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Quarterly Newsletter No.4 – April 2012

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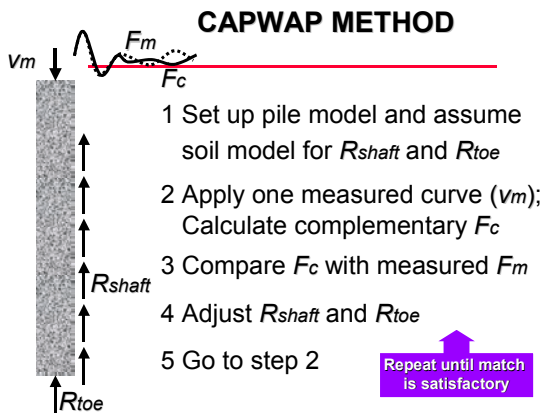
CAPWAP (CASE PILE WAVE ANALYSIS PROGRAM) ANALYSIS

Our 2nd newsletter provided information regarding High Strain Dynamic Pile Testing (HSDPT). This issue provides information regarding CAPWAP analysis which is inherent part of the dynamic testing of bored piles. CAPWAP (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 takes as input the force and velocity data obtained from the Pile Driving Analyzer (PDA). Data collected since 1980 shows that CAPWAP results correlate well with actual Static Load Tests. The topic will also be covered in our subsequent newsletters.

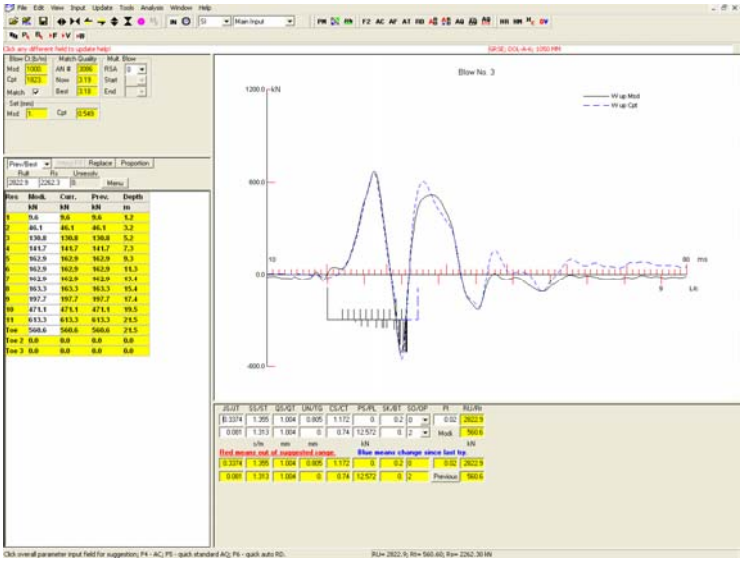
The values measured by the PDA on field are obtained assuming that the pile is uniform throughout its length. We also assume soil parameters like damping, quakes during field tests. Any change in the pile properties, pile profile or soil affects pile capacity. Hence CAPWAP is mandatory for all bored piles and atleast a certain percentage of driven piles depending on soil, blow count, damage etc. Typically one of the blows that is close to the test load is subjected to CAPWAP analysis.

The CAPWAP program is an analytical method that combines measured field data with pile wave equation type procedures, to estimate the pile's static bearing capacity and soil resistance distribution. The pile is discretized into a series of elements typically of 2m interval each. Based on the measured velocity data, the program computes the force required to induce the imposed velocity. Both measured and computed forces are plotted as a function of time and the iterative analysis is continued till there is good agreement between both the curves. If the agreement is not satisfactory, the soil resistances at the pile point and along the pile are adjusted until a good match is obtained. This gives the frictional distribution along the sides at every 2m (or as per the discretized length of each element) and the end bearing component of the pile. The method also corrects the field capacity to obtain a refined static capacity since the pile profile, quake and damping parameters are now better defined. Since the method computes the elemental load and displacement for each discretized element a cumulative of these values provides the simulated load displacement curve similar to a static load test. A graphical presentation of CAPWAP analysis screen is shown in the Figure.



CAPWAP Analysis Flow Chart

It includes a match for the measured (Msd) and computed (Cpt) force curves at the left top corner. A good match between both the curves indicates a Good analysis. The match is quantified by the match quality number. Lower match quality number indicates better match. The match quality of the analysis should be preferably less than 5 for the bored piles. However for rocksocketed piles or piles with greatly varying cross-section or soil it may be difficult to achieve good match quality.



