THE UNIVERSITY OF MAINE

Direct shear test

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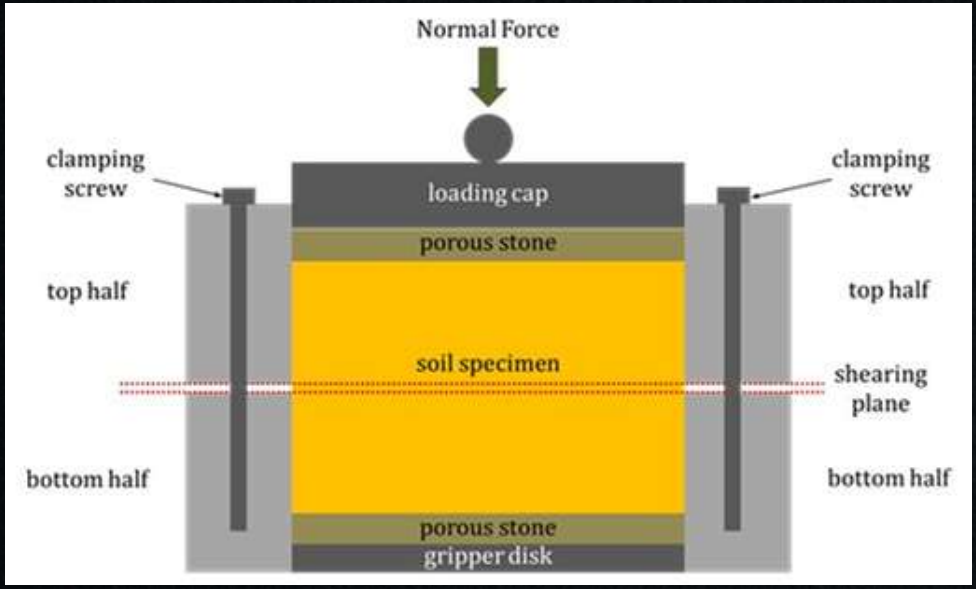
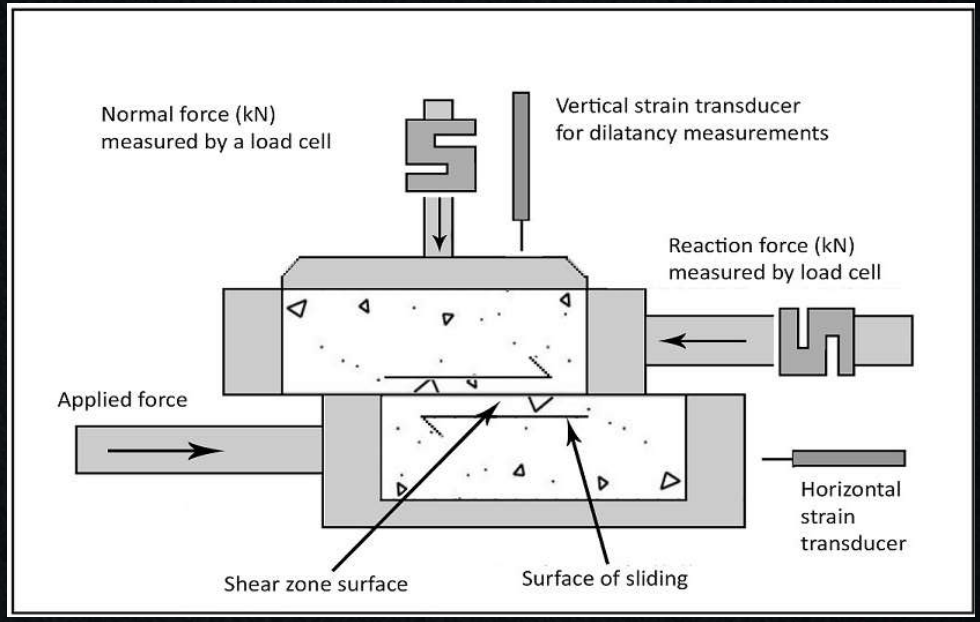
DIRECT SHEAR TEST

Initial configuration



Final configuration



OBJECTIVE OF THE DIRECT SHEAR TEST

- Measure **effective parameters** such as c', ϕ'_p, ϕ'_r.
- Consolidation parameters can also be obtained.
- C_v must be measured to determine shear rate.
- The DS is a **drained** shear test. Therefore, the shearing is controlled such that $\Delta u \approx 0$.

