Determining Triaxial Compression Strength of Soils
D 5202 – 91

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Scope

This test covers the determination of the strength and deformation properties of cohesionless soil.

This test method provides data useful in determining the Mohr strength envelope.

Significance and Use

Data from this test may be used for structural design purposes. Adequate safety factors, based in engineering judgement must be determined by the user.

Apparatus

Triaxial Compression Chamber – used to apply a confining pressure and an axial load.

Specimen Preparation

Follow your T.A.’s instructions closely.
1. Place the porous stone on top of the lower loading plate.
2. Place the sample membrane over the stone and the loading plate and secure the membrane with an o-ring.
3. Place the sample form around the lower loading plate and pull the sample membrane over the top of the sample form. Pull the sample membrane so that there are no folds in the membrane.
4. Fill the sample form with sand to the top of the sample form. Lightly tap the sand in to the sample form and refill the sample form if needed.
5. Place the top loading plate on top of the sample form, pull the sample membrane over the top plate and secure it with an o-ring.
6. Apply a vacuum to the sample by attaching the appropriate hose to the vacuum outlet.
7. Remove the sample form. The sample should be a smooth cylinder from the top of the porous stone to the bottom of the top loading plate. If it is not a smooth cylinder the results will be affected.
8. Measure and record the length of the sample in three locations.
9. Measure and record the diameter of the sample of three locations.
10. Assemble the pressure chamber as directed by your instructor.
11. Pressurize the chamber as directed by our instructor.
12. Remove the vacuum.
13. Raise the loading frame to reduce the distance top loading plate and the load cell extension.
14. Note the input and output channels and begin a data acquisition task that will sample those channels at intervals of five seconds.
15. Record the output voltage every 30 seconds until the output drops for three consecutive readings.
16. Stop and rest the data acquisition task.
This test should be run using a confining pressure of 15, 20 and 45 psig.

**Calculations**

\[ \varepsilon_t = \frac{tR}{L_o} \]

where:
- \( t \) = elapsed time from start of loading,
- \( R \) = rate of displacement
- \( L_o \) = initial length of the sample, and
- \( \varepsilon_t \) = strain at time \( t \).

Calculate the cross-sectional area at time \( t \) as follows:

\[ A_t = \frac{A_o}{1 - \varepsilon_t} \]

where:
- \( A_o \) = initial cross-sectional area, and
- \( A_t \) = cross-sectional area at time \( t \).

Calculate the deviator stress as follows:

\[ \Delta \sigma = \frac{F_t}{A_t} \]

where:
- \( F_t \) = the force at time \( t \), and
- \( \Delta \sigma \) = deviator stress at time \( t \).

Determine the deviator stress at failure for each test.

Determine the minor and principle stresses at failure for each test as follows.

Minor principle stress \( \sigma_3 \) = confining pressure, and
Major principle stress \( \sigma_1 \) = confining pressure + deviator stress.
Construct, on one plot, the Mohr circles for each test and estimate the friction angle for the sample. The friction angle can be estimated by drawing a line through the origin and tangent to the Mohr circles.

**Report**

Report the following:
Description of the specimen tested.
Plots or deviator stress for each test vs time.
More circles used to estimate the friction angle for the specimen.
Data Sheet for Triaxial Compression Test

Date: ________________    Transducer: ______________
Calibration Factor: _________________  Sample Circumference: ___________
Loading Rate: _______________   Cross Sectional Area: ___________
Sample Length: _________________
Description of Sample:

<table>
<thead>
<tr>
<th>Test #</th>
<th>File Name</th>
<th>Confining Pressure (psig)</th>
<th>$\sigma_3$ at Failure (psi)</th>
<th>$\Delta\sigma$ at Failure (psi)</th>
<th>$\varepsilon_f$ at Failure (in/in)</th>
<th>$A_0$ at Failure (in$^2$)</th>
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