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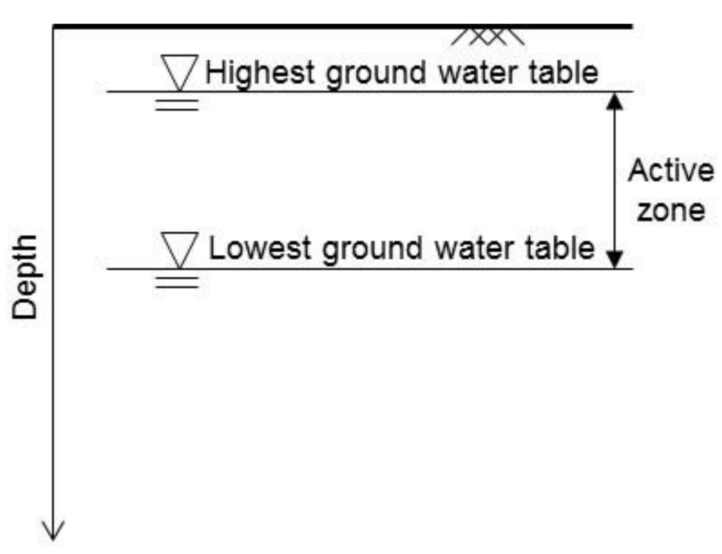
THE SHEAR STRENGTH ALTERATION ON CLAY SOIL CONSIDERING THE PLASTICITY INDEX AND THE PERCENTAGE OF FINE AGGREGATES IN TROPICAL CLIMATE REGIONS

