

Plate Load Test Apparatus or Plate Bearing Test Apparatus



Make: Vertex | Model: VSLIC-S173

Standard: IS 1888, ASTM D1194, ASTM D1195

Purpose:

These test methods are used to estimate the bearing Capacity of in-situ soil under field loading conditions for a Specific loading plate and depth of embedment. Test methods are also used for load tests of soil and flexible pavement Components for use in evaluation and design of airport and Highway pavements

Brief Construction Details:

The entire plate bearing test assembly consist of following parts and accessories:

- Hand operated Hydraulic jack with pressure gauge capacity 50 tone with 5-meter-long metal tube with end coupling – 1 No
- Ball and Socket arrangement, consisting of two steel plate with one steel ball in between them – 1 Set
- Extension rod, 12 mm diameter x 250 mm long for taking dial gauge reading – 16 Nos
- Magnetic base with male thread on top for holding extension rod – 4 No
- Column 15 cm diameter x 50 cm long with flanges complete with four bolts and nuts – 1 No



- Column 15 cm diameter and 25 cm long with flanges complete with 4 bolts & nuts – 2 No
- Datum bar, light weight, portable, total span 5 meter, height approx 30cms mounted on two removable legs, made of 2 parts – 1 No
- Dial gauge 0.01mm x 25mm travel – 4 No
- Grooved M.S. Plate 30cm x 30cm x 25mm thick – 1 No
- Grooved M.S. Plate 45cm x 45cm x 25mm thick – 1 No
- Grooved M.S. Plate 60cm x 60cm x 25mm thick – 1 No

LOAD TRUSS AT EXTRA COST



Working Principal

The Plate Load Test (**IS 1888: 1982**) is a field test used for ascertaining the ultimate bearing capacity of the soil. It is used to estimate the settlement of the footing under the given loading. The test comprises a rigid test plate that is used for the determination of the settlement corresponding to the different load increments. It is of crucial importance as it helps in checking the viability of soil for construction upon determining the loads at specific settlements and plotting the same on the load settlement curve. It can also be used to determine the pavement thickness.

Within the ambit of this blog, we shall be unravelling the different facades of the plate load test, including its purpose, apparatus, advantages, procedure, etc. This topic is very important for the upcoming examinations like SSC JE CE, and RRB JE Civil.

Purpose of Plate Load Test

The plate load test can be used for:

- Determining the load bearing capacity of the soil.
- To ascertain the type of foundation based on the Safe Bearing Capacity.
- Evaluating the thickness of the pavement.
- To ascertain the settlement corresponding to specific loadings from the load-settlement curve.

Plate Load Test Equipment

The following plate load test apparatus is necessary for performing the test.

- Test Plate with a **plate size between 30 cm to 75 cm** and a **thickness of 25mm**.
- Pump.
- Hydraulic jack.
- 6mm thick Steel shims.
- Reaction Truss
- Dial gauge.
- Pressure gauge.
- Loading frame attached to the ground. It should facilitate the application of the load at the centre of the plate.
- Measuring Steel tape (3 m length).



- Hammer.
- Wrenches.

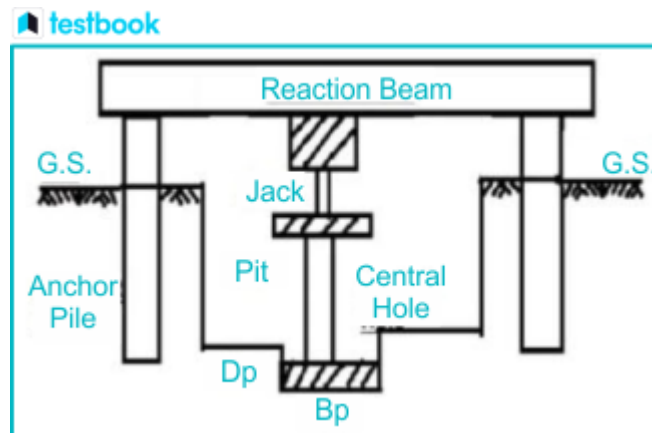


Fig 1: Plate load Test

- The test pit is dug to a sufficient depth and its size is altered to 5 times the size of the test plate.
- A small hole or depression is made in the middle of the pit. The size of the hole is the same as the size of the test plate.
- The bottom level of the hole should match the level of the foundation. The depth of the hole is made so that the ratio of its depth to its width is the same as the ratio of the actual depth and width of the footing.
- The test plate should be a mild steel plate with a thickness of 25 mm and a size range between 30 cm to 75 cm. The plate can be either square or circular in a cross-section.
- The square plate is used for square footing, and the circular plate is employed for circular footing.
- A column is placed at the centre of the plate and all this column transfers the applied load to the centre of the plate.

