

Fugro Engineering Services Limited

PILE INTEGRITY TESTING

INTRODUCTION

Defects in concrete piles caused either during or after construction may seriously affect their performance in service.

Load testing of piles may be used to check the assumptions adopted in the load capacity design of the piles. However, it is too expensive and time consuming to use load testing as a means of checking workmanship.

Modern non-destructive methods based on small strain impulse techniques enable the integrity of all the piles on a site to be established rapidly and economically to enhance greatly confidence in the foundation.

The test is performed using a portable, battery powered unit which requires no backup vehicle or vulnerable cables across site that disrupt normal construction activity.

The test equipment is based upon the most modern digital data acquisition and signal processing techniques currently available, thus maximising the resolution and effectiveness of the test system.

In excess of two hundred piles per day may be tested with this unit, depending on access and pile head condition.



PROCEDURE

Prior to testing the pile head should be exposed and cut back to sound concrete, with a reasonably level surface, free from standing water and pile cap reinforcing steel. It is recommended that the shaft concrete is allowed to cure for at least seven days before testing.

The test is performed by striking the pile head with either an instrumented or conventional hammer to propagate a compressive

stress pulse travelling longitudinally within the pile shaft.

A transducer held against the pile head registers the initial impact and the subsequent vibration response of the pile head. The measured signals are digitised by the test unit, and stored in memory.



ANALYSIS

As the stress pulse travels down the pile shaft, reflected waves are generated from any changes in the pile shaft acoustic impedance, which in most cases may be interpreted as changes in pile shaft area.

These reflected waves arrive some time later at the pile head and are registered by the pile head transducer. The time of arrival of these reflected waves and their form allows the elevation of the change in impedance and its sense (i.e. an increase or decrease) to be determined easily.

The test results can be analysed in both the time domain and the frequency domain.

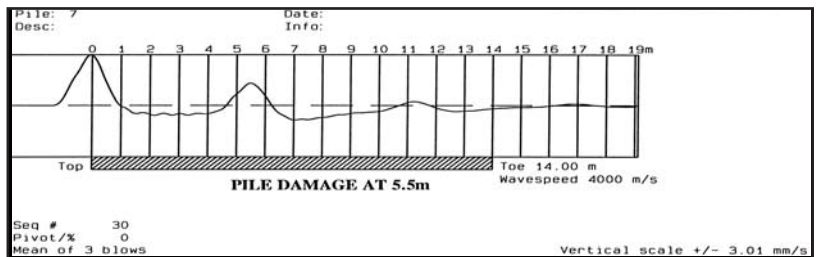
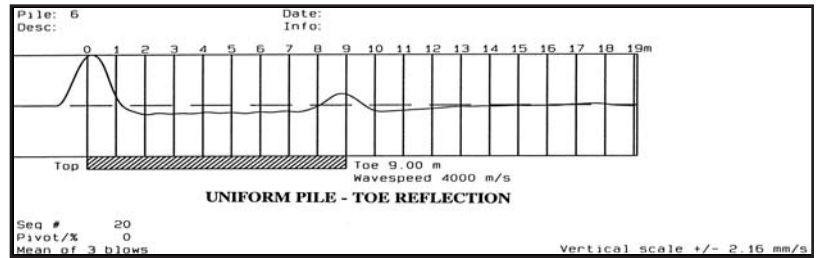
The Fugro Group is an international organisation with around seven thousand staff in over fifty countries. Our major disciplines are Geotechnics, Environmental Services and Survey.

TIME DOMAIN

In time domain analysis (also known as the sonic echo test), pile head velocity is plotted against time.

Reflected waves generated by pile shaft anomalies are readily identifiable with this method of presentation of the test results.

It is also possible to compensate analytically for the effects of the attenuation of the stress pulse by the soil resistance supporting the pile shaft.



FREQUENCY DOMAIN

Frequency domain analysis may also be performed. This involves converting the time domain signals via Fourier analysis into frequency spectra. If the information obtained from the instrumented hammer is included in the analysis a small strain pile head dynamic stiffness value for the pile can be calculated.

This is a very valuable index parameter, particularly useful in determining defects in the upper two to three diameters of pile shaft, which is often a critical region.

INTERPRETATION

Adoption of test result analysis in both the time and frequency domains maximises the reliability of the test interpretation.

In addition to the vibrational response of the pile head during the test, information regarding the pile dimensions, concrete mix design, reinforcing steel details and the soil conditions are desirable to complete the interpretation of any test result.

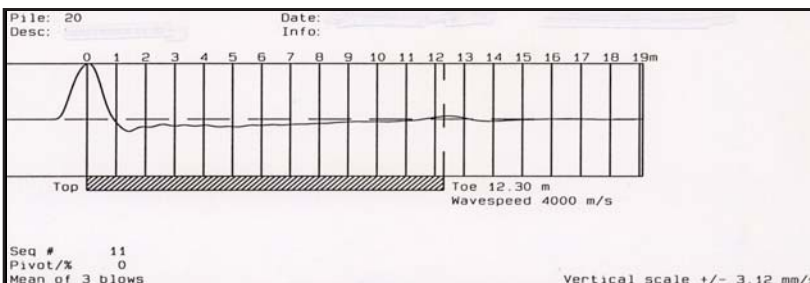
Preliminary identification of anomalous piles is easily accomplished on site.

EXPERIENCE

This Pile Integrity Testing service is offered to you by Fugro Structural Monitoring via our regional offices in Wallingford.

Fugro Structural Monitoring is the specialist structural measurement and instrumentation division of Fugro Limited with over 20 years experience of instrumentation technology to the civil engineering industry.

The wide geotechnical experience within the Group, coupled with a fundamental understanding of the stress wave theory governing the vibration response of the pile head, allows provision of a service to you which is probably unrivalled within the industry.



Display above shows a typical time domain test result

Fugro Engineering Services Limited

Fugro House
Hithercroft Road
Wallingford
Oxfordshire OX10 9RB
Tel: +44 870 4021 400
Fax: +44 870 4021 499
Email: wallingforde@fes.co.uk

Armstrong House, Unit 43
Number One Industrial Estate
Medomsley Road, Consett
Co. Durham DH8 6TW
Tel: +44 1207 581120
Fax: +44 1207 581609
Email: consett@fes.co.uk