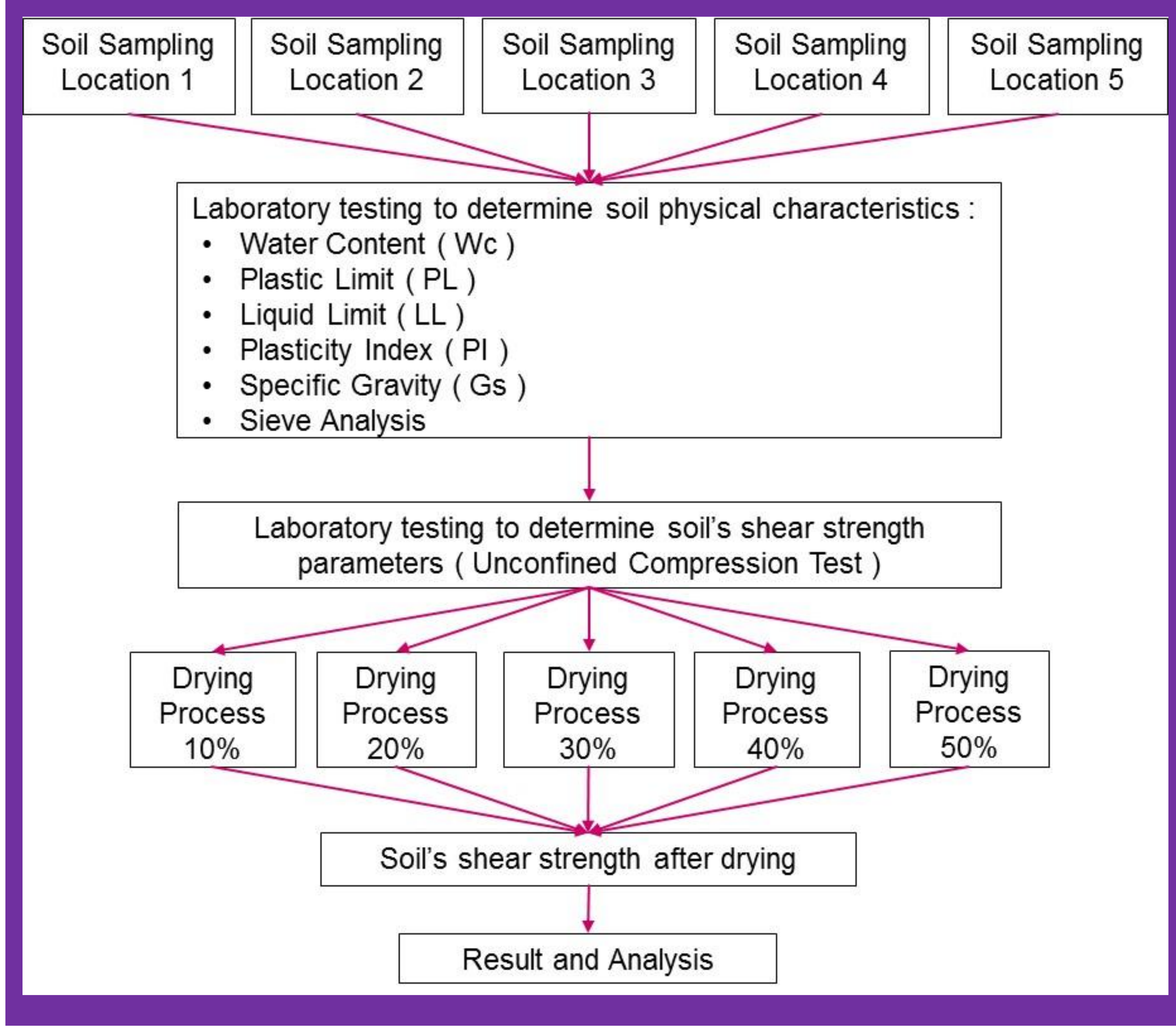


Introduction

Seasonal changes in tropical regions like Indonesia can cause variations in soil water content. In clay soils, these conditions affect the shear strength in the active zone, where groundwater fluctuations occur. Variation in water content in active zone will cause changes in soil characteristics and this change affects the shear strength of soil. The behaviour of clay soil due to variations in water content should be considered so that the foundation can be designed properly. One important thing to note is the penetration of water into the soil, which can increase the soil's water content and reduce soil shear strength significantly.

In this research, a series of laboratory experiments were conducted to understand the impact of variations in water content on the shear strength of clay. This study also investigated the effect of plasticity index values and the percent of fine aggregate on shear strength changes in clay soils due to seasonal groundwater fluctuations.

