis

Sieve Analysis (Bardet, 1997; Gupta et al., 2016; Ubani et al., 2018; Ruiz-Martínez et al., 2016) aims to determine the type of soil that is graded poorly, graded uniform and graded well. At once to know the grain size on the ground. The formula of Sieve Analysis is as follows:

$$R_n = \frac{W_n}{W_t} \times 100\%$$ [1]

Where:
Rn = amount of unloaded weight Wn = Weight
Wt = Cup Weight

3.3 Atterberg Limit

The Atterberg Limit Test is a method used to describe the nature of the fine-grained soil context on varying water-levels. The soil has certain conditions, namely from liquid to frozen state (Deng et al., 2017; Rehman et al., 2019).
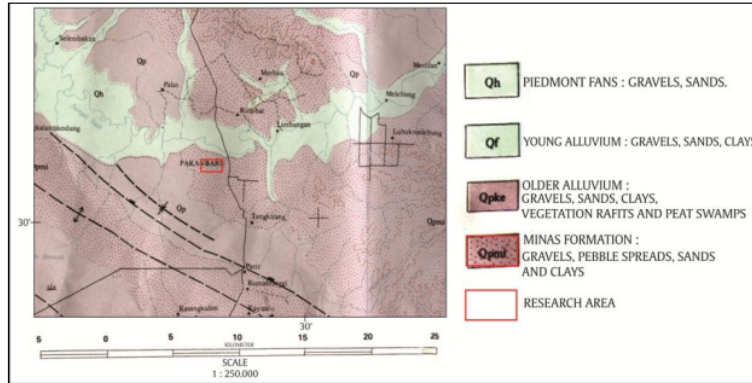
Fig. 1. Regional Geological Map of research Area.

3.3.1 Liquid Limit

The liquid limit is the groundwater level (Chai et al., 2017) at the liquid limit, and the plastic boundary or the maximum moisture content where the soil has a minimum slide is at the 25th beat with the Cassagrande tool. Liquid boundaries defined as the lowest moisture content in which the soil is in a liquid state or a condition where the soil changes from liquid to plastic:

$$LL = \frac{W - PL}{LL - PL} \qquad [2]$$

Where:
LL = Liquid Limit
W = weight of soil samples
PL = Plastic Limit

3.3.2 Plastic Limit

Plastic limits defined as the moisture content in the position between the plastic and semi-solid (Hamzaban et al., 2019), which is% water content where the ground with a cylinder diameter of 3.2 mm begins to crack – cracks when rolled. The plastic boundary can be determined by simple testing by rolling several soils using the soil repeatedly into an ellipsoidal form. Soil sample water content where the ground starts cracking – fractures are defined as plastic boundaries:

$$IP = LL - PL \qquad [3]$$

Where:
IP = Plastic Index
LL = Liquid Limit
PL = Plastic Limit

3.3.3 Plasticity Index

The plasticity index demonstrates the nature of soil saturation. If the value of the PI is high, then the soil contains a lot of clay, then if the PI value is low, the soil contains muchsilt. The characteristic and nature of silt are with the moisture content that decreases minimal soil will dry. The plasticity index PI is the difference between the liquid limit and the plastic boundary of the soil.

3.4 Capacity Analysis for Support And Decrease Soil

If the soil is experiencing a load like a foundation burden, the soil will experience distortion or decline. If this burden is augmented, the reduction also increases. Finally, at one time, there was a condition that, at a fixed load, the foundation suffered a considerable decline. This condition indicates that the support capacity has occurred.

3.5 Analysisof N-SPT (Standard Penetration Test)

Methods carried out in conjunction with drilling to know both ground dynamic resistance and sampling, which is interrupted by the SPT test. The technique consists of a thick cold-tube beating test into the ground, accompanied by a measurement of the number of strokes for inserting a deep-side tube 300mm vertically.

3.6 Soil Reduction Analysis

The decreasing calculation stated based on Bowles Theory (1977). The Bowles theory is the result of the modifying of the Meyerhoff theory. Bowles considers the Meyerhoff theory to be overly cautious, resulting in considerable decline. So Bowles recommend for better improvement is as follows:

$$S_i = \frac{2,5q}{N} \qquad [4]$$

$$S_i = \frac{4q}{N}\left(\frac{B}{B+1}\right)^2 \qquad [5]$$

Where:
Si = Lower Foundation (inch)
Q = load intensity (kip/ft2)
N = number of SPT test punch
B = width of foundation (ft)

3.7 Analysis Of Power Capacity Supports Depth Of Land (Meyerhof 1956 – 1974)

With QA is the capacity to support net permit in kN/m^2, for a decrease of 2.54 cm. The Meyerhof suggests the value of "*n*" taken an average value from a distance of 0 to B under the base of the foundation.

