SMG-08: DIRECT SHEAR TEST (SHEARBOX TEST)

Reference Standard: BS 1377; EN DD ENV 1997-2; ASTM D3080

INTRODUCTION

In principle the shearbox test is an 'angle of friction' test, in which one portion of soil is made to slide along another by the action of a steadily increasing horizontal shearing force, while a constant load is applied normal to the plane of relative movement. These conditions are achieved by placing the soil in a rigid metal box, square in plan, consisting of two halves. The lower half of the box can slide relative to the upper half when pushed (or pulled) by. A motorised drive unit, while a yoke supporting a load hanger provides the normal pressure.

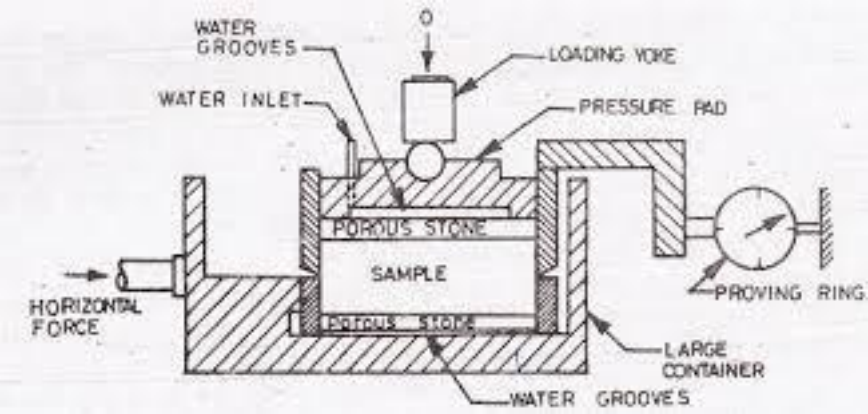


Figure 1: Schematic diagram of shearbox

During the shearing process the relative displacement of the two portions of the specimen and the applied shearing force are both measured so that a load/displacement curve can be drawn. The shearbox test described as a standard 'quick' test carried out in a 60 mm square shearbox.

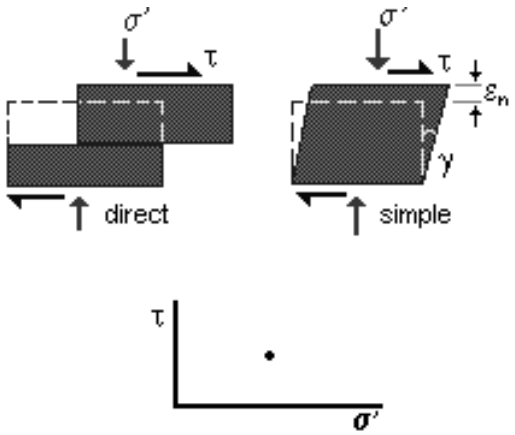
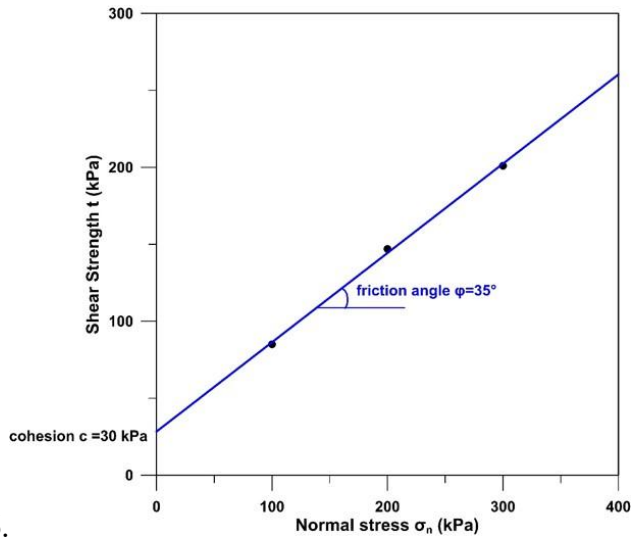


Figure 2: Principle of shearbox test

After conducting at least 3 tests at different normal stresses, the maximum shear stresses derived at each one is plotted versus the normal stresses and the best fit line determines the optimum Mohr-Coulomb Failure Envelope. The components of cohesion and friction angle are derived. An example is shown in Figure 3.