Research Method

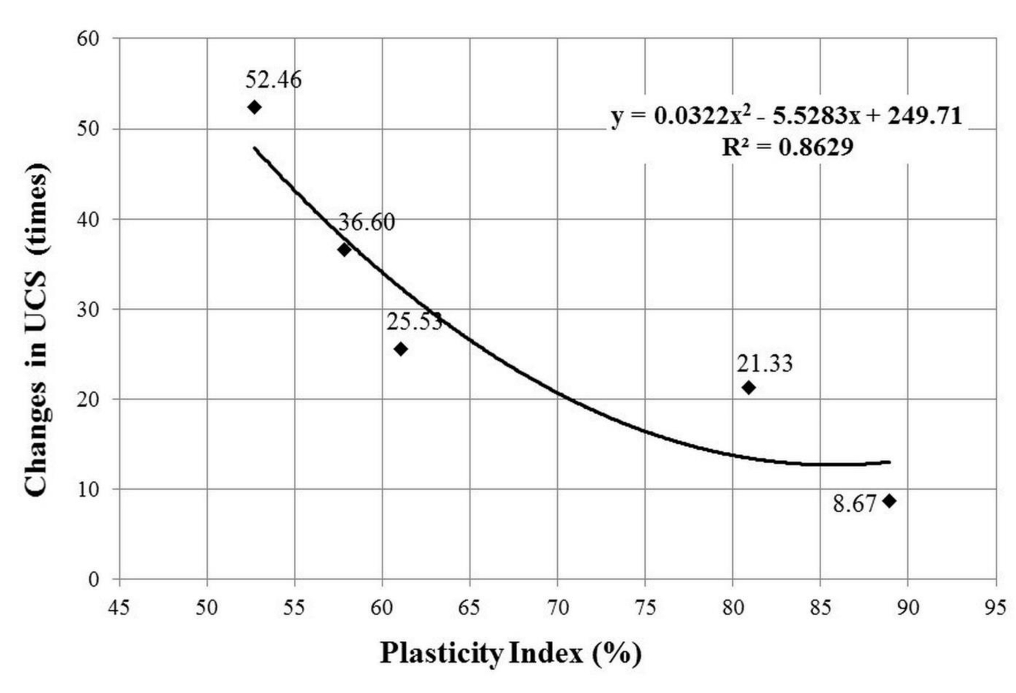


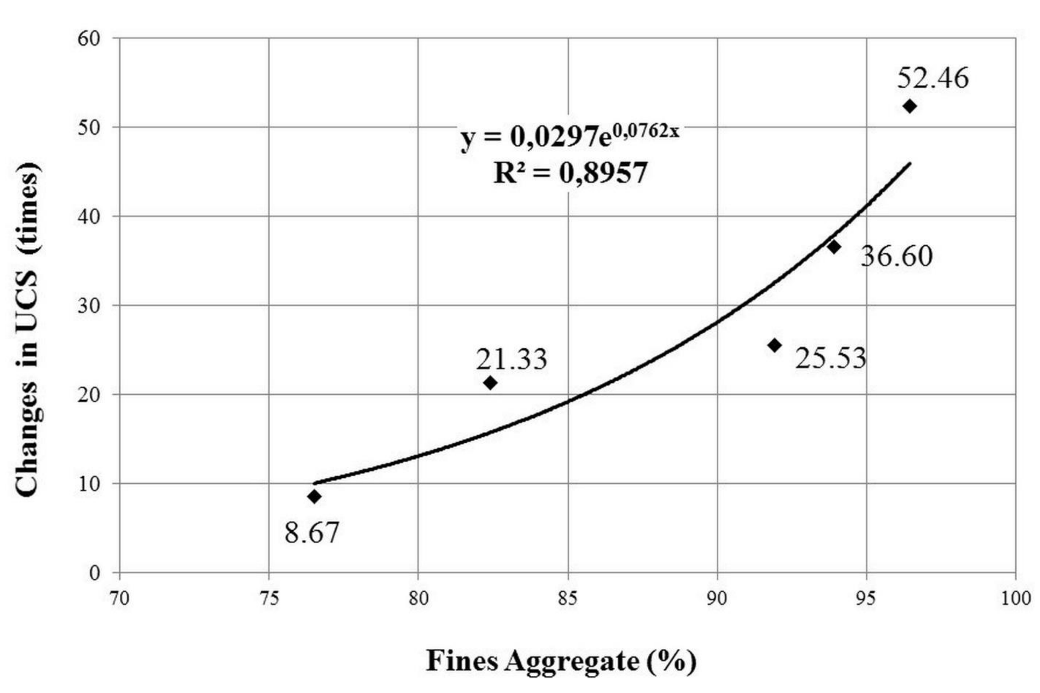
Results

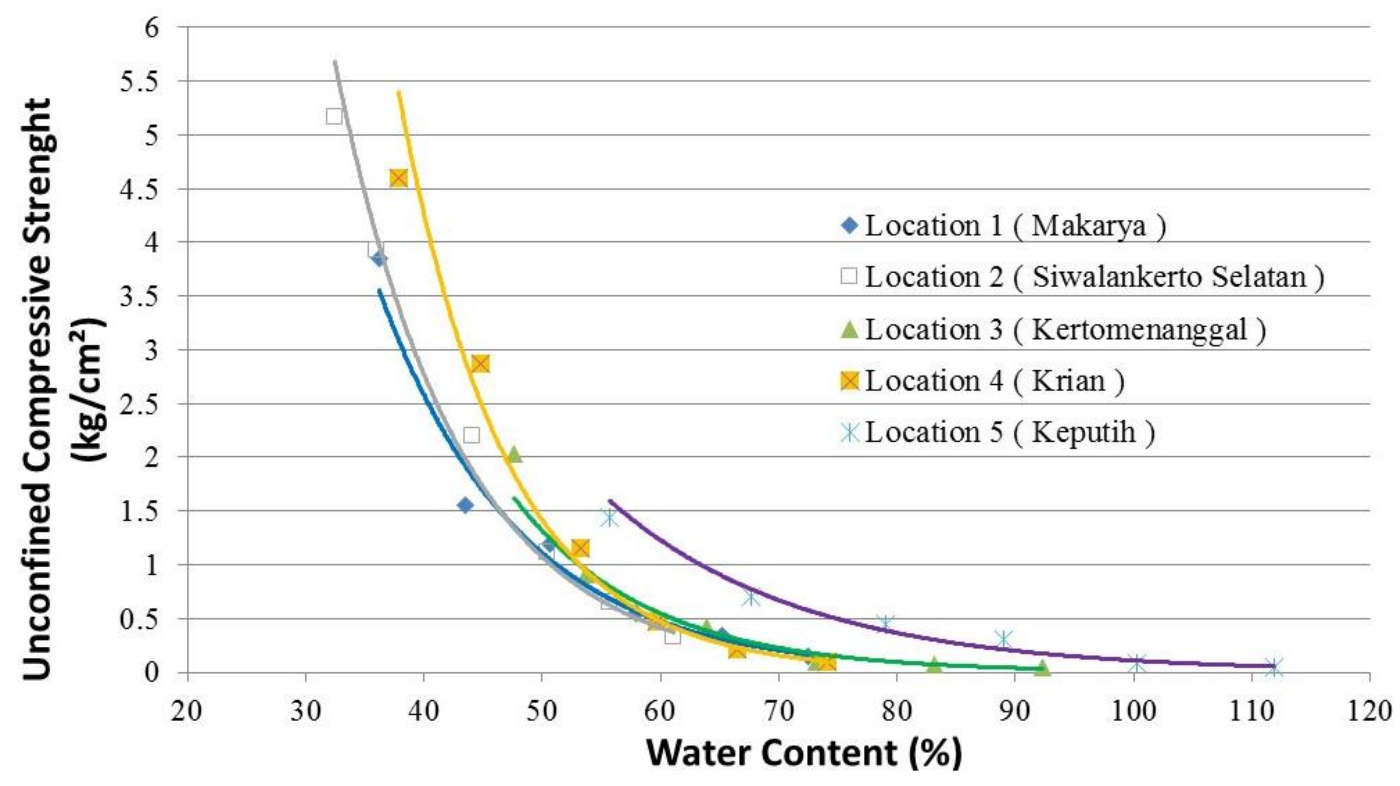
Initial Soil Characteristics

No	Location	Water Content (%)	Specific Gravity	Liquid Limit (%)	Plastic Limit (%)	Plasticity Index	Fine Aggregates (%)
1	Makarya	72,46	2,61	103,44	22,56	80,88	82,41
2	Siwalankerto	61,09	2,63	104,15	43,10	61,06	91,92
3	Kertomenanggal	92,28	2,64	99,04	41,23	57,81	93,92
4	Krian	74,17	2,66	93,51	40,81	52,71	96,42
5	Keputih	111,85	2,58	117,32	28,37	88,95	76,52

- The variation in water content was carried out in the form of a reduction in soil moisture content of 10%, 20%, 30%, 40% and 50% of the initial moisture content. The variation in water content on unconfined compressive strength of the soil in the five locations can be seen in figure below.
- The results showed that the shear strength increases with a decrease of soil water content. As the water content of the soil sample reduce there was an exponential increase in the soil's unconfined compressive strength, especially when the soil water content approached the plastic limit value. This phenomenon is caused by the soil changing from the plastic phase to the semi-solid phase.
- Unconfined compressive strength changes significantly when changes in water content occur in the soil with a small index of plasticity
- Percentage value of fine grains was very susceptible to addition or reduction in water content.







Discussions & Conclusions