A. QA = 12 N; For width B ≤ 1.2 m   [6]
B. QA = 8 N ((B + 0.3)/B) ^ 2; for width B > 1.2 m   [7]
Where:
QA = Maximum support power
N = N-SPT
B = Foundation Width

3.8 Analysis Of Power Capacity To Support Clay (Meyerhof 1956 – 1974)

For the foundation load in the form of squares, circles, and elongated foundations that lie in the soil of the clay, capacity supports the ultimate by observing the depth factor of the foundation, as follows:

$$q_u = c_u N_C + D_f \gamma \qquad [8]$$

And the capacity for net Ultimate:

$$q_{un} = c_u N_C \hspace{3cm} [9]$$

Where:

q_u = capacity to support Ultimate (kN/m²)

q_{un} = capacity to support net Ultimate (kN/m²)

D_f = Depth of foundation (m)

γ = weight of the soil volume (kN/m³)

c_u = cohesion in undrained condition (kN/m²)

3.9 Analysis Of Power Capacity To Support The Sand (Meyerhof 1956 – 1974)

Granular soil types do not have cohesion (c) or have little cohesion. This granular soil usually forms a supporting capacity, especially by Relative Density (Df). Groundwater position against the foundation.

For granular or sandy soils, because cohesion C = 0 The equation of soil buffer capacity for elongated shaped foundations is as follows:

$$qu = yDN_q + 0.5\ ByN_y [10]$$

Where:

Y = Weight Unit

D = Depth of foundation

B = Foundation Diameter

NQ + Ny = factor – support capacity factor

3.10 Analysis of Plaxis 2D Data

The Plaxis 2D is a two-dimensional element program developed for the analysis of deformation, stability, and groundwater flow in geotechnical engineering (Brinkgreve et al., 2016; Vickneswaran and Ravichandran, 2020; Jadid et al., 2020; Vali et al., 2018). PLAXIS 2D geometry models can be easily defined in-ground and structure modes after an independent solid model can automatically be cut and fused. The staged construction mode enables to simulate the construction and digging processes by enabling and disabling ground clusters and structural objects.

4. Result and Discussion

4.1 Sieve Analysis

4.1.1 Drill Sample 1 (depth 4.50 – 5.00 M)

Calculation of Sieve analysis on Drill Sample 1 (depth 4.50-5.00 M) (Table 1) shows the result as below.

Table 1. Calculation tables of Sieve analysis on Drill Sample 1 (4.50-5.00) M.

FILTER SIZE		HEAVY RESTRAINED	AMOUNT OF WEIGHT HELD	PERCENTAGE	
Mm	INCH			STUCK	ESCAPE
9,5	3/8	0,00	0	0	100,000
4,75	NO # 4	0,00	0	0	100,000
2,36	NO # 10	8	8	3,186	96,814
1,18	NO # 20	118,30	126,3	50,302	49,698
0,6	NO # 40	80,90	207,2	85,522	17,478
0,3	NO # 80	27,90	235,1	93,634	6,366
0,15	NO # 100	1,70	236,8	94,311	5,689
0,075	NO # 200	4,90	241,7	96,263	3,737

The sieve size 3/8 in getting weight-held in 0.00, which indicates no samples restrained at the size of this 3/8 sieve with a percentage of escaping 100%.

The Sieve size No. 4 in the weight is 0.00 which indicates that there is no sample held on the size of the Sieve No. 4 with a percentage of a breakout of 100%.

Size of filter No. 10 obtained weight 0.00 which indicates that no sample is held at the size of this No. 10 sieve with a percentage of a breakout of 100%.

Size of filter No. 20 obtained 26 GR held weight with a percentage held at 17.35% and the percentage of RP 82.641%.

Size of filter No. 40 was obtained the weight of 51.30 gr with the amount of weight held to be 77.3 Gr. Percentage held at 51.61% and percentage escaped by 48.350%.

55.80 GR held the size of filter No. 80 obtained weight with the amount of weight held to be 133.1 Gr. Percentage held at 88.86% and percentage escaped by 11.134%.

