

DETERMINATION OF FREE SWELL INDEX OF SOIL

1. Objective: Free swell or differential free swell, also termed as “free swell index”, is the increase in volume of soil without any external constraint when subjected to submergence in water. A soil with high free swell index is considered “unsuitable” for use as embankment fill material and in case the sub soil is having high free swell index then suitable “ground improvement measures” may be needed before constructing embankment on such soil. Actual magnitude of swelling pressure developed depends upon the dry density, initial water content, surcharge loading and several other environmental factors.

2. Apparatus Required:

2.1 Hot Air Oven, thermostatically controlled, capable of maintaining temperature of 105⁰ to 110⁰ C.

2.2 Weigh Balance, with accuracy of 0.001g

2.3 Sieve, 425 Micron IS Sieve

2.4 Glass Graduated Cylinder, Two nos. of 100 ml capacity conforming to IS: 878-2008.

3. Reference: IS 2720 (Part-40): 1977 (Reaffirmed 2021) “**Method of test for soils: Determination of Free swell Index of soils**”.

4. Procedure:

4.1 Take two 10g oven dried soil specimens, passing through 425 micron IS sieve. Pour each soil specimen in each of the two glass graduated cylinders of 100 ml capacity.

4.2 Fill one cylinder with kerosene oil and other with distilled water up to the 100 ml mark. Stir both the cylinders with a glass rod to remove entrapped air and allow them to settle for 24 hours, to attain equilibrium without any further change of volume of soils. Read out the final volume of soils in each of the cylinders.

5. Calculations: The level of soil in the kerosene graduated cylinder shall be read as the original volume of the soil samples, kerosene being a non-polar liquid does not cause swelling of the soil. The level of the soil in the distilled water cylinder shall be read as the free swell level.

$$\text{Free swell Index, percent} = [(V_d - V_k) / V_k] \times 100$$

Where:

V_d = the volume of soil specimen in the cylinder containing distilled water

V_k = the volume of soil specimen in the cylinder containing kerosene

The free swell index is reported to nearest whole number.

6. General remarks: In case of highly expansive soils such as sodium Bentonite, the sample size may be 5 g or alternatively a cylinder of 250 ml capacity for 10 g of sample may be used.

7. Video:

8. Download: