iJRASET
International Journal For Research in Applied Science and Engineering Technology

INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 9 **Issue:** XI **Month of publication:** November 2021

DOI: https://doi.org/10.22214/ijraset.2021.38873

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International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.429
Volume 9 Issue XI Nov 2021- Available at www.ijraset.com

Analytical Research of Integrity Testing on Bore Pile

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***Abstract:** The integrity test is conducted on RCC bore pile this test is conducted as per the guidelines of ASTM D5882 respectively. This test is conducted on "Perstorp site which is located in dis -Bharuch Gujrat. In this region the Strata of soil is soft aquifer hence to carry heavy structural load, pile foundation is best solution. The experimental study is carries out on 20 meter length of Bore pile of 600mm in diameter. This paper is based on experimental study on bore pile due to assess the pile integrity for potential problem like cross section change, honeycombing, concrete quality, continuity etc.*

I. INTRODUCTION

This experimental test is carried out at Perstorp site project of chemical production which is located in dist.-Bharuch Gujrat come in seismic zone 3 and the geological condition of this region is soft rock aquifer having very high ground water table
Approximate of 5-10 m from ground level so, there is only pile foundation is option to Carry heavy structural load. In the paper perform experimental study on RCC bore pile . This test is performed on 20 m depth of pile of 600 mm diameter. This test is performed commercial corporate geo Dynamics. In this experiment all the testing procedure and equipment are as per ASTM D5882. The report presents the result the pile integrity testing using pile integrity tester (PIT) .base on the detail available and the site condition at the time of testing.

II. METHODOLOGY AND DETAILS

Pile Details
The pile was RCC bored pile with diameter of 500mm, details which are given below

Pile location	Group A
Pile type	RC Bore
Pile diameter	600 mm
Liner depth from test RL	Unlined
Pile depth from test RL	20 m
Concrete grade	M30
Period of casting	20/01/2021-05/02/2021

III. TESTING EQUIPMENT

Integrity test were performed using the most advance state of art data collection system available to estimate the pile integrity by surface impact method. In this system the PIT collector allows for detection of wave reflection from change in pile impedance. The collector can acquire, enhance, display and plot data. The conclusion and interpretation of the result are based on pile top velocity against time curve. The involves attachment of accelerometer on the pile top. after the attachment , the impact device (a nylon tipped hammer) generate a low strain compressive wave , which travel down the pile .the acceleration and velocity records of the impact , along with subsequent reflection from either pile toe and or discontinuities are graphically displayed.
The integrity testing method separate the effect of impact and surface reflection from other relevant reflection (i.e. pile toe or other discontinuities) by averaging record of several impact . This averaging technique tend to cancel random signal in any particular blow while amplifying the effect of relevant repetitive response the signal records obtain are also exponentially amplified with time . The enhances the identification of relevant reflection records, which have low energy due to signal dampened out by the skin friction

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IV. INTERPRETATION OF RESULT

The interpretation of result consist of an elevation of data base on a surface reflection recorded during testing as describe above .the reflection are produce by various in shape, material, soil resistance changes, joint etc. the deepest reflector in pile toe and its reflection is last observed , all this reflection are in acceleration from and numerically integrated to velocity before displayed .the integrity of the pile thus tested is based on such reflection and detected change in impedance along the pile length when subjected to impact blow. Here E is the elastic modulus of the pile material, A is the crosses section of the pile, and C is the wave speed.

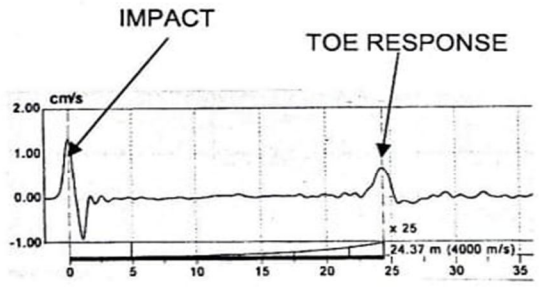

Fig.1a Typical Velocity Trace - Good Pile

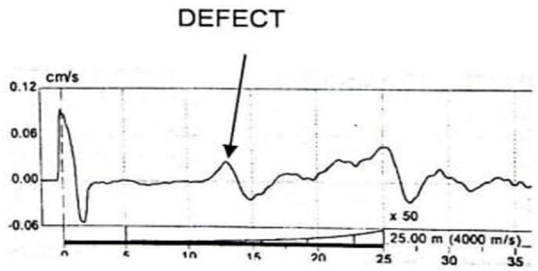

Fig.1b Typical Velocity Trace - Damaged Pile

Refer to the typical trace for trace of the defective pile in Fig. 1b the method cannot identify the nature of defect as the wave reflection from reduction in either elastic modulus or cross section. Thus whether the defect is necking, honeycombs, void, soil inclusion, termite chock etc. they all are classified as a defects.

