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Discussion
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Discussion: Shear behaviour of peat at different stress levels

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1. Introduction

The authors are to be commended for adding to the database of consolidated undrained triaxial tests on peat (Wang and Li, 2024). There are few such studies published in the literature and further studies are well warranted. The contributors feel that some clarification of points made in the paper would benefit future readers of the paper and potential users of the data.

2. Peat characterisation

The peat tested in the study was from a depth of 1.65 m. A picture of a specimen is shown in Figure 4 of the paper (Wang and Li, 2024) and the material is characterised as H8 (Table 1 of the paper) using the well-known von Post scale (von Post and Granlund, 1926). In the contributors' experience, deposits with this level of decomposition (H8) are relatively rare in Irish peats. Some H8 peats are found close to the base of the sequence in deep deposits. However, it is very rare to find H8 peat at relatively shallow depths. According to the von Post scale, H8 peat has a very indistinct plant structure. Examination of Figure 4 reveals that the plant structure is in fact clearly distinct. The contributors have not examined this peat in detail but, based on the image, it is estimated that it is a more moderate decomposition, likely a H5–H6 peat. Such deposits are very common in Ireland.

3. Sampling

It is particularly good that samples as deep as 1.6 m were recovered as peat is not an easy material to obtain samples while minimising the effect of disturbance, particularly at these depths. Some further details on the sampling technique, sample dimensions, sample protection, transportation and storage would be especially useful for readers. It would also be very useful to learn how the triaxial test specimens were prepared from the samples.

4. Volume change during consolidation

As reported in Table 1, the volume/void ratio changes during consolidation of the samples were very large. This leads one to question how uniform the specimen was for the shearing stage of the tests. Was the diameter smallest at the centre of sample and largest at end? It would be interesting to learn how these non-uniform dimensions were allowed for in subsequent analyses.

5. Membrane details

The authors correctly pointed out that membrane corrections are important for analysis of triaxial tests on peat. The details of the membrane are an important part of the analysis (Henkel and Gilbert, 1952). The authors said that a membrane thickness of 0.2 mm and a stiffness of 1400 kPa are 'usually taken'. It would be interesting to learn what were the actual measured values of the membranes used in this study.

6. Membrane correction

Given that the samples are likely to have been significantly non-uniform, it would seem to be difficult to apply Equation 2, which has its origin in compression shell theory and assumes that the specimens and membrane are more or less cylindrical. The mid-plane diameter of the specimen is likely to be less than at the ends, so it is unlikely to deform as a compression shell. The authors thoughts on this would be helpful.

Some of the data reported in Table 3 is misleading. For example, the test results reported from Boylan (2008) have already been corrected for membrane stiffness effects. Boylan went to great lengths to measure the effect directly for the actual membranes used.

7. Critical-state shear strength

It would be interesting if the authors could detail how the critical-state shear strength can be determined from the maximum curvature point (MCP) data. Also, the authors might confirm what actually is the definition of the 'critical-state strength' of peat. Given that peat is an assemblage of decomposing organic materials that are compressible, it is questionable if theories that were developed for particulate materials can be directly applied.

8. Interaction with the tension cut-off line

It is very unusual for the peat stress path not to reach the tension cut-off line. In the study, several of the tests failed to reach the line. Is this possibly due to the effects of membrane correction or could this finding be due to the limited maximum axial strains applied in the tests?

In deviator stress/mean effective stress diagrams (Figure 6) it often makes visual interpretation of the diagram easier if the *x* and *y* axis scales are the same.

9. Reliability of previous test results

The authors question the reliability of previous tests conducted at low effective stresses, for example the work of Boylan (2008). Boylan's work was carried out in the University College Dublin (UCD), GDS instruments triaxial system, which had several features to enable such testing, including the following.

- A differential pressure transducer that controlled the differential pressure between the cell and the back pressure.
- A special top cap and loading arrangement to ensure uniform application of the axial loading during shearing.
- Membrane stiffness correction was carefully applied using measurements made specifically on the membranes used in the study and tests on dummy specimens.
- An arrangement to reduce the effects of end restraint on the specimen during shearing. Muraro and Jommi (2021) investigated this aspect in detail and showed the importance of considering this aspect when testing peats in triaxial compression.

10. Future testing

The authors suggest improvements to triaxial testing and operator skills are required, but do not elaborate specifically on what might be appropriate. It would be helpful to elaborate on this point.

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