Size of filter No. 100 obtained weight was held by 2.50 GR with the amount of weight held to be 135.6 Gr. Percentage held at 90.53%, and percentage escaped by 9.465%.

The size of the filter No. 200 is obtained by the weight of 7.60 gr with the amount of weight held to be 143.2 Gr. Percentage held at 95.610% and percentage escaped by 4.390%.

The result of the projection of the calculation value in the analysis sieve graph (Figure 2) obtained a group 1 curve shape that is categorized as medium-size sand with poor gradation according to the Cu and Cz values that can be because the sand has a uniform grain size.

Based on the test of the sieve analysis that is done, get results on the 200 no sample of soil type that passes by the amount of < 50%. Based on USCS category, in this case, samples are included in the S (sand) types, according to the sample in the analysis. According to the USCS criteria for poorly graded soil, if it has a smaller Cu of 5 and has a Cz between 0.5 to 2.0 indicating well-graded soil, it can be concluded that the soil is well graded. Good gradated soil will have Cu > 4, and Cc between 1 and 3 for gravel land and sand has Cu > 6 with Cc between 1 and 3.
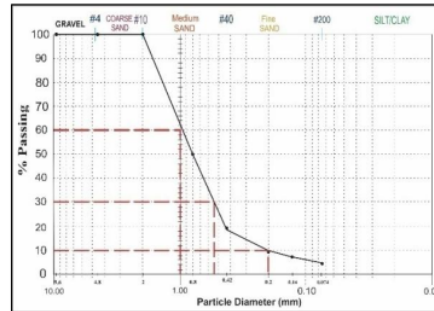

Fig. 2. Graph Sieve analysis on Drill Sample 1 (4.50-5.00) M.

4.1.2 Drill Sample 2 (depth 8.00 – 8.50 M)

Calculation of Sieve analysis on Drill Sample 1 (depth 8.00-8.50 M) (Table 2) shows the result as below.

Table. 2. Calculation of Sieve analysis on Drill Sample 2 (depth 8.00-8.50 M).

FILTER SIZE		HEAVY RESTRAINED	AMOUNT OF WEIGHT HELD	PERCENTAGE	
Mm	INCH			STUCK	ESCAPE
9,5	3/8	0,00	0	0	100,000
4,75	NO # 4	0,00	0	0	100,000
2,36	NO # 10	0	0	0,000	100,000
1,18	NO # 20	26	26,0	17,359	82,641
0,6	NO # 40	51,3	77,3	51,610	48,390
0,3	NO # 80	55,8	133,1	88,866	11,134
0,15	NO # 100	2,5	135,6	90,535	9,465
0,075	NO # 200	7,6	143,2	95,610	4,390

The size of the sieve 3/8 to get a weight held in 0.00 which indicates that no samples were restrained at the size of this 3/8 sieve with a percentage of escaping 100%

The size of Sieve No. 4 in weight is 0.00, which indicates that there is no sample held on the size of the Sieve No. 4 with a percentage of a breakout of 100%.

Size of filter No. 10 obtained weight held by 8 GR with a percentage held at 3.186% and the percentage of RP 96.814%.

Size of filter No. 20 was obtained weight was held at 118.30 GR with the amount of weight held to 126.3 gr percentage was held by 50.302% and the percentage passed by 49.698%

Size of filter No. 40 was obtained the weight of 80.90 gr with the amount of weight held to be 207.2 Gr. Percentage held at 82.52% and percentage escaped by 17.478%

27.90 GR held the size of filter No. 80 obtained weight with the amount of weight held to be 235.1 Gr. Percentage held at 93.634% and percentage escaped by 6.366%

Size of filter No. 100 obtained weight was held by 1.70 GR with the amount of weight held to be 236.8 Gr. Percentage held at 94.311% and percentage escaped by 5.689%

The size of the filter No. 200 is obtained by the weight of 4.90 gr with the amount of weight held to be 241.7 Gr. Percentage held at 96.263% and percentage escaped by 3.737%.

Results of projection of calculation value on graph sieve analysis (Figure 3), obtained form The Class 1 curve is categorized as a medium-size sand with poor gradation according to the Cu and Cz values that can be because the sand has a uniform grain size.
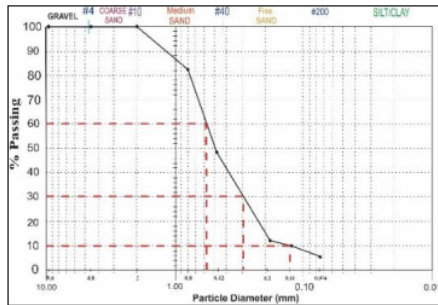

Fig. 3. Graph Sieve analysis on Drill Sample 1 (8.00-8.50) M.

According to the USCS criteria for the soil to graded well when it has a Cu greater than 5 and has a Cz between 0.5 to 2.0 indicating good graded soil, it can be concluded that the soil is a bad gradation. Well graded soil will have Cu > 4 and Cc between 1 and 3 for gravel soil, and sand has Cu > 6 with Cc between 1 and 3.

4.1.3 Calculation of Sieve analysis on Drill Sample 3 (depth 8.00-8.50 M)

The size of the sieve No. 3/8 (Table 3), the weight of soil is 0.00 GR, which is that no grain is stuck on this filter, and the amount of the weight of the rate is 0gr. While the percentage of grain size is 0.000% and the percentage of escaped is still 100,000%.

Size of Sieve No. 4 weight of the soil is 0.00 GR, which is that no grain is stuck in this filter, and the amount of weight is the rate of 0gr. While the percentage of the size of the weighted grain is 0.000%, and the percentage escaped is still 100,000%.

Size of sieve No. 10 weight of the soil is 0.40 GR, which is the details that are held Disaringan. This is included in the fine grain, and the amount of the weight of the rate is 0.4 gr. While the percentage of the size of the weighted grain is 0186%, and the percentage passes the size of 99,814%.

Size of sieve No. 20 weight soil is 46.30 gr, which is the details that are held Disaringan. This is included in the fine grain-medium and the amount of the weight of the 46.7 gr. While the percentage of the size of the weighted grain is 21,763%, and the percentage passes the size of 78,237%.

The size of the sieve No. 40 the soil weight is 97.40 gr, which is the details that are held in the sieve. It is included in

coarse grain, and the current amount weight is 144.1 gr, while the percentage of the size of the grain measure is 67,154%, and the percentage passes by 32,846%.

Size of Sieve No. 80 the soil weight is 54.40 gr which is the details that are held Disaringan is included in the fine grain-medium, and the amount of the weight of the 198.5 Gr. While the percentage of the size of the weighted grain is 92,505%, and the percentage passes the size of 7,495%.

Size of sieve No. 100; soil weight is 2.20 gr.Fine-grain restrained in the sieve with the weight amount of 200.7 Gr. The grain weight size percentage is 93,530%, and the pass size percentage is 6,470%.

Size Sieve No. 200 the soil weight is 5.10 gr which is the details that are held in the sieve included in the fine-grain and the amount of the weight of the 205.8 Gr. While the percentage of the weighted grain size is 95,907% and the percentage passes the size of the grain 4,093%.

Uniformity Coefficient (Cu) samples of the soil are 3,714, which is included in the poor gradation category, which is smaller than 5. While the gradation coefficient (Cz) sample of the soil is 1.2363 (Figure 4).

The value of the resulting chart derived from D60, D30, and D10 data, where the maximum of the D60 is the diameter passed at 60mm sieve size, as well as the D30 is the diameter passes at a 30mm sieve size, and the D60 is diameter qualified at 10mm sieve size.

Table. 3. Calculation of Sieve analysis on Drill Sample 3 (depth 8.00-8.50 M).

FILTER SIZE		HEAVY RESTRAINED	AMOUNT OF WEIGHT HELD	PERCENTAGE	
Mm	INCH			STUCK	ESCAPE
9,5	3/8	0,00	0	0,000	100,000
4,75	NO # 4	0,00	0	0,000	100,000
2,36	NO # 10	0,40	0,4	0,186	99,814
1,18	NO # 20	46,30	46,7	21,763	78,237
0,6	NO # 40	97,40	144,1	67,154	32,846
0,3	NO # 80	54,40	198,50	92,505	7,495
0,15	NO # 100	2,20	200,7	93,530	6,470
0,075	NO # 200	5,10	205,8	95,907	4,093

