ENGINEERING PROPERTIES OF OLDER ALLUVIUM

BADEE ABDULQAWI HAMOOD ALSHAMERI

Universiti Teknologi Malaysia

DECEMBER 2010

ENGINEERING PROPERTIES OF OLDER ALLUVIUM

BADEE ABDULQAWI HAMOOD ALSHAMERI

A project report submitted in partial fulfilment of the
requirements for the award of the degree of
Master of Engineering (Civil - Geotechnics)

Faculty of Civil Engineering
Universiti Teknologi Malaysia

DECEMBER 2010

Dedicated to beloved parents, my lovely wife, my son Elyas, my daughter Taraneem, my grandfathers, my grandmothers, my brothers, my sisters, my sister in law and my family. Thanks for all your love and supports.

Badee Alshameri

ACKNOWLEDGEMENT

I would like to thank my wife and my son for helping me during collecting preparing samples at field. Also I would like present my regard and thankful for my supervisors Dr. Edy Tonnizam bin Mohamad and Prof. Dr Khairul Anuar Mohd Kassim and I present special thank for Dr. Edy Tonnizam bin Mohamad who give me guideline during prepare the project and encourage me and support me with geological references and maps and give time for discussion and corrections the project . Moreover I present my regard to Prof. Dr Khairul Anuar Mohd Kassim who mention to me to starting with Dr. Edy .

ABSTRACT

Moisture content is one of the most crucial factors influencing soil and rock strength. This paper deals with the effect of moisture content on strength of older alluvium under dry, wet and saturated conditions. Older alluvium is semi cemented eroded deposited and reshaped by water to make non-marine setting. Specimens were tested in for shear strength, hardness and point load index. According to these results, the petrophysical properties of older alluvium decrease with increasing moisture. The strength was extremely reduced after the moisture content increased over the range of natural moisture content i.e. at saturated condition. For soil mechanics and soil engineering projects the shear strength, friction angle and cohesion assess at dry condition in order to give classification for soil strength. While the design parameters (shear strength, friction angle and cohesion) were taken at weak condition i.e. saturated and wet condition. However the difficulties and non reliable preparing regular samples at laboratory, most of samples destroyed during the sample preparation. Point load apparatus and Schmidt (rebound) hammer test did not able to record any reading during test the samples for both wet and dry condition. Older alluvium shows equilibrium between distribution of the clay/silt and gravel with percent finer approximately 38% and 38.5% respectively, and lower presence of sand with percent finer approximately 23.4%. The range of natural moisture content was within range of 17.98 to 19.65%. The results revealed that moisture content have great influence in the reduction of the shear strength τ, friction angle $\emptyset$ and cohesion c. When the moisture content on older alluvium deposits increased the shear strength reduced to 22.3% and to 75.3% at wet and saturated condition respectively (the shear strength equal to 57.4kPa and 18.3kPa for wet and saturated condition respectively) in comparison to the magnitude of shear strength at dry condition (shear strength at dry condition equal to 74.1kPa). The same as for friction angle, when the moisture content increased the friction angle reduced to 18.6% and 66.9% at wet condition and saturated condition respectively (friction angle equal to 55.19^{o} and 22.45^{o} for wet and saturated condition respectively) in comparison to the magnitude at dry condition (at dry condition friction angle equal to 67.83^{o}). Otherwise the effective of increase the moisture content at cohesion is different i. e. the magnitude of cohesion at dry condition was equal to 21.044 kPa. At wet condition the cohesion increased to 12.7% (cohesion equal to 23.71kPa) in comparison to the magnitude at dry condition. At saturated condition the cohesion value will decreased to 54.6% (cohesion equal to 9.54 kPa) in comparison to the magnitude at dry condition.

ABSTRAK

Kandungan lembapan ialah salah satu faktor penting yang mempengaruhi kekuatan tanah dan batu. Kajian ini dibuat bagi mengkaji kesan kandungan lembapan terhadap kekuatan Alluvium tua dalam keadaan kering, basah dan tepu. Alluvium tua ialah separa tersimen. Spesimen diuji untuk kekuatan ricih, ketahanan dan indeks beban titik. Keputusan uji kaji menunjukkan sifat petrofizikal alluvium yang berkurangan apabila kelembapan meningkat. Kekuatannya menurun dengan mendadak selepas kandungan lembapan meningkat melebihi daripada kadar yang sepatutnya, sebagai contoh ketika dalam keadaan tepu. Kebiasaannya, rekabentuk mekanik tanah dan kejuruteraan tanah, kekuatan ricih, sudut geseran dan kejelikitan dibuat ketika keadaan kering dengan tujuan untuk mengklasifikasikan kekuatan tanah. Walaubagaimanapun, parameter reka bentuk (kekuatan ricih, sudut geseran dan kejelikitan) sangat terubah ketika keadaan tepu dan basah. Kesukaran dan cara pengambilan sampel yang tidak betul menyebabkan kebanyakan sampel musnah. Alat Beban Tumpu dan Ujian Hentakan Schmidt tidak dapat mencatatkan sebarang bacaan ketika uji kaji sampel dilakukan dalam keadaan basah dan kering. Alluvium tua menunjukkan persamaan di antara agihan untuk tanah liat dan batu kerikil, peratus halus di antara 38% dan 38.5%, manakala untuk pasir, peratus lulus ialah 23.4%. Kebiasaannya, bacaan untuk kandungan lembapan yang asal ialah di antara 17.98% ke 19.65%. Keputusan menunjukkan kandungan lembapan memberi kesan kepada pengurangan kekuatan ricih τ, sudut geseran $\emptyset$ dan kejelikitan c. Apabila kandungan lembapan untuk mendapan alluvium tua ditingkatkan, kekuatan ricih berkurangan kepada 22.3% dan 75.3% dalam keadaan basah dan tepu (kekuatan ricih bersamaan dengan 57.4kPa dan 18.3kPa untuk keadaan basah dan tepu) dengan membandingkan dengan kekuatan ricih dalam keadaan kering (kekuatan ricih ketika kering bersamaan dengan 74.1kPa). Begitu juga dengan sudut geseran, apabila kandungan lembapan meningkat, sudut geseran juga berkurangan kepada 18.6% dan 66.9% dalam keadaan basah dan tepu) dengan membandingkan dengan magnitud dalam keadaan kering (sudut geseran bersamaan dengan 67.83% dalam keadaan kering). Walaubagaimanapun, kandungan lembapan efektif dalam keadaan jelekit adalah berbeza. Sebagai contoh, magnitud kejelikitan dalam keadaan kering adalah bersamaan dengan 21.044kPa. Dalam keadaan basah, kejelikitan telah meningkat kepada 12.7% (kejelikitan bersamaan dengan 23.71kPa) dengan membandingkan magnitud dalam keadaan kering. Dalam keadan tepu, nilai kejelikitan akan berkurangan kepada 54.6% (kejelikitan bersamaan dengan 9.54kPa) dengan membandingkan dengan magnitud ketika keadaan kering.