Plate Load Test Procedure

- In the gravity loading method of the plate load test, a platform is built over the column, and sandbags are placed for the application of the load.
- The hydraulic jack is placed between the column and the loading platform so that the load can be applied gradually. Such loading is termed reaction loading.
- Three dial gauges are set up on the platform at the diagonal corners of the plate to measure the plate settlement.



- A seating load of **0.7 Tonne/m²** is applied initially in order to compact the load.
- Soon after, loading is applied at the rate of **0.25 mm/hour**.
- The load is applied using the hydraulic jack, and the force is slowly increased. The increment is usually one-fifth of the expected safe bearing capacity, one-tenth of the ultimate bearing capacity, or any smaller value.
- Load is measured by the pressure gauge.
- Upon application of each load increment, settlement is measured on the dial gauge. The settlement should be checked after 1, 4, 10, 20, 40, and 60 minutes, and then every hour until the rate of settlement is less than 0.02 mm per hour.
- After all the data for a certain load have been collected, the next load increment is added, and readings are taken under the new load.
- This process of increasing the load and collecting the data is repeated until the maximum load is applied. The maximum load is 1.5 times the expected ultimate load or 3 times the expected maximum pressure.

Method of Plate load test

- Reaction truss method
- Gravity loading platform method
- **Reaction truss method**
- In this method, the movement of the hydraulic jack is affected by the reaction truss.
- Soil anchors keep the truss in place on the ground.
- With the help of hammers, the anchors are driven deep into the ground.
- Mostly Mild steel sections are used to construct the reaction truss. For the truss to be stable on the sides, ropes are used.
- The reaction truss is extensively used in the plate load test since it is easy, quick, and less tedious.

Gravity loading platform method

- In this form of plate load case, a platform is built on top of a vertical column that rests on the test plate. Sandbags, stones, or concrete blocks are used to load the platform.
- The test plate settles upon the application of this load. With the help of dial gauges, the settlement is ascertained.



- Two dial gauges attached to a datum bar are used for the square plate.
- As the plate settles, the ram of the dial gauges moves down.
- Load is measured from the load gauges on the hydraulic jack.

Calculation of Bearing Capacity from Plate Load Test

- At a certain depth, a **30cm x 30cm** square plate or a 30cm diameter circular plate is placed in the foundation.
- Then, a gradual load is applied to the plate.
- Each time the load increases, the foundation settles down due to pressure.
- The bearing capacity of the soil is ascertained from the settlement.
- The equation relating the bearing capacities and the settlement is:
- $S_p B_p = S_f B_f$
- From the results of the plate load test, a logarithmic graph is plotted to represent the relationship between the load and the settlement.
- The x-axis represents the load, and the y-axis shows the settlement due to the load.
- From this load-settlement curve, the ultimate bearing capacity of the soil can be determined along with the settlements corresponding to different loads.

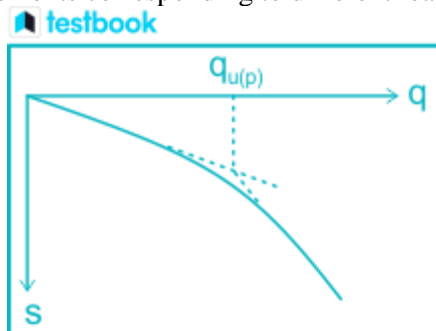


Fig 2: Load Settlement Curve



Calculation of Foundation Settlement from Plate Load Test

Foundation Settlement Calculation on Clayey Soils

$$\text{Settlement of foundation } (S_f) = S_x \frac{B_f}{B_p}$$

Foundation Settlement Calculation on Sandy Soils

$$\text{Settlement of foundation } S_f = S_p \left[\frac{B_f(B_p + 0.3)}{B_p(B_f + 0.3)} \right]^2$$

, where B_f is the width of the foundation and,

B_p is the width of the plate.

Advantages of Plate Load Test

The plate load test has several advantages earmarked below:

- The plate load test helps in the determination of the settlement of the foundation under gradual loading.
- This test is used for computing the ultimate load bearing capacity of the soil.
- It can be used for determining the depth of the foundation from the ultimate load bearing capacity.
- It is a quick test and is less tedious in contrast to other soil tests in geotechnical engineering.
- It is easy to perform.
- The results are fairly accurate and reliable.

Limitations of Plate Load Test

Some limitations of this test are as follows.

- The test depicts the settlement characteristics of the soil for depths less than twice the width of the bearing plate. But in an actual field scenario, the influence zone of the footing can be of a greater depth.
- The plate load test is a quick test and is performed for a short period of time. It cannot give a true depiction of the settlement occurring over a longer period of time.



- The bearing capacity of clayey soil, as determined by the plate load test, is fairly accurate. However, the plate load test gives a conservative value for dense sand soil. The actual capacity of dense sand is higher than what is computed from the test.
- The settlement caused in sands is greater than the theoretical settlement.