According to the criteria from USCS, the soil is well-graded if it has a Cu greater than five and has a Cz between 0.5 to 3.0, indicating well-graded soil. It can then conclude the soil in the drill holes 8.00 – 8.50 meters have a poor gradation because there are smaller Cu of 5 and have a good Cz because it has a gradation of not more than 3.0 mm.
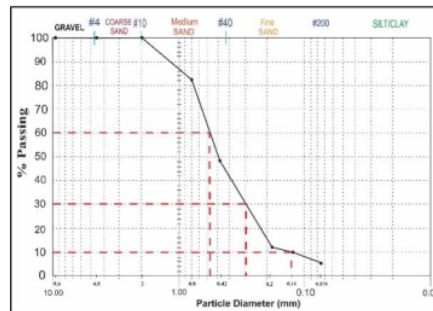

Fig. 4. Graph Sieve analysis on Drill Sample 3 (8.00-8.50) M.

4.2 Atterberg Limit

The first experiment had a water content of 32.8% with a low number of 11 times. The second attempt has a water content of 30.5% with a low number of 19 times. The third test has a water content of 27.9% with a blow count of 28 times. The

fourth experiment had a water content of 26.2% with a low number of 38 times (Table 4).

From the experiments that have been carried out so that the average value of water content is 28.65 grams. With the number of beats averaging 24 times the tap.

4.3 Standard Penetration Test (N-SPT)

4.3.1 Analysis Power Capacity Calculation For Soil Support Through SPT Test

The test for power capacity is necessary, and then it can be deduced increasingly in the drilling that is done then the type of soil gained will be more distinct-different and also the level of consistency is different so that at the time of Test N-SPT on soil that has a hard consistency will be done as much as 60 times the punch and on the soil that has a soft consistency feeding the amount of blow its SPT under 50 Based on the calculation of land support capacity through N-SPT test.

Table 4. Atterberg Limit Bore Hole 3 at the depth 22.00-22.50 M.

NUMBER OF BLOWS	n	38	28	19	11	PLASTIC LIMIT	
Wet soil weight + Cruss	gr	27,8	32,7	28,5	33,39 2	14,1	13,1
Dry soil weight + Cruss	gr	25,1	28,8	25,3	28,8	13,2	12,4
Water weight	gr	2,7	3,9	3,2	4,592	0,9	0,7
Heavy Cruss	gr	14,8	14,8	14,8	14,8	9,6	8,7
Heavy dry soil	gr	10,3	14	10,8	14	3,6	3,7
Moisture content	%	26,2	27,9	30,5	32,8	25,0 0	18,92
ATTERBERG LIMIT RESULT							
LIQUID LIMIT (LL)		28,65	PLASTICITY INDEX (PI)			6,69	
PLASTIC LIMIT (PL)		21,96	UNIFIED SOIL CLASIFICATION				
LAND TYPE NAME		Inorganic clay, with plasticity of low or medium, gravel clay, sandy clay, Berlanau, thin clay (lean clays)					

Table 5. Calculated Result Of Land Support Power Capacity Through Test N-SPT In Bore Hole 3.

No	Depth	Soil Type	N-SPT	B	MEYERHOF qa = 12 N	Consistency
1	1,00	Sand clay	2	1	24	Very Soft
2	3,00	Fine sand	8	1	96	Soft
3	5,00	Fine sand	10	1	120	Soft
4	7,00	Fine sand	15	1	180	Medium
5	9,00	Fine sand	16	1	192	Medium
6	11,00	Fine sand	20	1	240	Medium
7	13,00	Fine sand	24	1	288	Medium
8	15,00	Sand	60	1	720	Very Hard
9	17,00	Sand	60	1	720	Very Hard
10	19,00	Sand	60	1	720	Very Hard
11	21,00	Sand	60	1	720	Very Hard
12	23,00	Clay	22	1	264	Very Hard
13	25,00	Clay	26	1	312	Very Hard
14	27,00	Clay	31	1	360	Hard
15	29,00	Clay	21	1	252	Very Hard
16	31,00	Clay	35	1	420	Hard
17	33,00	Sand	37	1	444	Hard
18	35,00	Sand	58	1	696	Very Hard
19	37,00	Sand	60	1	720	Very Hard
20	39,00	Sand	60	1	720	Very Hard
21	41,00	Sand	60	1	720	Very Hard

