7.6.7 'Built-in load cell' test

This is a static load test using a bi-directional load cell which is a calibrated high capacity testing device built-in at the pile-toe. One such method is 'Osterberg cell' load test (O-cell load test). When the O-cell is pressurized internally, an equal upward and downward force acts on the pile shaft and pile-toe respectively at the same time, thus testing the shaft resistance and end-bearing separately. Telltales are attached to the top of the pile and to the bottom of the O-cell for measurement of upward and downward displacements separately (Figure 7.16(a)). The load test is ended when the ultimate capacity of either the pile shaft or end-bearing is mobilised or the maximum capacity of the O-cell is reached. Upon completion, the shaft is grouted to fill up all the voids. The method is most suitable for cast-in-place piles and can also be used for driven piles except steel H-section piles, timber piles and tapered piles.

The test results are plotted as load versus displacement curves for the upward and downward displacement independently (Figure 7.16(b)). The two component curves may then be utilized to construct an equivalent pile-top load versus displacement curve (Figure 7.16(c)). Assumptions are the pile shaft is a rigid body with pile top and toe displaced by the same amount at a given pile-top load and that the pile shaft upward resistance equals that of the downward resistance. Each point on the equivalent pile-top load versus displacement curve is determined by adding the downward shaft resistance to the mobilized end-bearing at selected value of displacement from the two component curves. Where necessary, extrapolation of shaft resistance or end bearing component curve may be used to extend the equivalent curve to a greater displacement than the maximum measured on the component that has not been fully mobilised at the end of load test. Correction for submerged weight of the pile shaft is required to derive the value of upward shaft resistance (Osterberg 1984).

Advantages of this testing method include cost, time and work area savings for high-load test; improved safety at the testing site; and direct availability of the shaft resistance and end-bearing components. Disadvantages include the need to pre-select test pile before its installation; inability to fully mobilize the ultimate shaft resistance and end-bearing capacity simultaneously; and no flexibility to increase the loading capacity once the O-cell is installed.

