SWELLING POTENTIAL OF CLAY SOIL KALIWANGU FORMATION IN CIBOGO DISTRICT, SUBANG REGENCY AREA BASED ON ITS BASIC PHYSICAL PROPERTIES

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ABSTRACT

The research is conducted in Cibogo District, Subang Regency. The focus of the research is taking samples in the area inside Kaliwangu Formation by doing field observation and field sampling using disturbed sample method then it will be tested in laboratory for its basic physical properties. The results of its basic physical properties will be analyzed to determine their swelling potential by taking 5 samples of soil from Kaliwangu Formation. Based on sieve analysis every sample of Kaliwangu Formation (Pk) have more than 50% of clay fraction for each sample and based on Atterberg limit test Kaliwangu Formation (Pk) samples are dominated by Silt High Plasticity (MH) soil with 3 samples of the MH type and only 2 samples of the CH type. According to consistency limit test of Kaliwangu Formation (Pk) soil, the swelling potential can be determined by classifying it based on liquid limit (%) and plasticity index (%) using swelling potential classification. Using the soil consistency value, especially the liquid limit value and the plasticity index value, it can be classified as the swelling potential of Kaliwangu Formation (Pk) classified as high - very high potential with a very high dominance.

Keyword: Subang, Kaliwangu, Soil, Swelling Potential.

INTRODUCTION

Clay soil itself has the property that it can experience expansion or in other words change in volume. Changes in clay soil volume can be caused by the presence of clay minerals in soils that have expansive properties, the mineral smectite (montmorillonite) is the most dominant source of swelling in expansive soils throughout the world (Mitchell & Soga, 2005).

Montmorillonite mineral has a parallel layered mineral structure. Smectite absorbs water between the unit layers and expands (van Olphen, 1977). In identifying the presence of clay minerals that determine the expansive properties of soil, it can be done in two ways in which is identifying minerals and using the soil physical properties approach.

The research area coverage is about 25 km^2 in Cibogo District, Subang Regency. The focus of the research is taking samples in an area inside Kaliwangu Formation.

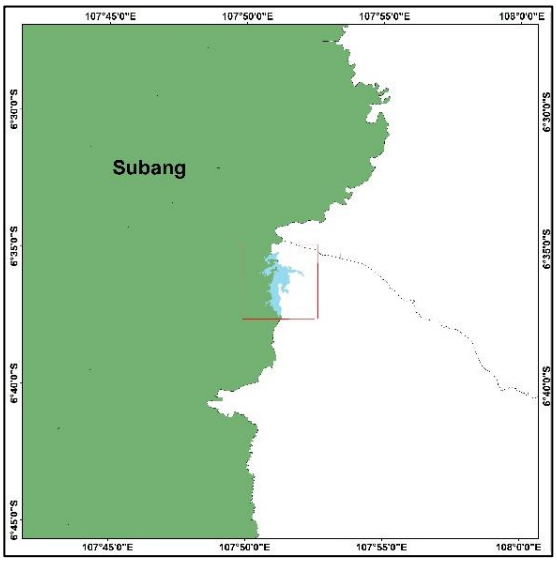

Figure 1. Research location

RESEARCH METHOD

Research is conducted by doing field observation and field sampling using disturbed sample method then it will be tested in laboratory for its basic physical properties. The result of its basic physical properties will be analyzed to determine their swelling potential.

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Table 1. Laboratory test and reference

No	Parameter	Reference
1	Soil Type	USCS (Unified Soil Classification System)
2	Atterberg Limit	ASTM D 4318-00
3	Sieve Analysis	ASTM D 2487-69

Every clay soil that is sensitive to changes in volume due to water content is generally considered as expansive soil. Several approaches will be used in this research using classification and graph plotting to see the swelling potential of each Kaliwangu Formation sample based on their basic physical properties of soil, such as atterberg limit and sieve analysis.

Table 2. Swelling potential based on % liquid limit

Swelling Potential	Liquid Limit (%)	
	Chen (1965)	Snethan et al. (1977)
Low	<30	<50
Medium	30 - 40	50 - 60
High	40 - 60	>60
Very High	>60	-

Table 3. Swelling potential based on plasticity index

Swelling Potential	Plasticity Index (%)	
	Chen (1988)	Snethan et al. (1977)
Low	<30	<50
Medium	10 – 35	50 - 60
High	20 - 55	>60
Very High	>35	-

RESULT AND DISCUSSION

The research area comes under Regional Geology Map Bandung Page 1:100.000 scale and were composed by 4 formations in which is Subang Formation (Msc), Kaliwangu Formation (Pk), Citalang Formation (Pt), and Young Volcanic Product (Qos) (Silitonga, 2003). Focus of the research are only on the Kaliwangu Formation (Pk) that covered about 15% of all the research area, by doing field observation and sampling this research use 5 sample of soil from Kaliwangu Formation (Figure 2.).

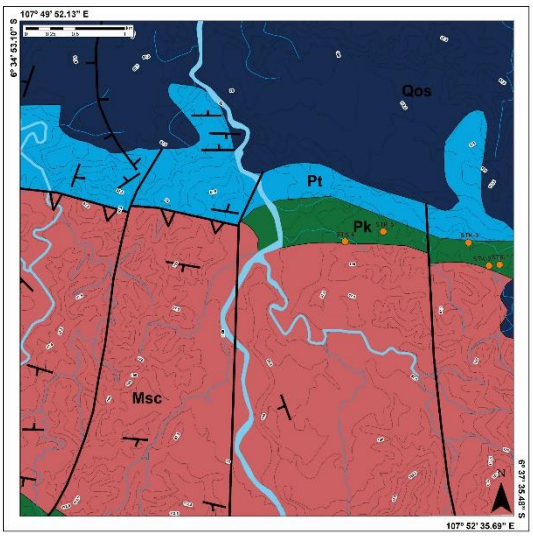

Figure 2. Sample point of Kaliwangu Formation

Material Properties of Kaliwangu Formation Sample

Each sample then taken to laboratory to test their basic physical properties, in this research all 5 samples were tested with sieve analysis to know the grain size spread of each sample and Atterberg limit to know the consistency limit of every sample from Kaliwangu Formation (Pk).

