Geotech Geol Eng (2019) 37:1059–1072
https://doi.org/10.1007/s10706-018-0643-3

TECHNICAL NOTE

Measurement of Amorphous Peat Shear Strength in the Direct Shear Box at High Displacement Rates

Akeem Gbenga Amuda · Fauzan Sahdi · Alsidqi Hasan · Siti Noor Linda Taib · Noel Boylan · Aliaa Mohamad

Received: 20 March 2018 / Accepted: 18 July 2018 / Published online: 21 July 2018

Abstract The ASTM standard provides guidelines for the drained direct shear test (DST) and requires the samples to be sheared at rates estimated from time to failure, $t_f \geq 50t_{50}$ (where t_{50} is the time required to achieve 50% consolidation). This paper investigates the potential of estimating the undrained strength of peat in the DST owing to its ease of accessibility and simplicity over other laboratory tests. In this experimental study, peat samples were sheared at various displacement rates at t_f/t_{50} values of 0.065–70. The samples tested at the ASTM specified rate of $t_f \geq 50t_{50}$ exhibit continuous increase and decrease in shear stress and volume respectively with increasing shear strain. Hence, determining the drained strength properties of peat in the DST apparatus is complicated. However, it is concluded that the shear stress ratio, τ/σ'_v of the DST test samples sheared at rates corresponding to $t_f \leq 0.2t_{50}$, reasonably corresponds to that measured in undrained direct simple shear (DSS) tests on peat, found in the literature. Therefore, DST conducted at high displacement rates will be adequate for preliminary evaluation of the shear strength of peat at close to undrained conditions, when constant volume DSS apparatus is not available.

Keywords Peat · Undrained strength · Direct shear test · Displacement rates · Consolidation

A. G. Amuda (✉) · F. Sahdi · A. Hasan · S. N. L. Taib
Department of Civil Engineering, Universiti Malaysia Sarawak, Kota Samarahan, Sarawak, Malaysia
e-mail: haykaycivilengr@gmail.com

F. Sahdi
Centre for Offshore Foundation Systems, The University of Western Australia, Perth, WA, Australia

N. Boylan
Norwegian Geotechnical Institute, Perth, Australia

A. Mohamad
Lebuhraya Borneo Utara, Kuching, Malaysia

1 Introduction

Peat is a challenging soft geotechnical material with high moisture content and void ratio. It is primarily made up of partly decomposed plants and inclusions of roots that have accumulated under water and fossilised (Moore and Bellamy 1974). Peat is often associated with high compressibility and poor strength characteristics (Den Haan and Kruse 2007). Despite the challenges posed by these characteristics to engineering developments, construction and development in areas of peatland have been on the increase. In Malaysia, mega infrastructure projects such as Sarawak Corridor of Renewable Energy (SCORE) and the Pan Borneo Highway project (East Malaysia) are situated in peat areas. However, the unfavourable engineering properties of peat have caused the construction industry to either be inclined to avoid peat areas or total removal of peat layers when it is not