CHAPTER V
DESIGN AND CONSTRUCTION OF A 200t CAPACITY LOADING FRAME AND FOUNDATION TEST BED

5.1 General

A foundation test bed with a 200t capacity self straining loading frame for testing prototype foundation structures was designed and constructed. The test bed consisted of a pit 7.5m x 5m in size and 5m deep, filled with the foundation soil. The foundation structure to be tested may be either cast directly on the test bed or cast elsewhere, transported and placed on the test bed. The foundation structure can be loaded by jacking against the loading frame at required points.

5.2 Design Features

The loading frame consisted essentially of six ISHB 300 x 140 columns connecting the frame work of RSJ's above and the doubly reinforced 70 cm thick concrete slab encasing RSJ's in the transverse and longitudinal directions as shown in Fig.5.1 at the bottom of the pit.

A pit was prepared to a depth of 6m and having plan dimensions of 8.3m x 5.8m. A leveling course 20cm thick of cement concrete 1:4:8 mix was provided at the bottom of the pit. The six columns were placed in position. A mesh of 12mm diameter mild steel bars at 12cm centre to centre both ways with a cover of 10cm at the bottom was placed above the leveling course. The beams in the longitudinal direction were placed on either side of the
columns as shown in Fig.5.1. Then the beams (ISMB 300 x 140) in the transverse direction were put in place. They were connected to the longitudinal beams by welding in situ. The longitudinal beams were connected to the columns at top and bottom by welding them to channels which were in turn welded to the columns. Above this setup was placed a mesh of 12mm diameter mild steel bars at 12cm centre to centre both ways. The mesh was also spot welded to the longitudinal RSJ's. The floor of the pit consisting of the reinforcement meshes at its top and bottom and the RSJ's in the longitudinal and transverse direction was concreted using M150 concrete mix. Then the side walls of the pit were constructed using 1.5 brick work in cement mortar 1:4 and the inside faces were plastered. River sand was filled in the pit upto the ground level to facilitate handling of girders to be erected on the loading frame. Two long beams (ISMB 500 x 160) were rested on two brick columns centrally located at the ends of the pit at a height of 1.8m. Above these beams were placed beams (ISMB 500 x 160) in the transverse direction which were later suspended from the longitudinal beams at the top of the frame. The beams in the transverse direction were suspended by U-clamps secured to small trolleys on wheels (Fig.5.2) that can move in the longitudinal direction. This arrangement was done in order to enable movement of the cross girders longitudinally to place them directly above the desired load points on the test structure. The two longitudinal girders on either side of the columns consisted of ISMB 500 x 160. They were
secured to the columns by welding channel pieces at top and bottom.

5.3 Test Procedure

5.3.1 Preparation of soil bed

The pit has to be filled with the soil that is chosen as the foundation medium.

The test conducted in connection with the present research work were on sand bed. The sand bed was prepared by removing the sand in the pit to the required depth, refilling and compacting it in layers using a suitable rammer to the required relative density. For testing a square footing of side B it is necessary to ensure that the sands in the test pit, of lateral dimensions 5B x 5B and depth 2B, is removed and recompacted to the required relative density to ensure uniformity of soil conditions and to enable comparisons between various tests conducted on the test bed.

5.3.2 Placing foundation element

The soil on the test bed is excavated roughly to the shape of the convex contact face of the shells. Then the funicular shell is placed in position ensuring proper contact with the soil. In case of testing with multiple funicular shell foundations, the connecting elements were cast in situ on the elements placed in their position. Sufficient time was allowed for the proper setting of
concrete of these elements, before the foundations were tested.

5.3.3 Loading

The loading of the foundation was done by jacking it against the loading frame at the load points. In case of the strip foundation, a centrally applied load (by jacking) was distributed as sixteen concentrated loads on the strip beam by a system of load distributors (Fig.10.3). A 180t capacity hydraulic jack was used to apply the load axially on the foundation structure for multiple shell footings in the test bed. The loads were measured using proving rings and were also verified from the readings of the pressure gauge fitted to the loading jack.

The settlements of the foundations were measured using dial gauges with magnetic bases fitted to reference lines of mild steel angles supported independently.

For all the laboratory studies in the present research programme, this loading frame was used. This structure could be used for testing prototype foundation structures of ultimate capacity up to 200 t.
FIG. 5.1 DETAILS OF 200t CAPACITY LOADING FRAME
Figure 5.2 Details of trolley that can be moved over longitudinal girders of loading frame and from which cross beam is suspended.
FIG. 5.3 200t CAPACITY LOADING FRAME