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Aspects of „in situ" testing of piles with large diameter. Study case

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Summary

During the stage of development of a bridge, the quality has a great significance for the life cycle of the work itself. A work performed incorrectly, shortens proportionately the duration of service of construction -bridge, often, may have major implications for economic, social, etc..

This article presents the concept of evaluation of pilots test using tests "in situ" as we find in literature specialized in this field.

The case study presented in the second half, highlighted both the need and importance of achieving vertical strength test pilot for foundations.

The test confirms the correctness of the calculation assumptions provided by the project, by establishing precise bearing capacity real exerted by the pilot tried.

KEYWORDS: bridge foundation, indirect foundations, test piles, evaluation

1. INTRODUCTION

The need of tests in construction is required, first, to ensure accurate design correlated with a check level of quality performed.

Test results highlight the possible reserve safety of test pile, which may be considered an important time to achieve other work .

Under current legislation, the test pilot test for the indirect foundations is subject to the NP 045/2000 "Regulatory framework for field testing of pile trial of foundations".

Checking real bearing capacity of vertical pilots can be achieved using the following types of tests:

- Static tests (Figure 1) with steps of loading:

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- Axial
  - Compression
  - Draw
- Transversal – with horizontal strengths

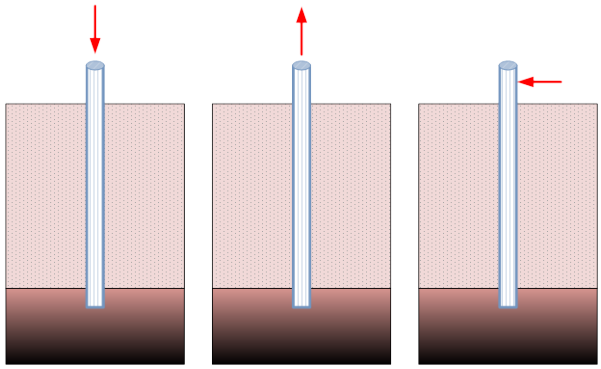

Fig.1 (a) Compresion, (b) Draw, (c) Horizontal strengths

- Dynamic tests, they performed just for prefabricated piles placed in the ground or vibro-pressing driving.

Depending on the purpose for each test are set four levels of test piles sample:

- N_1level for testing purposes of scientific research;
- N_2 level for testing to design foundations on piles;
- N_3 level for control tests to confirm the preliminary bearing capacity in the project;
- N_4 level for tests at piles reception with potential defects in execution.

2. TEST METHODOLOGY

2.1. General data

Test pilot test is placed for the passage over rail road located on a roundabout version of Iasi. The passage has a number of openings 17 to 24.00 m each, and the test is made at pilot 39, located within abutment number 6. Test pile diameter is 1200 mm and drilled length is 17.50 m.

The aim of the test fall in the quality N3, control tests on the piles from the foundation to confirm the bearing capacity by the project preliminary.

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For pilot tested are presented data sheets and concrete drilling, which include the following elements:

- position in the plan of pile test (indicated by the designer);
- geometric dimensions (diameter and length of pile);
- characteristics of foundation soil (lithologic stratification);
- equipment used in achievement of the pile and its characteristics;
- material characteristics of the pile: the class of concrete and steel mark;
- comments during the completion of the pile.

The site the geotechnical study indicate the following layers:

- from 0-0,60 m coating plant;
- from 0,60-4,60 m of clay, loam yellow, with brick areas, with high and very high plasticity, plastic consistent to vigorous, very moist to saturated;
- from 4,60-7,60 m sandy clay and sand dust, cochilifer, brown, with high plasticity, soft plastic to consistently, saturated;
- from 7,60-12,60 m looking clay shale, dark gray, with medium to high plasticity, stout plastic to hard, very wet.

A particular importance is given to protect the pile tested at shock on the period between the end of the realization and completion of the pilot.

2.2. Test equipment

The loading of the pilot no. 39 is made in steps of loading up to a maximum force of 3000 kN, while the reaction is taking over the anchor provided by 3 anchorage piles of the work and the 4th is executed outside the work (Figure 2.2.1.).

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Fig.2.2.1. Overview of test

In the test is used a double-acting hydraulic cylinder for 6000 kN (figure 2.2.2.b) which is placed centered on the pilot's head. The cylinder is operated by a group of pumping (a), operated by a distributor. Precision hydraulic cylinder is 2%.

