Shear Strength Parameters of Cement Stabilized Amorphous Peat of Various Water Additive Ratios at Different Natural Moisture Contents under Consolidated Undrained Triaxial Test

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Abstract: ***Peat is a problematic soil which has a low shear strength characteristic. Addition of cement can improve the properties and strength of peat soil. This paper presents the findings of the shear characteristic of cement stabilized amorphous peat under consolidated undrained (CU) triaxial test. Three different natural moisture contents of peat which are 1210%, 803% and 380%, were stabilized using cement with water to additive (W/A) ratio of 2.0 and 3.0. CU triaxial test was conducted to the specimens after cured for 90 days. The shear parameters and characteristics were investigated towards the change of W/A ratio of the samples with different moisture contents. The result shows that the stabilized peat specimens exhibited ductile behavior and were sensitive to the over consolidation. The total and effective cohesion (c_{cu}, c') of the stabilized peat were found to be greater at W/A ratio of 2.0 compared to W/A ratio of 3.0, and greater at lower initial moisture content specimens. The total and effective friction angles (φ_{cu}, φ') are ranged from 14° to 27° and 36° to 47° consecutively and found to be increased upon the increase of W/A ratio except for the specimens with moisture content 1210% and 803% in term of total friction angle.***

Keywords: cement-stabilized peat, consolidated-undrained triaxial, peat, shear parameters, water to additive ratio.

I. INTRODUCTION

Peat is considered as a problematic soil due to the weak characteristic to support built structures, including the high moisture content, low shear strength, low bearing capacity, high compressibility, etc. Cement stabilization is one of the solutions to solve the geotechnical problems. Many studies had proved that the peat shear strength can be improved by adding cement ([1], [2]). However, there is still a lack of study of cement-stabilized peat strength shear characteristic. This paper presents the shear characteristics and parameters of cement stabilized amorphous peat obtained from consolidated undrained (CU) triaxial test.From the previous studies, the behavior of saturated peat can be observed according to the principle of the effective stress as in the inorganic soils [3]. Fibrous peat has a low cohesion, high friction angle, and greater undrained strength parameters compared to those of inorganic soils caused by the effect of the tension in fibers ([3]–[6]).

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Long [7], and Mesri and Aljouni [8] found the friction angles of fibrous peat are ranged from 40° to 60°. For the cement-stabilized fibrous peat, Hwa [6] found that the specimen with lower moisture content achieved higher strength. The strength increased as the confining pressure increase for both untreated and treated specimens [6]. The cement-stabilized peat stress-strain behavior under consolidated undrained test depends on the effective confining pressure given [4].

Several studies had been carried out to investigate the fibrous peat strength parameters, thus, further investigation of the behavior and strength parameters of the other types of peat is needed. In this study, consolidated undrained triaxial test was conducted to study cement-stabilized amorphous peat of different initial moisture content with different water to additive (W/A) ratio.

II. MATERIAL AND METHOD

Peat sample was taken from Kampung Meranek, Sarawak, Malaysia from 0.5-1 m depth below the surface. Peat sample that transported to the laboratory, was kept in a sealed container. Disturbed amorphous peat samples were sieved through 6.63 sieve. Soil investigations were conducted to get the soil properties of the peat.

Samples were air-dried until it reached the desired moisture content in order to make the sample of varied moisture contents (1210%, 803%, and 380%). In this research, the moisture contents varied in the gap of ±400% to investigate the differences of the behavior of the peat with different moisture contents. To reach the desired moisture content, peat cannot be dried by oven and added water afterwards. It is because once peat is dried, losing its moisture content, and added water afterwards, it will not have the same moisture content as before [9]. Thus, the peat samples must be air-dried.

For each sample of different natural moisture contents, cement was added with the water additive (W/A) ratio of 2.0 and 3.0. All of the samples were air-cured for 90 days before tested for consolidated undrained triaxial test. Peat with the initial moisture content of 1210%, 803%, and 308% later are referred as peat A, B, C consecutively.

Triaxial test carried out in consolidated undrained (CU) condition based on ASTM 4767 guidelines. The test was run in three phases, saturation, consolidation, and shearing phases. The saturation ratio (B) above 0.95 is considered saturated. During the consolidation phase, three initial effective stresses used were 50, 100, and 200 kPa. Constant rate of strain in shearing phase was maintained at 0.13% per minute until 40% axial strain was reached (εa = 40%).