

METHOD STATEMENT FOR HIGH STRAIN DYNAMIC TEST



INTRODUCTION

In India, Maharashtra State Road Development Corporation has initiated a HIGH STRAIN DYNAMIC TEST scheme. The results of High Strain Dynamic tests were hence first co-related to static tests by subjecting the pile both to static testing and dynamic testing. Based on satisfactory match of the results, dynamic testing was adopted on the project sites. The paper also describes the principle and procedure involved in dynamic pile testing and presents the methodology and results for testing on bored piles. The collected data was also subjected to CAPWAP (Case Pile Wave Analysis Program) the use of which is relatively new here to evaluate the soil and pile parameters including skin friction, end bearing, cross-sectional profile etc. Data collection was conducted using a Pile Driving Analyzer (PDA).

This statement does not address all of the safety concerns, if any, associated with its use. It is the responsibility of the user to establish appropriate safety and health practices before test.

PRINCIPLE OF HIGH STRAIN DYNAMIC PILE TESTING

The basic purpose of dynamic testing is to evaluate pile capacity and structural integrity of the pile and the total settlement under the measured capacity. Strains are recorded by the Pile Driving Analyzer™ with the help of strain transducers attached to the pile, whereas accelerometers record the accelerations generated in the pile caused due to the impact of a heavy hammer falling from a pre-determined height. The PDA converts strain to force, and acceleration records are converted to velocities. The resistance developed by the pile is then a function of force and velocity and includes few assumed factors such as the quake and damping parameters as inputs based on the soil type. A more accurate value of these parameters is then obtained from CAPWAP analysis conducted on field data. Field results usually includes capacity of the pile, based on an assumed damping value, stresses in the pile, net settlement and total settlement of the pile, skin friction, end bearing, etc., although 30 different parameters are evaluated.

CAPWAP ANALYSIS (Case Pile Wave Analysis Program)

Is a software program that estimates total bearing capacity of a pile or shaft, as well as resistance distribution along the shaft and at the toe. The program inputs the force and velocity data obtained with a Pile Driving Analyzer® (PDA) system to perform a soil resistance test. It is essential to post-process PDA data with CAPWAP for at least one foundation element per job. CAPWAP completes the Dynamic Load Testing procedure and simulates a Static Load Test to determine the deep foundation capacity. The program includes a completely automated mode as well as adjustable parameters with which the user systematically improves the calculated results of the pile capacity test. CAPWAP works in English, Metric or SI units, and a comprehensive report option.



METHOD OF TESTING

The method involves attaching strain transducers and accelerometers to the sides of the pile approximately 1.5 times pile dia. below the pile top. A pair of transducers is fixed onto opposite sides of the pile so as to detect bending in the pile if any during testing. These transducers are then connected through the main cable to a Pile Driving Analyzer - MODEL PAK, which is a State of Art Pentium Computer System with ability to record strain and acceleration measurements and convert them from analog to digital form. The signals are then triggered by the impact of a ram falling from a pre-determined height. The ram weight and fall height is determined in advance. As a thumb rule, the ram weight shall be 1-2% of the testing capacity of the pile. For case histories described below, hammer weight equal to 1% of test capacity was used and the drop height varied from 1m to 3m. A 25mm thick plywood cushion and 16mm thick steel plate were placed on the pile top to avoid any damage to the pile during testing. The testing procedure as per ASTM D4945



BENEFIT'S

- On the basis of above findings, it can be concluded that High Strain dynamic pile testing was found to be fairly reliable to evaluate pile capacity.
- The method is significantly faster than an equivalent static load test. The use of concrete blocks which was very time consuming and cumbersome is avoided.
- Further several piles can be dynamically tested in one day resulting in considerable savings of time, and early completion of the project.
- Dynamic pile testing avoided the problem of availability of space for other site movement and construction. It was possible to also test piles that were very close to the road traffic, which otherwise would have been impossible with a static test.
- Structural integrity of the pile is also verified. It is also possible to evaluate the skin friction and end bearing component of the pile if required.
- Data generated proves that dynamic testing can be adopted on project sites in the region and elsewhere. It is expected that this method of testing will find increased use in construction in India and the region due to above benefits.

LIMITATIONS

Unlike static testing, evaluation of dynamic pile test results requires an experienced engineer trained in interpretations of the results. Interpretations carried out by persons not fully trained for use of PDA can result in serious errors on site and can also lead to delay of site work and various complications.

Hence more such co-relations between dynamic and static testing should be encourage under different types of soil, before the method can be widely adopted on other sites. This also helps evaluating the reliability of test agency hired to do the test.

Large diameter bored piles are still relatively new in Indian industry. Eventually as pile load capacity increases, it may be difficult to fabricate heavier hammers and design fall mechanisms. Recently many countries have reported using the PDA to measure pile capacity upto 50000kN and this should solve any problems associated with drop weight or mechanisms.