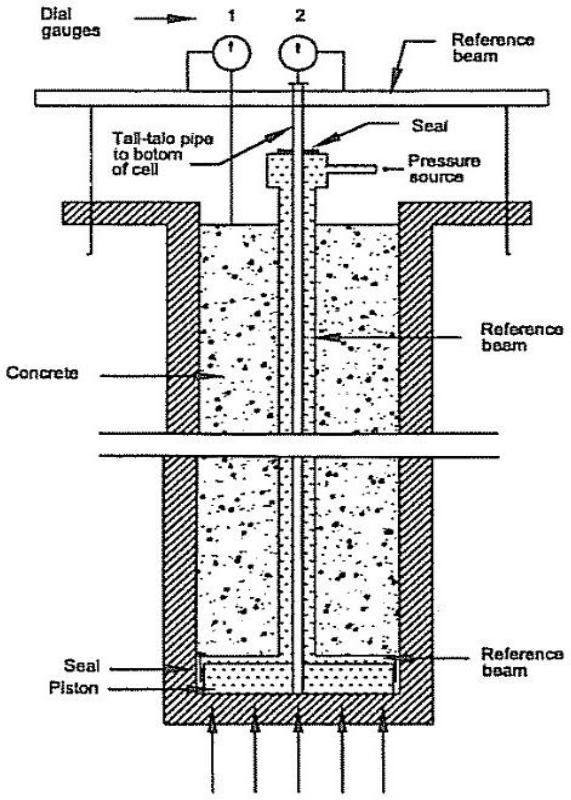

Figure 7.16(a) – Schematic of 'built-in load cell' test

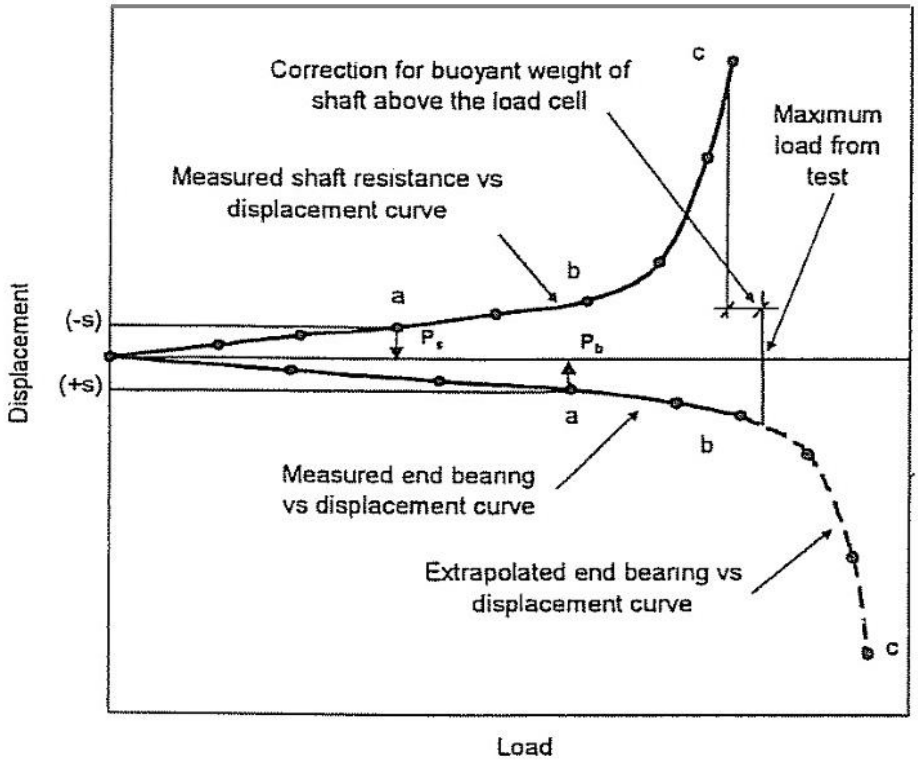

Figure 7.16(b) – Load displacement curves of 'built-in load cell' test

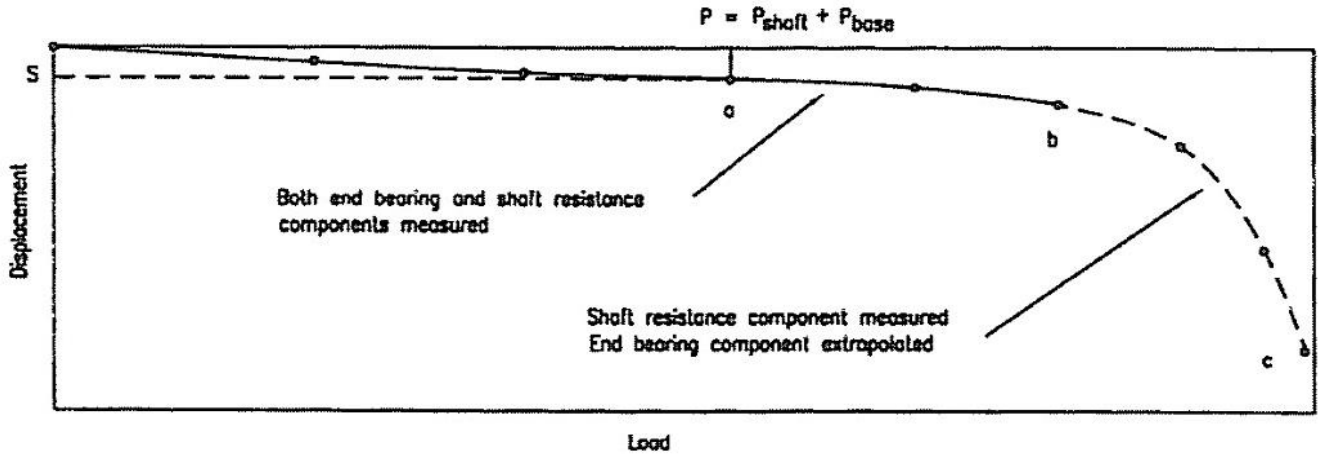

Figure 7.16(c) – Constructed equivalent pile top load vs displacement curve