CHAPTER VI

CONCLUSION AND RECOMMENDATION FOR FUTURE STUDY

Conclusion

1. Modulus of elasticity of soil is not only going to vary from point to point in the soil mass, but at a given point it will vary with the stress conditions at that point. From unconfined compression test the E_s is about 18.43 ksc. From Poulos's approach, the E_s is about 104 ksc, which is about 460 % different from laboratory test, however good agreement is found between the measured load-deflection curves for a series of tests on full-scale piles in Bangkok clay and those predicted from the theoretical curves, using a value of Young's modulus of about 400 c_u in the analysis.

2. The coefficient of subgrade reaction varies widely between laboratory testing and the proposed Poulos's approach.

For long piles, the calculated lateral deflections are insensitive to the assumed value of the coefficient of subgrade reaction. From the testing results, if the coefficient of subgrade reaction is 7 times the assumed value, then the deflections at the ground surface will be less than the calculated deflections about 300 %.

For short piles, the calculated lateral deflections are sensitive to the assumed value of the coefficient of subgrade reaction. If the coefficient of subgrade reaction is 7 times the assumed value, then the deflections at the ground surface will be less than the calculated deflections about 800 %. Thus small variation of the coefficient will have large effects on the calculated lateral deflections for short piles.

3. The results of short pile and long pile tests in Bangkok clay have shown that both proposed theoretical approaches (the theory of subgrade reaction and the theory of elasticity) give good prediction of the load deflection behaviour, if a value of E_s of about 400 c_u is used. The pile displacements are considerably underestimated by both theories for relatively rigid piles. For flexible piles, the deflections are also generally underestimated by the subgrade reaction, but overestimated by the elastic theory.

4. Using a value of E_s of about 18.43 ksc. (from unconfined compression test) in the analysis, the deflections are greatly underestimated by both theories; however, using E_s from unconfined compression test in analysis gives a conservative estimate of the lateral deflection of the pile, so the designer is satisfied with this value.

5. Repeated loading causes deflections to increase 60 % to 100 % approximately, compared to the value for the first cycle of load.

6. Criteria of defining pile failure are given and examined with examples from full-scale field tests, it shows a great difference of failure value between the interpreted smallest and highest values. The acceptance criteria for laterally loaded pile are criteria Nos. 1, 9 and 10. The criteria No. 1 is the best acceptance criteria.

7. The predicted ultimate load which is Brom's approach, tends to overestimate for short pile and underestimate for long pile. However, good agreement is found between the predicted ultimate loads and measured ultimate loads.

8. By the use of CRD test method considerable saving of cost and time can be achieved, as the test can be completed within about 2 hr. - 3 hr. It is found that the CRD test gives ultimate load 18 % higher than ML test, so the CRD test can be used to provide the indication of the ultimate lateral resistance of the pile. Field testing has shown that the load-deflection curves of CRD test and the predicted agree quite well. However, this method is unaccepted when the time dependent movements of the pile is concerned.

9. By using the Quick test method considerable saving of cost and time can be achieved, as the test can be completed within about 3 hr. - 5 hr. The Quick test gives ultimate load 17 % higher than ML test, so the Quick test can be used to provide indication of the ultimate lateral resistant of the pile. The shape of the Quick test agrees well with ML curve.

Recommendation for Future Study

The following study is recommended.

1. The laterally loaded unrestrained piles of medium length in cohesive soils.
2. The lateral resistance of restrained piles in cohesive soils.
3. The lateral resistance of restrained piles in cohesionless soils.
4. The lateral resistance of free headed piles in cohesionless soils.
5. Model study of laterally loaded piles in cohesive soil.
6. Model study of laterally loaded piles in cohesionless soil.
7. The lateral capacity of deep augered footings.
8. Principles for test-loadings of large bored piles by horizontal loads.
9. Large diameter piles under axial and lateral loads.
10. Soil modulus for laterally loaded piles.
11. Behavior of laterally loaded piles : Pile groups.
12. Analysis of the displacement of laterally loaded piles by theory of elasticity.