If the value of N-SPT obtained is big then the capacity to support the land will be greater and vice versa if the value of N-SPT is small, the capacity of the supporting power is smaller so that when implanted the foundation of the small N-SPT value bridge pole will multiply a large decline, so it can be concluded that the value of N- The soil type that has a small n-SPT value is the clay and silt soils and the type of soil that has a large N-SPT value is the sandy soil because the sandy soil does not have a liquid boundary and a plastic boundary so that the sand can not keep the water and the sand soil also has bad porosity. Then in the land of clay and silt has a liquid boundary and a plastic boundary so that the soil type of clay and silt has soil properties that can stray water. If the foundation of the pole is implanted in the soil of the clay and eat water will occur a large decline because the clay and silt can not withstand a large burden, then if the foundation to be implanted bridge pole should be implanted on the type of sand soil because this type of sand soil can withstand a large burden because the greater the burden received by the sand to lowing the land.

4.3.2 Calculation Of N-Spt Test On Sand Soil

On the depths of the 08.00 – 08.50 meters (Table 5), deep sand can support large soils. So that at the time of the foundation of the sand-covered soil, then the decline is very small because the sand can support a strong soil to withstand the burden it receives, it is advisable to plant the foundation of the bridge pole preferably in the sandy soil because the sand has the capacity of large soil support and when the drilling is done at sufficient depth in the advisable to obtain the Then for the sand can support a large license, because the sand can support permit up to 200 which means good enough if implanted the foundation of the bridge pole.

Table 6. Calculation Of N-Spt Test On Sand Soil.

Depth	Soil Layer	Large angle (Φ) = N_q, N_γ	Unit Wight (kN/m²)	Diameter Bore (B)	Meyerhof qu = kN/m²
08.00 – 08.50	Sand	$N_q = 18,4$ $N_\gamma = 22,0$	1,265 kN/m²	1 m	200,123 kN/m²

4.3.3 Calculation Of N-SPT Test On Clay

The soil of the clay depth 22.00 – 22.50 meters has the capacity of small soil so that when planted the foundation of the clay soil in the field, there will be a decline due to heavy loads will affect the condition of the land strength at the time of the burden that is working. So to plant a foundation in the clay land is not advised even if done deep drilling, the clay will not be strong withstand the burden received and the capacity of the land support the clay is very small, and consistency in this layer of clay is soft to medium.

Table 7. Calculation Of N-Spt Test On Clay Soil.

Depth	Soil Layer	Large Angel (Φ) = N_c	Cu (kN/m²)	Unit Weight (kN/m²)	Meyerhof qu = kN/m²
22.00 – 22.50	Silty - Clay	$N_c = 14,83$	72,60 kN/m²	1,799 kN/m²	66,248 kN/m²

The depth of sand soil type 08.00 – 08.50 meters have the value of the capacity of the large soil support with a value of 200,123 KN/m2 so that at this depth the decline is small and at a depth of 22.00-22.50 meters acquired soil type is the form of clay and silt which has the value of capacity of small soil support that will cause the decline will be greater. Then it is recommended to embed the foundation of the bridge pole should have the value of the capacity of the large land support

to be exposed to the burden on the foundation of the bridge pole decline that occurs in the land will be smaller.

4.4 Plaxis Modelling

4.4.1 Plaxis Modelling Power Capacity To Support Land

Increasingly in the drill done and large loads received by the soil, then the capacity of land support will influence on the foundation of the pole so that it can cause the slope of the Pole Foundation (Figure 5).

The greater the NSPT value that can be, then the smaller the decline that occurs, so too, the smaller the NSPT value that can be, then the greater the decline that occurs.

The depth of 00-01.00 M is obtained by a large reduction of NSPT value of 10 with the lithology of flared-sand and smooth consistency with the loose grain.
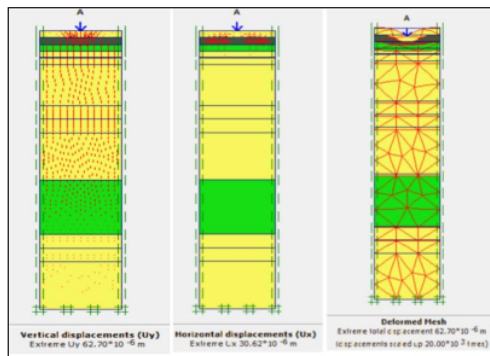

Fig. 5. Plaxis Modelling Power Capacity To Support Land.

Depth of 3-7 meters is ground domination with fine sand granules with NSPT value of 11-30 so that the soil at this depth categorized as soil with medium consistency.