The curve after the toe response is basically a second cycle of the wave moving through the pile. If the energy of impact is sufficient or for shorter pile length, it is possible that the wave move a few time along the pile before it dies down where I some cases, it only completes partial second cycle. Generally the wave form after the first cycle is inconsequential for interpretation

The length is the important input in the test system which uses to compute wave speed. Typical range of wave speed for good and consistent concrete is 3500 m/sec to 4200 m/sec and wave speed lesser than 3500 m/sec it may time likely for larger job with the lesser quality control or low percentage reinforcement. The pile with permanent liners may have higher speed from 3800 m/sec to 4300 m/sec.

V. LIMITATION OF THE TEST SYSTEM

A. The method does not evaluate minor defect and also multiple defect inside the pile as the wave generally reflect from the first major defect. Similarly it may be difficult to evaluate the pile integrity beyond a major bulge and in such case; it's likely that the pile integrity is inconclusive.

B. Although the test system can be used to evaluate length of the pile, the determination of pile length is the approximate range of 5 -10 % due to variation of concrete density. this implies that the method cannot evaluate the defect that could be present in bottom 5-10 % of the pile shaft

C. The method does not provide information on pile capacity.

D. The test method can generally evaluate the for the pile up to an L/D ratio 45 to 50. However this also depend on the soil resistance that may attenuate the signal and thus is a general settlement .

VI. OBSERVATION TABLE

Sr.no	Pile no.	Toe response	Length of pile from test (m)	Wave speed (m/sec)	Shaft cross section and soil changes	Pile integrity	Remark
1	PL2017A	Evident	20	3950	Fairly uniform pile Shift	OK	-
2	PL2018A	Evident	20	4200	Fairly uniform pile Shift	OK	-
3	PL2020A	Evident	20	3700	Fairly uniform pile Shift	OK	-
4	PL2021A	Evident	20	4000	Fairly uniform pile Shift expect bulge increases in soil resistance seem evident around 15 m from test level	OK	-

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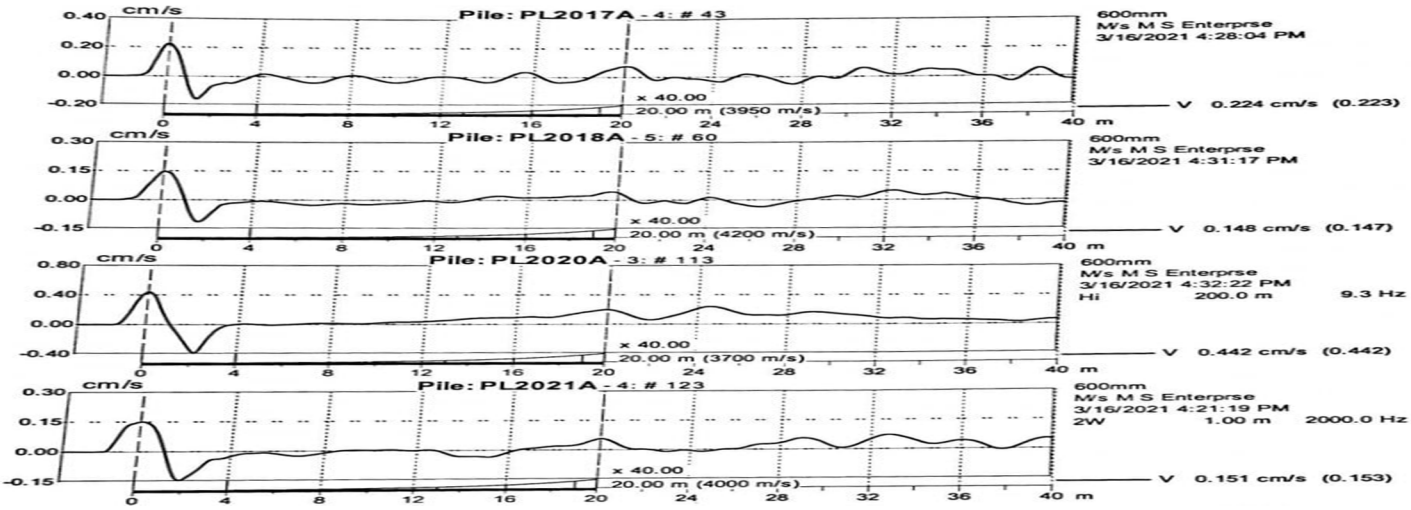
GRAPH



Photographs

Cc

VII. CONCLUSION

A. Wave speed for the pile varies generally from 3450 m/sec to 4200 m/sec and can be termed as consistent concrete quality
B. Most of the pile show bulge /increase in soil resistance around 4m to 6m from test level
C. No major defect seem evidence for all tested pile
D. Pile integrity is classified as OK based on low strain test records and subjected to above mention comment
E. This report has been prepared with the generally accepted engineering practice and the result of integrity testing as per ASTM D5882.

