# Estimate of the Insitu CBR using a Farnell Cone Penetrometer

## Scope

The following describes a method of measuring the Insitu CBR of cohesive fine grained soils using a Farnell Penetrometer. The testing, whenever practical, shall be undertaken when the cut level is in the order of 100mm above formation level and extended to at least 100mm below the subgrade zone.

The Farnell Penetrometer is a proprietary device. It includes a head fitted with driving handles and two rotating scales and steel cones. The CBR cone is the smaller of the two cones. The cones are pushed into the ground via the handles and scaled connecting rods. The reaction of the cone to the soil is measured on the rotating scales within the head. The two scales read Cone Index (CI) and CBR.

The method is limited to CBR’s of less than 15. It is not appropriate for cohesionless soils or soils containing significant gravel and stone.

## Equipment

* Farnell Penetrometer head. (Note 1)
* Extension rods
* CBR Cone (30º Cone, not less than 12.5mm diameter) (Note 1)
* Spanner tools
* Recording Sheets

## Procedure

1. Assemble the instrument, ensuring that the correct (the smaller) cone is selected. Check the connection of the cone to the rod. Check zero on the CBR scale and adjust if required by turning the screw under rubber sleeve with an appropriate Allen Key.
2. Push the penetrometer steadily into the ground at a rate of approximately 10mm per second. Be careful not to bend the rod or to change the direction of thrust. The penetration depth should not exceed 600mm.
3. Record the cumulative penetration (mm) and the average reading on the CBR scale to the nearest 0.5 over each 50 or 75mm of penetration (Note 2).
4. Calculate the average CBR recorded within the subgrade zone at each test site.

## Representative Insitu CBR

The Representative insitu CBR for the subgrade zone is the lowest average CBR recorded within the particular lot, determined in accordance with Step 4of the procedure above.

## Report

The report shall include:

* The reading interval (50 or 75mm) of the penetrometer rod.
* Table of the measured Insitu CBR at each test interval and the average CBR within the subgrade zone for each test site within the particular lot, including the chainage and offset;
* Representative Insitu CBR;
* The mean of all the test results, calculated in accordance with Step 4the procedure above.

*Notes:*

1. *The penetrometer shall have a valid calibration, not more than 2 years old. The load deflection relationship for the CI scale shall be within the range, of 0.95 to 1.05 of Load = CI x 0.225.*

 *The Farnell kit contains a template to check the diameter of the cone. The cone should not fit through the hole. The diameter should not exceed 12.7mm. The point should be sharp and not noticeably rounded. The sides of the cone should not be scored.*

1. *The rods will normally have markings at 75mm. Some are marked at 50mm. Either interval is satisfactory but has to be recorded. The calculation of average values will be based on 3 or 4 readings with the 50mm interval and 2 readings with the 75mm intervals*
2. *Studies (Black WPM-TRRL Report 901 “ The Strength of Clay Subgrades: Its Measurement by a Penetrometer”) have indicated that the best estimate of the Insitu CBR is obtained by dividing the Cone Index Scale (CI) by 20. It is recognised that readings based on the CBR scale, below a scale reading of CBR=7, will generally underestimate the Insitu CBR. This inbuilt conservatism is generally acceptable to the Superintendent.*