Fixing of Model Piles to Pile Cap

by

Alam Singh*

D.V. Talwar**

Introduction

LABORATORY tests on model piles have been used rather extensively in recent years to study the load-deformation characteristics of piles and pile groups under applied vertical and/or lateral loads. Model testing offers certain basic advantages as compared to full scale tests of piles. It affords strict control over test conditions—especially with regard to preparation of a soil bed of reproducible and homogeneous properties. Model testing of pile groups is very economical. It is particularly true for those studies which involve pile groups of different pile spacing and different number of piles.

In an actual pile foundation the piles are generally rigidly connected to the pile cap. For similarity between the model and the prototype, the model piles are to be rigidly connected to the pile cap. The rigid connection should be so achieved that it does not damage the pile head and allows the piles to be re-used. A number of ways have been devised to obtain such rigid connections. Prakash (1962) used gypsum cement pile caps which were cast around pile heads in suitable moulds. The bond between the aluminium piles and the cement provided the rigidity of connection. Murthy (1964) used epoxy resin 'Araldite' for fixing model piles to cast aluminium caps which were longitudinally split in two halves and were bolted together near the ends. In two other studies (Singh, 1969 and Talwar, 1970) carried out in the Department of Civil Engineering, University of Jodhpur, steel wedges and spring collets have been successfully used in fixing the model piles to caps. Apart from satisfying the conditions of rigidity, these devices enabled an easy fixing and removal of the piles for re-use in different tests. This short note is intended to describe the use of steel wedges and spring collets in fixing model piles to caps, which, it is hoped, should be of interest to research workers in the field of model pile testing.

Use of Steel Wedges

Thin steel wedges (Singh, 1969) were used for fixing model piles of square-sectioned extruded aluminium alloy tubing to cast aluminium caps.

* Professor and Head of Civil Engineering Department, M.B.M. Engineering College, University of Jodhpur Jodhpur, (Rajasthan).

** Reader in Civil Engineering, M.B.M. Engineering College, University of Jodhpur, Jodhpur (Rajasthan).

This paper was received on 25 May 1971. It is open for discussion up to December 1972.

The piles were 12.7 mm by 12.7 mm in section and of 1.6 mm wall thickness. The cap was 25 mm thick. The wedges were 35 mm long, 12.5 mm wide and had a roughened vertical face for contact with the piles. From a base width of 2 mm, the other face of the wedges was tapered to a fine edge. Snugly fitting square holes were drilled in the cap according to the pile spacing and arrangement. The two opposite faces of the holes normal to the plane of lateral loading were given a taper corresponding to the wed ges. Two wedges could be driven upwards from the underside of the cap to fix a pile. On insertion, the wedges projected only about 10 mm below the cap. In the exposed portion of the wedges, a 5 mm hole was provided near the base in which a bent tommy rod could be engaged to remove the wedges from the cap. The grip strength of the wedges was of the order of 160 kg as determined by pull out test of the pile section from the cap. Figure 1 shows the steel wedges and their mode of fixing the pile to the cap.

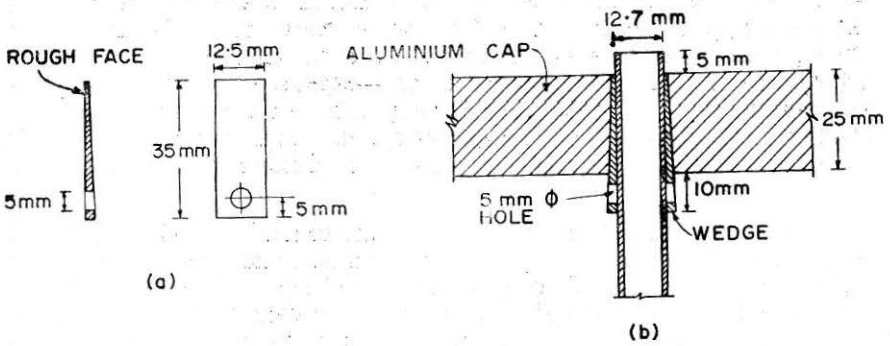

FIGURE 1.

(a) Section and elevation of wedge.

(b) Pile rigidly connected to pile cap by wedges.

Steel wedges can be considered quite suitable for fixing model piles which are square in section. They are particularly suitable for hollow piles instrumented with electrical resistance strain gauges the leads of which are taken out through the open ends of the piles.

Use of Spring Collets

In the other study (Talwar, 1970) mild steel spring collets were used for fixing circular sectioned aluminium alloy piles of 15.87 mm outer diameter and 1.6 mm wall thickness, to 20 mm thick pile caps. The spring collets consisted of a lower hollow cylindrical part with a threaded shank at the top. The cylinderical part had an internal diameter of 16.25 mm and external diameter of 20 mm. The lowermost 5 mm length of this part was, however, given an outside taper [(Figure 2a)]. Four equally spaced longitudinal cuts, 1 mm wide, were made in the lower 17 mm length of the cylindrical portion which resulted in the formation of four "jaws". Circular holes 20 mm wide, were drilled in the pile cap and their lower 3 mm lengths were given a taper similar to that given to the jaws of the collet.

For fixing the pile to the cap, the pile head would first be introduced into the jaws of the collet and both would then be inserted in the hole of the pile cap from the underside so that the threaded shank would project

1.5 cm above the top of cap. A nut would then be screwed over the shank, the tightening of which would make the jaws grip the pile head

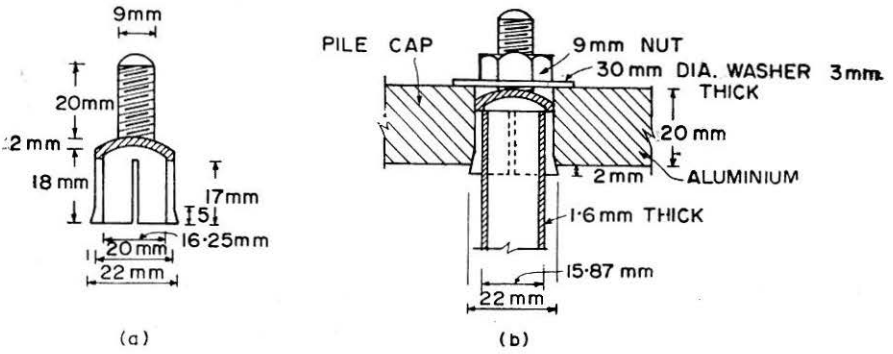

FIGURE 2.
(a) Sectional elevation of collet.
(b) Pile rigidly connected to pile cap by collet.

firmly without affecting their alignment. Figure 2(b) shows a pile section rigidly connected to pile cap by a collet. The average grip strength of the collets in pull-out test was 670 kg.

The spring collets should be considered a very suitable gripping device for tubular piles, in particular, the wall thickness of which does not permit threading and screwing.

References

MURTHY, V.N.S. (1964): "Behaviour of Batter Piles Subjected to Lateral Loads". *Ph. D. Thesis*, Indian Institute of Technology, Kharagpur.

PRAKASH, S. (1962): "Behaviour of Pile Groups subjected to Lateral Loads." *Ph. D. Thesis*, University of Illinois.

SINGH, A. (1969): "Investigations of Pile Groups under Lateral and Vertical Loads." *Ph. D. Thesis*, University of Jodhpur.

TALWAR, D.V. (1970): "Effect of Spacing and Geometrical Arrangement on the Lateral Resistance of a 3-Pile Group." *M. E. Thesis*, University of Jodhpur.