DS IN SAND

DS IN CLAY

DS STRESS PATH

PROS AND CONS OF THE DS TEST

Pros	Cons
• Is a K_0 consolidated test • Plane-strain test • Conservative if sheared parallel to sedimentation plane • Simple to mount and perform • Provides consolidation results • ASTM provided	• Does not provide undrained shear strengths • Does not provide strains • Modulus and stress-strain relationships cannot be obtained • Pore pressures are not measured • Stress paths are unknown • Progressive failure

SAMPLE PREPARATION-SAND

- Sand must be deposited with care using a consistent procedure.
- Ensure that the test can be replicated. Typically conduct tests under identical settings at least twice.
- Should try to have uniform void ratio trough the sample
- Various methos available:
  1. Pluviation
  2. Sedimentation
  3. Funnel deposition
  4. Controlled compaction or vibration
- Need max and min void ratio to determine relative density
- All samples should have the same initial void ratio

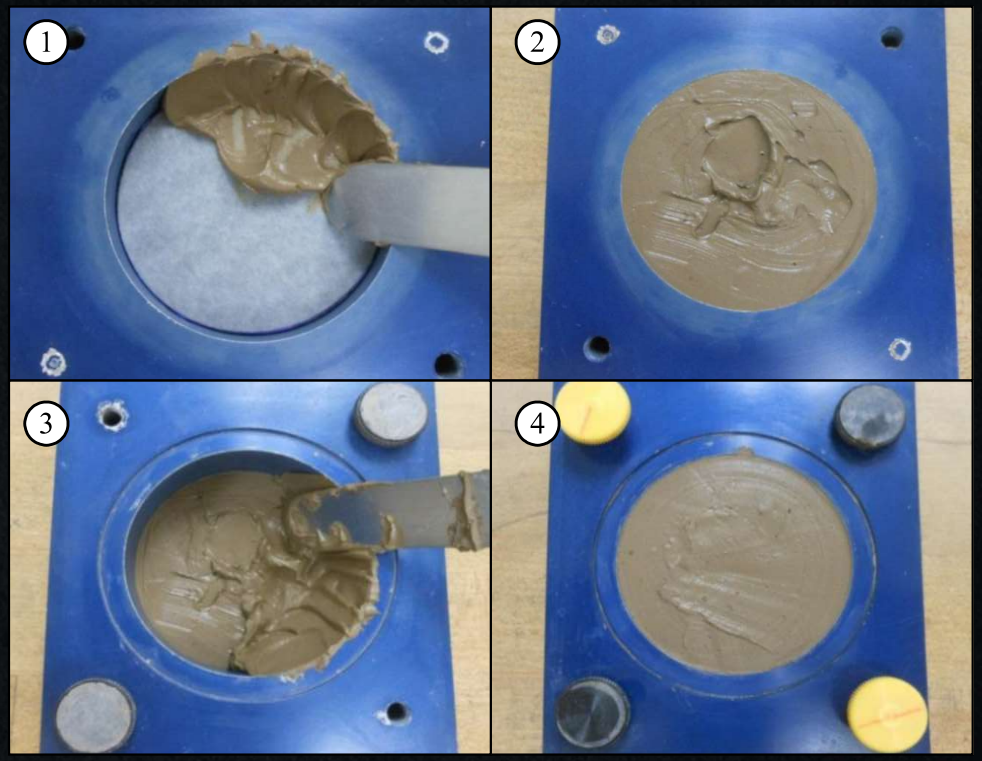
SAMPLE PREPARATION-SAND

SAMPLE PREPARATION- CLAY

- Intact samples are trimmed first following bets practices.
- For fully softened shear strength follow the following procedure:
  1. Soak soil for two days
  2. Sieve through sive No. 40
  3. Air-dry the sample
  4. Sample should be near the liquid limit for testing. 24-26 blows in a Casagrande cup.
- Place the bottom place with saturated porous stone and filter paper.
- For FSSS fill using a spatula from outside to inside. Press to remove air.

SAMPLE PREPARATION- CLAY

- Clean and put top box and black screws. Repeat filling procedure.
- Clean excess soil and place the gap screws (yellow screws).



ASTM D3080 DETAILS

- Withdrawn in April 2020.
- 2:1 minimum test specimen diameter or width to thickness ratio required.
- During shear, readings should be taken at displacement intervals of 2% of specimen diameter or width.
- Follow recomendations presented in ASTM D2435 for the consolidation stage.
- Weight of top half of the DS box should be less than 1% of the applied normal load. Otherwise it should be supported by a counter force.

PROBLEMS IN A DS TEST

- End of primary consolidation not reached. It is very important to ensure EOP for last consolidation load.
- Sample sheared too fast. Test will not be a drained test.
- Shearing stage stop early. The test specimen should past the peak shear stress to get a well defined curve.

SPECIFYING A DS TEST

- Normal stress is selected based on problem being analyse. Could perform a sacrifitail analysis to find a range of normal stress for testing.
- Shear rate is based on the C_v. Use Taylor's or Casagrande's method and calculate the displacement rate using:

$$d_r = \frac{d_f}{50t_{50}} = \frac{d_f}{11.6t_{90}}$$

- $d_r =$ displacement rate, $d_f =$ final displacement (Use 0.1 in for NC clays and 0.2 in otherwise).

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