Table 4. Grain size data of Kaliwangu Formation (Pk) sample

Sample	Gravel (%)	Sand (%)	Silt (%)	Clay (%)
STK - 1	0,00	2,06	33,87	64,07
STK - 2	0,00	0,24	16,03	83,73
STK - 3	0,02	0,20	12,28	87,50
STK - 4	0,00	0,20	40,46	59,34
STK - 5	0,00	0,16	39,86	59,98

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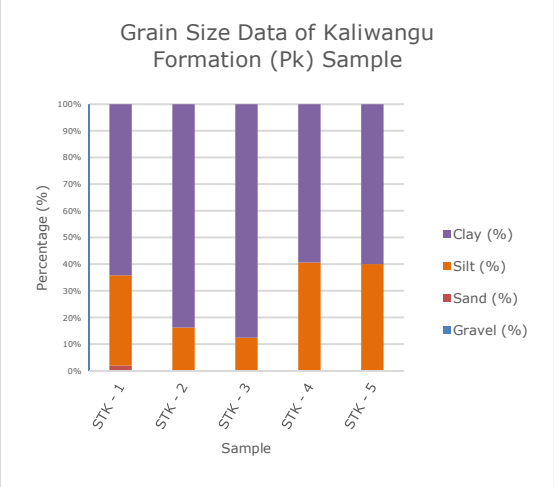

Figure 3. Grain size data graph

Based on the result of sieve analysis its concluded that every sample of Kaliwangu Formation (Pk) have more than 50% of clay fraction for each sample and a very small amount of sand and gravel fraction, so it has a big probability to be an expansive soil because they have a high percentage of clay.

Table 5. Consistency limit of Kaliwangu Formation (Pk) sample

Sample	LL (%)	PL (%)	PI (%)	USCS
STK - 1	67,71	35,00	32,71	MH
STK - 2	85,44	19,71	65,73	CH
STK - 3	95,27	8,94	86,33	CH
STK - 4	72,28	26,28	46,01	MH
STK - 5	64,56	29,31	35,25	MH

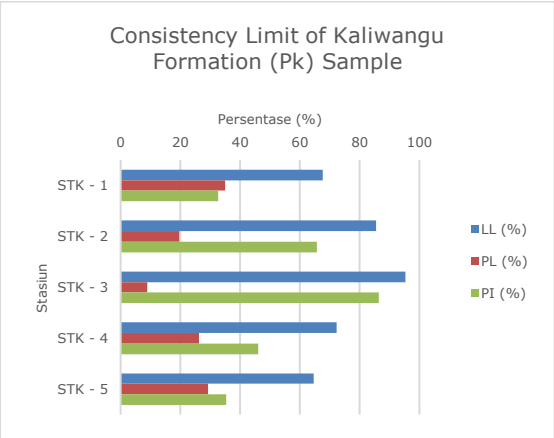

Figure 4. Consistency limit data graph

The plasticity condition of the research sample is obtained from the liquid limit value. Based on the results of the liquid limit test, it can be classified that the plasticity characteristics of the research sample are in the high plasticity category. So, if it is correlated with the results of testing the grain size of the soil in the research samples, the research samples are dominated by Silt High Plasticity (MH) soil with 3 samples of the MH type and only 2 samples of the CH type.

Soil has expansive properties because it is triggered by the water content which reacts with clay minerals in soil which has expansion properties. The liquid limit value can be considered as a value that represents the capacity of the soil to hold water, where this value can measure the potential to expand a soil (Asuri & Keshavamurthy , 2016).

Swelling Potential of Kaliwangu Formation (Pk)

According to consistency limit test of Kaliwangu Formation (Pk) soil, the swelling potential can be determined by classifying it based on liquid limit (%) and plasticity index (%) using swelling potential classification.

Table 6. Swelling potential based on Liquid Limit (%)

Sample	LL (%)	Swelling Potential	
		Chen (1965)	Snethan dkk. (1977)
STK - 1	67,71	Very High	High
STK - 2	85,44	Very High	High
STK - 3	95,27	Very High	High
STK - 4	72,28	Very High	High
STK - 5	64,56	Very High	High

Table 7. Swelling potential based on Plasticity Index (%)

Sample	PI (%)	Swelling Potential	
		Chen (1965)	Snethan dkk. (1977)
STK - 1	32,71	High	High
STK - 2	65,73	Very High	Very High
STK - 3	86,33	Very High	Very High
STK - 4	46,01	Very High	Very High
STK - 5	35,25	Very High	Very High

CONCLUSION

Based on the physical properties test, the soil consistency value and the grain size distribution are obtained. Using the soil consistency value, especially the liquid limit value and the plasticity index value, it can be classified as the swelling potential of Kaliwangu Formation (Pk) classified as high -

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very high potential with a very high dominance according to Chen (1965), and Snethan, et al (1977) for classification based on liquid limit values, as well as according to Chen (1988) and Holtz & Gibbs (1956) for classification based on liquid limit values. plasticity index.

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