CAPWAP Input Screen

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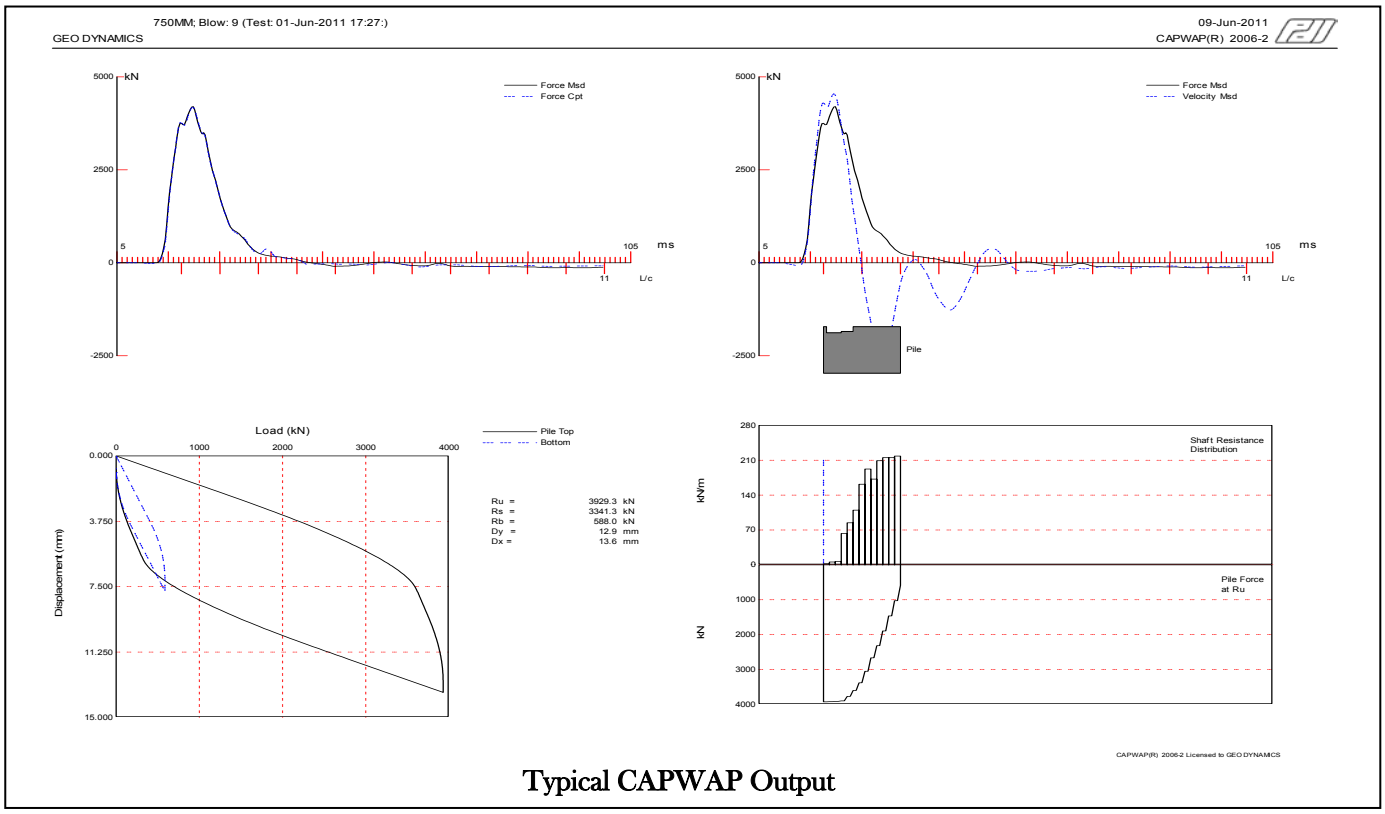

Typical CAPWAP Output

A standard CAPWAP graphical input and output is also provided in the Figures. The curve on the top left corner is the match between measured and computed forces. The curve on the top right corner is the measured field data that can be used to compare with the output submitted on site. The curve on the bottom left corner is the simulated static load test curve. Here Ru indicates the measured or ultimate pile capacity. Rs=Rshaft is the total skin friction component and Rt=Rtoe is the total end bearing component of the pile. Dy indicates displacement at pile toe and Dx is the maximum pile top compression. The curve on the bottom right corner is the graphical representation of friction distribution and a complete numerical analysis is also available separately and provided as a standard output with all the reports.