1. When the soil water content approaches the plastic limit, there was a significant increase in unconfined compressive strength. From this study, the relationship between unconfined compressive strength and water content was expressed in the form of equations with R^2 greater than 0.95.
2. In the same range of water content changes, which was approximately 36%, in clay soils with a plasticity index of about 90, unconfined compressive strength changes about eight times. Whereas in clay with a plasticity index value of around 50, unconfined compressive strength changes in the soil reached 50 times The relationship between the plasticity index (PI) and the unconfined compressive strength change of soil (Δqu) in this study could be expressed in the equation $\Delta qu = 0.0322PI^2-5.528PI + 249.71$ with the value $R^2 = 0.86$.
3. In the same range of water content changes, which was equal to 36%, clay soils with a percentage value of fine grains less than 80% underwent unconfined compressive strength changes in the soil eight times. When clay had a percentage value of fine grains of more than 95%, changes in unconfined compressive strength reached fifty times. The relationship between the percentage of fine grains and the changes of unconfined compressive strength of soil (Δqu) in this study can be expressed in the equation $y = 0.0297e^{0.0762x}$ with the value $R^2 = 0.9$, where: x = percentage of fine grains, y = unconfined compressive strength change (Δqu)

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Daniel Tjandra and Paravita Sri Wulandari
Civil Engineering Department, Petra Christian University