The depth of 9-13 meters is ground domination with fine-grained sand grains with an NSPT value of 31-50 so that the soil at this depth is categorized as ground with Stiff (rigid) consistency with dense density.

Depth of 13-15 meters is ground domination with fine sand grains with an NSPT value of > 50 so that the soil at this depth is categorized as ground with a very stiff consistency (very rigid) – Hard (hard) with a relatively dense.

Depth of 15-35 M is ground domination with granular sand – loam with NSPT value of < 60 and > 10 so that the soil at this depth is categorized as soil with medium-stiff consistency (rigid) with medium-dense relative density (dense).

Based on the calculations, it can be seen a large NSPT value as well as large impairment value occurs in drill 1 holes with soil type contained in each depth, and also the consistency of each at any depth. From these two charts can be concluded the greater the value of NSPT that canbe, then the smaller the decline in the value of each depth, N-SPT values that can relate to the soil type and also the consistency of each depth.Sand has a large N-SPT value because it has no liquid and plastic properties, which sand can drain the water more easily. After all, it has pores, and the loam or silt usually has a relatively large N-SPT value because the clay or silt has soft soil properties that have plastic boundaries and liquid boundaries, which are not able to pass the water. But the type of soil that can be sometimes unbiased to be a reference for the value of N-SPT that is found, for example, can be seen at a depth of 5 meters, which has a relatively small N-SPT value and a large decline, which affects

the depth of this is the groundwater face. Because the groundwater in Bor 1 is at a depth of 4 meters.

4.4.2 Plaxis Modeling On Declining Soil

The first image in getting deformed mash land drop profile. This deformed function to show a large decrease in the land that occurs can be seen in the soil that decreases. The decline occurred at a depth of 00.00 – 03.00 meters, on the layer of piles of soil material.The decline was shown by the direction of the blue-colored arrow that leads vertically. The load point is given in the center of the layer.

The second image is for getting a displacement vertical land drop profile. The vertical image shows the direction of pressure or stress and the load given on the ground at the center of the soil layer and gets red stripes on the layer, which means the soil obtains the pressure of the ground.On the upper part receives a pressure greater than the bottom, which means from top to bottom is decreased pressure gained on the ground. The decline occurs as deep as 20.77 x 10-3 M. or 2.077 cm (Figure 6).
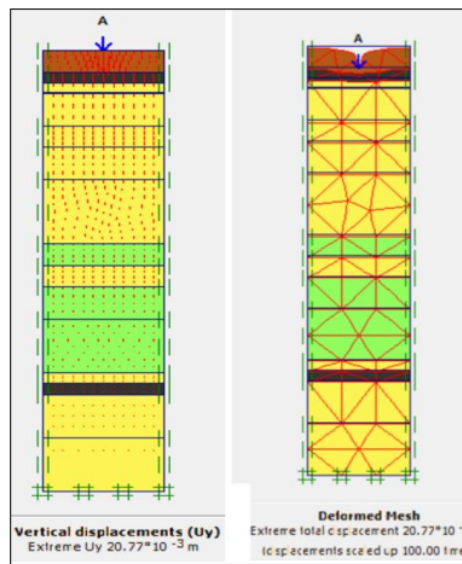

Fig. 6. Plaxis Modeling On Declining Soil.

5. Conclusion

The calculation of the filter analysis in drill with depth (4.50-5.00) and (8.00 – 8.50) meters, it indicates that the sample is categorized as fine soil has poor grain uniformity, because in the sample (4.50-5.00) The meter has a value of Cu 3.714, and in the sample (8.00 -8,50) meter has a value of 4. Included in the category of bad graded soil. All the tests Comply with ASTM, AASHTO, and USCS standards.

At the depth (22.00 – 22.50) at a rate of water at an average of 18.92 grams. With an average beat amount of 24 beats. The average value of the plastic sample rate at this depth is 21.96%, and the value of the plastic index at this depth is 6.69%. Plastic indices get through the calculation of liquid limit – plastic limit.

The decline also influenced by the value of NSPT that can, if the soil type is sandy but has a small NSPT value then the decline is also greater and vice versa.

Based on the results of the sieve analysis and Atterberg connection limit on the capacity of the land support, it can be

conditioned for the foundation strength of the pole. It should be implanted at depth to obtain the type of soil that does not have a plastic boundary and liquid boundaries that the plastic boundary and liquid limits save water content that will affect the foundation of the pole.

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