REFERENCE

[1] IS 2911 (Part 4)-2013, "Code of Practice for Design and Construction of Pile Foundation -Load Teat on Pile.
[2] GEO DYNAMICS (ISO 17025:2005 NABL Accredited & ISO 9001:20015 Regd.

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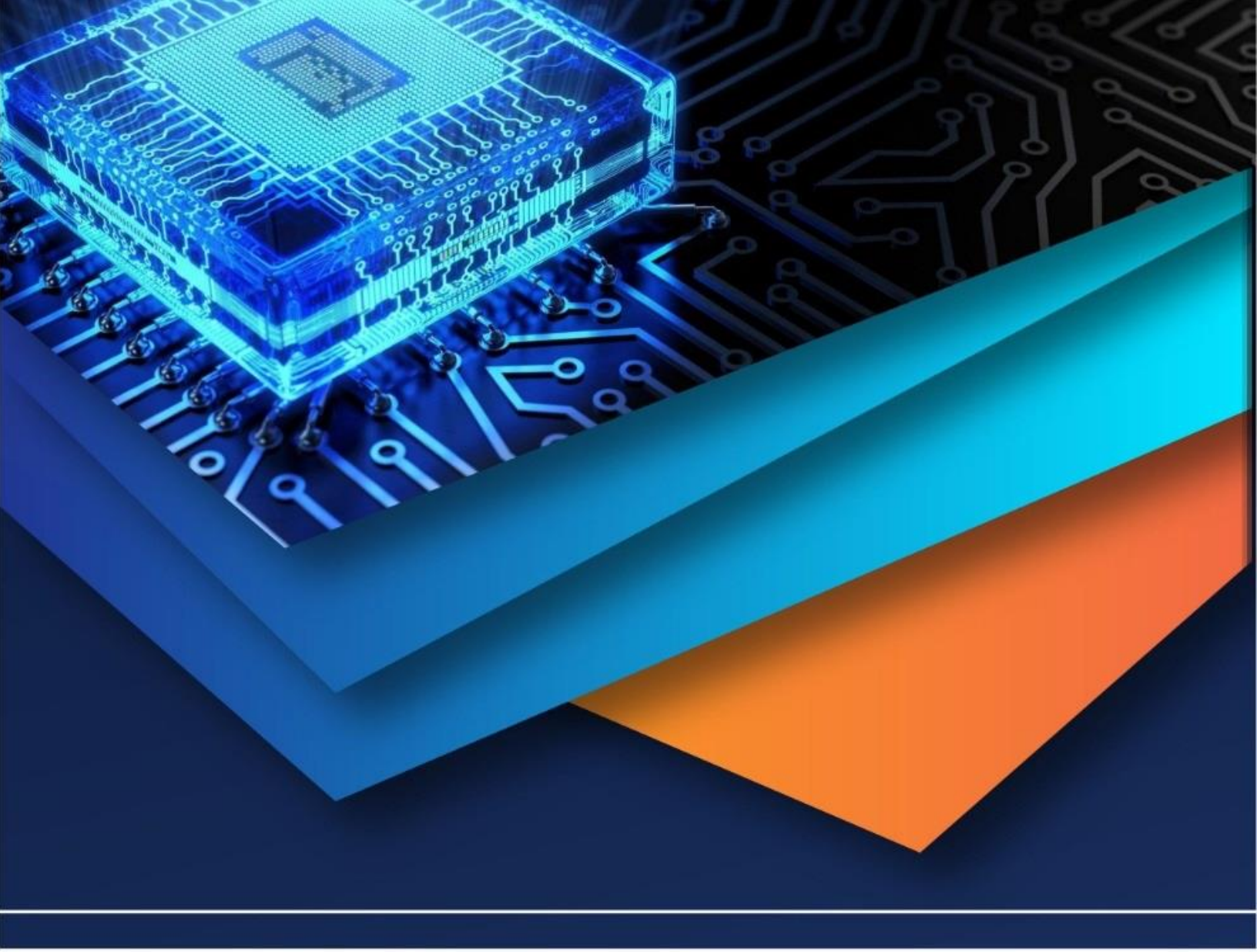

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