INDIAN INSTITUTE OF TECHNOLOGY GANDHINAGAR
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LABORATORY VANE SHEAR TEST
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THEORY:

The objective of this test is to find the shear strength of soil. This test is performed to find shear strength of a given (generally very soft) soil specimen. Vane shear test is a useful method of measuring the shear strength of soft clay. It is a cheaper and quicker method. The test can be conducted in field as well as in laboratory. The laboratory vane shear test for the measurement of shear strength of cohesive soils is useful for soils of low shear strength (less than 0.3 kg/cm^2) for which unconfined tests cannot be performed.

NEED &SCOPE:

The test gives the undrained strength of the soil. The undisturbed and remolded strength obtained are also useful for evaluating the sensitivity of soil. The data acquired from vane shear test can be used to determine:

- Undrained shear strength
- Evaluate rapid loading strength for total stress analysis
- Sensitivity of soil to disturbance
- Analysis of stability problems with embankment on soft ground

APPARATUS REQUIRED:

1. Vane shear apparatus
2. Soft Soil Specimen
3. Specimen container
4. Vernier Caliper
5. Sensitive weighing balance with 0.01 g accuracy

PROCEDURE:

1. In case of remolded soil specimen, the dry weight of soil and the required water content to be taken depends on the requirement. (Usually in-situ dry density and water content will be taken for sample preparation).
2. Prepare eight specimens of the soil sample by rapidly mixing the soil with the water taken until uniform soil sample is obtained.
3. The uniformly prepared sample is filled in the specimen container whose height is 76mm and diameter is 38mm (Having (H/D) aspect ratio of 2).
4. The application of torque can be done using springs of different stiffness referred as spring constants (2, 4, 6, 8 kg-cm). To start with, the spring of stiffness (spring constant, 2 kg-cm) is attached to the vane shear apparatus.
5. Mount the specimen container with the specimen on the base of the vane shear apparatus. If the specimen container is closed at one end, it should be provided with a hole of about 1 mm diameter at the bottom.
6. Gently lower the shear vanes into the specimen to their full length without disturbing the soil specimen. The top of the vanes should be at least 10 mm below the top of the specimen. Note the initial readings of the (upper and lower) needles of angle of twist before applying torque.

7. Both needles should essentially be at the same angle before starting the experiment.
8. Rotate the vanes at a uniform rate (say 0.1^o per second) by suitably operating the torque application handle until the lower needle of angle handle reverts back which signifies the failure of soft soil specimen.
9. Note the final reading of the angle of twist by measuring the upper needle's indicated angle.
10. Find the value of blade height in cm and find the value of blade diameter (total width) in cm.
11. The same procedure needs to be done by changing the springs of other stiffness/spring constant say 4, 6, 8 kg-cm.
12. The repetition of tests for all springs of different stiffness is mandatory for reporting the results.

OBSERVATIONS & RECORDINGS:

$$S = \frac{T}{\pi(\frac{HD^2}{2} + \frac{D^3}{6})}$$

Where, S = Undrained shear strength of soil in kg/cm^2;

T = Torque in cm-kg (corrected for the vane rod and torque rod resistance, if any);

D = Diameter of vane (in cm);

H = Height of vane (in cm)

Soil Description: ……..

Sl. No	Initial Reading (Deg.)	Final Reading (Deg.)	Difference (Deg.)	Spring Constant (kg-cm)	T=Spring-(Constant*Difference)/180 (kg-cm)	$G = \frac{1}{\pi(\frac{HD^2}{2} + \frac{D^3}{6})}$	S=T x G (kg/cm^2)	Avg. S (kg/cm^2)
1				2				
2				2				
3				4				
4				4				
5				6				
6				6				
7				8				
8				8				

Note: This test is useful when the soil is soft and its in-situ water content is nearer to liquid limit