6.

Figure 3: Typical Mohr-Coulomb Failure Envelope derived for three direct shear tests with different normal stress. The envelope yields the friction angle φ and cohesion c of the M-C Failure Criterion.

OBJECTIVE

To determine the shear strength of a sandy to silty soil.

APPARATUS

List out equipment and apparatus use in the experiment complete with figures.

PROCEDURES

A) SAMPLE PREPARATION

1) Take sufficient amount of soil sample to conduct at least 3 set of tests.
2) Carefully assemble the shear box apparatus into correct position.
3) Take the shear box measurement (length, width and depth). Calculate the area of the box.
4) Weigh the empty box.
5) Put the soil sample into the box using spatula until the soil reach the required thickness.
6) Weigh the box again. Determine the weight of soil inside the box.
7) Put the porous stone and the loading block into position. Make sure that the loading block is leveled.

8) Put the apparatus in the direct shear machine. Tighten the jack and ensure all screws (horizontal and vertical) and sensor were in correct position.

B) SAMPLE TESTING

1) Test initialization:
   i. Go to DS7 program. Select new test and choose the correct machine for the test.
   ii. Select new sample. Fill in all the compulsory parameters that indicated with *. Press Ok.
   iii. Click reset to initialize all transducers relating to shear box test. Press Ok.
   iv. Select test stage (test initialization). Press Ok.
   v. Fill in the column of physical properties (weight and height of the sample) and apparatus size (lever weight).
   vi. Reset the vertical deformation gauge and press Ok twice.
   vii. Put load at the hanger.

2) Consolidation stage:
   a) Select test stage (consolidation stage). Press Ok.
   b) Ensure all the values are correct and press Continue.
   c) Start test countdown (one group member should standby near the shear box machine to release the jack). Immediately release the jack after hears long beep which is 5 seconds after the countdown started.
   d) Observe the reading appears at the screen.
   e) Select end test stage and press Ok.

3) Shearing stage:
   i. Select test stage (shearing stage). Press Ok.
   ii. Press calculate rate of displacement.
   iii. Follow the instruction given and press Ok for the popup box that appears at the screen.
   iv. Carefully remove the clamping screws at the shear box apparatus
   v. Select button to reset transducers and press Ok twice.
   vi. Select the Continue button.
   vii. Start test countdown (one group member should standby near the shear box machine to press Run button). Immediately press Run button after hears long beep which is 5 seconds after the countdown started.

viii. Observe the data appears at the screen.

ix. When the soil sample shows sign of failure (the value starts to drop), select end test stage and press Ok. Immediately press Stop button at the shear box machine and follow by pressing Return button.

4) Final measurement:
   a) Carefully take out the soil sample from the shear box machine. Weigh the shear box (without the loading block).
   b) Transfer all the soil inside the box into the container and leave it in the oven for 24 hours.
   c) Select test stage (final measurement). Press Ok.
   d) Click to confirm data and press Ok and then Save. Please ensure the destination of the files and folder that you saved.

C) TEST REPETITION

1) Proceed using another sample and repeat all the procedure until all the soil specimen finish to be tested.

D) DATA EXTRACTION

1) Go to DS7 program. Select Analysis & Report button. Select Browse directory and find the folder and file which saved previously. Select Current directory and select the correct raw data files. Click Analyze test.
2) Input data for dry specimen weight and press confirm data.
3) Follow the instruction given and press Ok for the entire pop up box that appears.
4) Press processed data file and select the correct file. Press button for write test report and save.
5) Press button for write group report. Select all items listed and click Ok. A graph of max shear stress and normal stress will appear and click Ok twice.
6) Finally, click Open report to generate full report.

.

DATASHEET