It should be noted that PDA measures the field capacity while CAPWAP refines the field results and corrects the field assumptions. Hence field capacities obtained using PDA may not necessarily match with the CAPWAP analysis.

PIT TRAINING FOR AL HOTY STANGER LTD.

A 2nd round of training course was conducted by Mr. Vaidya for Al Hoty Stanger Ltd. The session was 2 day long and was held in Dubai. Mr. Vaidya trained the attendees on PIT-FV. The training covered procedure for field testing as well as analysis using PIT-W PROFESSIONAL software along with details related to Profile and PIT-S software.

EXTRACURRICULAR ACTIVITIES AT GEO DYNAMICS

Other than leading in professional and technical activities Geo Dynamics is also very active in extracurricular activities. Uttarayan is one of the largely celebrated festivals in Gujarat. Geo Dynamics was also very enthusiastic in celebrating this Kite festival during 14th and 15th January. Also in the winter season Geo Dynamics team enjoyed game of cricket every Sunday. Mr. and Mrs. Vaidya successfully completed the half marathon which was held in Baroda on 5th February, 2012. Furthermore, Mr. Vaidya also participated and completed the Half Marathon which was held in Ahmedabad in 2 hrs 35 mins. Such activities

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keep Geo Dynamics motivated and spirited to continue sailing successfully!

TECHNICAL LECTURES

Mr. Vaidya presented a paper "High Strain Dynamic Pile Testing Practices in India – Favourable Situations and Correlation Studies" jointly written by ITD and Geo Dynamics for IGC Kochi which was held on December 15th to 17th, 2012. This paper summarizes the correlation studies performed in the past and presents recent case studies performed in Indian scenario. The paper is available for downloading on our website.

Mr. Vaidya also delivered a technical lecture for the SVIT Vasad students as well as staff on December 2, 2011 at their campus. Mr. Vaidya delivered a lecture on Innovative NDT applications for Super Structure and Deep Foundation Testing.

GEO DYNAMICS' PRESENCE AT IGC KOCHI

Geo Dynamics put up booth at the IGC Kochi which was held in December 2012. Geo Dynamics displayed range of equipment including PDA, PIT, GPR, UPV, Rebound Hammer etc. We received overwhelming response from the attendees and would like to thank to the people who took time to visit our stall.

GEO DYNAMICS ANNOUNCES OPENING OF KOCHI REGIONAL OFFICE!

Geo Dynamics is glad to announce opening of its one more regional office in Kochi, Kerala to cater to projects in Southern India and the Konkan belt. All low strain integrity testing (PIT) and NDT tests like rebound hammer, UPV testing shall be done locally. HSDPT shall be done through our Chennai office or Baroda HO based on specific project requirements. All reports and commercial aspects shall be managed by our HO only. Contact Neeti Patel or Sevugan (Mobile: 07708303255) for any testing requirements.

CLIENT FEEDBACK

General Manger Operations, Alembic Group – "Geo Dynamics was engaged by us to conduct in-situ quality assessment using NDT & semi destructive methods for one of our commercial buildings in Vadodara. I was happy to see their transparency, commitment and dedication to the job. The work was done within our time frame and we enjoyed the technical interactions. Thank you for your professionalism and competency."

WHAT'S HAPPENING IN 2012?

- International Civil Engineering and Sustainable Infrastructure Conference, New Delhi, India (May 24)
- AARCV 2012: International Conference On Advances In Architecture And Civil Engineering, Bangalore, India (June 21)
- Indian Geotechnical Conference, New Delhi, India (December 13-15)
- 2nd International Conference on Electrical, Electronics and Civil Engineering (ICEECE'2012), Singapore (April 28)
- International Conference on Civil, Offshore and Environmental Engineering (ICCOEE 2012) Kuala Lumpur Malaysia (June 12)
- 3rd International Conference on Construction In Developing Countries Advancing Civil, Architectural, and Construction Engineering & Management Bangkok Thailand (July 4)
- 2012 International Conference on Civil Engineering and Architecture (ICCEA 2012) Hong Kong China (August 2012)

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