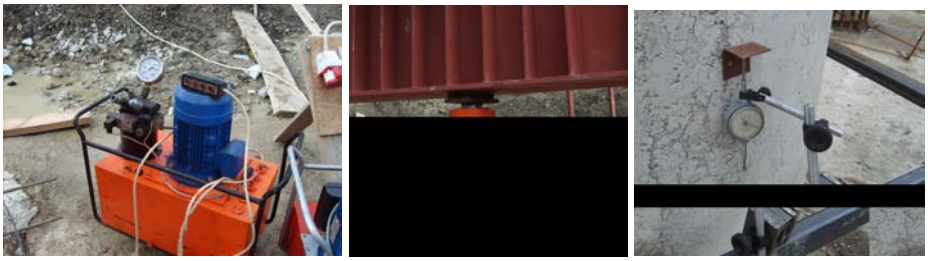

Fig.2.2.2. (a) group of pumping, (b) hydraulic cylinder, (c) micro comparator

Upper part of the pile's movements will be recorded by the 4 micro comparators (figure 2.2.2.c), attached to a metal frame of reference. Micro comparator accuracy is 0.01 mm.
Test reference beams used are made of metal profiles U (figure 2.2.1), made of steel OL 52-4K. The beams are arranged in cross working scheme is shown in figure 2.2.3. as shown marginal piles are pulling loaded and pile in the middle is pressure loaded.

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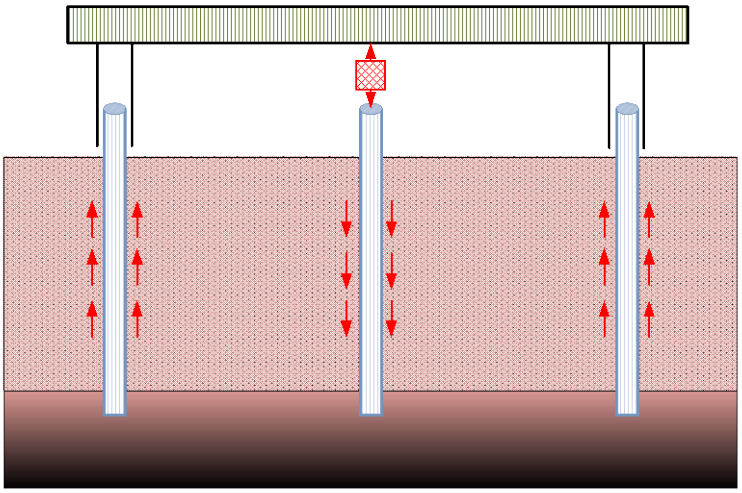

Fig.2.2.3. Charging scheme

2.3. Preparation for test piles

The pile test under compression capitel run with a reinforced concrete (using longitudinal pile fittings), with a height of 1.30 meters and a diameter of 1200 mm. On top of the capitel a tank is done with a 5 cm depth, which will mount a disk-shaped jars with a diameter of 1090 mm and a thickness of 20 mm. Metallic disk will mount on a 5 cm layer of sand.

Fig. 2.3.1. Pilot called compression fittings

Fittings piles will be subjected to pulling the weld metal tube with a diameter of 970 mm, thickness 15 mm. The connection between beams and anchoring pilots is articulated through metal tie at both ends.

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The reference is made of pipe square support brackets are willing at least 2.00 m from the test pilot (NP 045/2000).
Readings for each load step are made at all measuring equipment and devices: every 15 minutes during the first hour and every 30 minutes to stabilize subsidence.
The total discharge will continue reading for another two hours to determine with certainty the amount of elastic and residual deformations.

Fig. 2.3.2. Fitting the pile requested to pluck

Fig. 2.3.3. Detail thrusts-beam test fixture

Fig. 2.3.4. Detail of the boundary of test beams

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2.4. Result of a test (particular case)

The maximum value test was established by the project by project test as KN 3000, this is accomplished in a first cycle charge and discharge up to 3,000 KN.

The designer can specify that the loading will take place in 10 steps of loading up to 300 KN to load 3000 KN. For each step of the test were made readings of movement at 15 and 30 minutes and they started to load the next step only after it was found to conventional stabilization movement. Discharge was performed in 5 steps of downloading each one of 600 kN.

Contact between micro comparators bars and reference beams were achieved by means of perfectly smooth surfaces, provided specially for this purpose. Differences in displacement from the average are about 5%, so that the records satisfy the requirements of normative and thus conclusive. Differences between readings due to position are due to test equipment to the axis and atmospheric conditions. Attachment points of reference beams were placed at 60 cm from the pilot tried. Catching assured fixing reference beams for the entire duration of the tests.

Chart of load - settling – time resulting based on measurements shown in Figure 2.3.3.

Based on results from pilot tests to establish a centralized graphical chart of compression-compaction, comprising:

- Changes in P loading in time;
- Change of pilots compactions S depending on time;
- Changes of stabilized settlement with loading.

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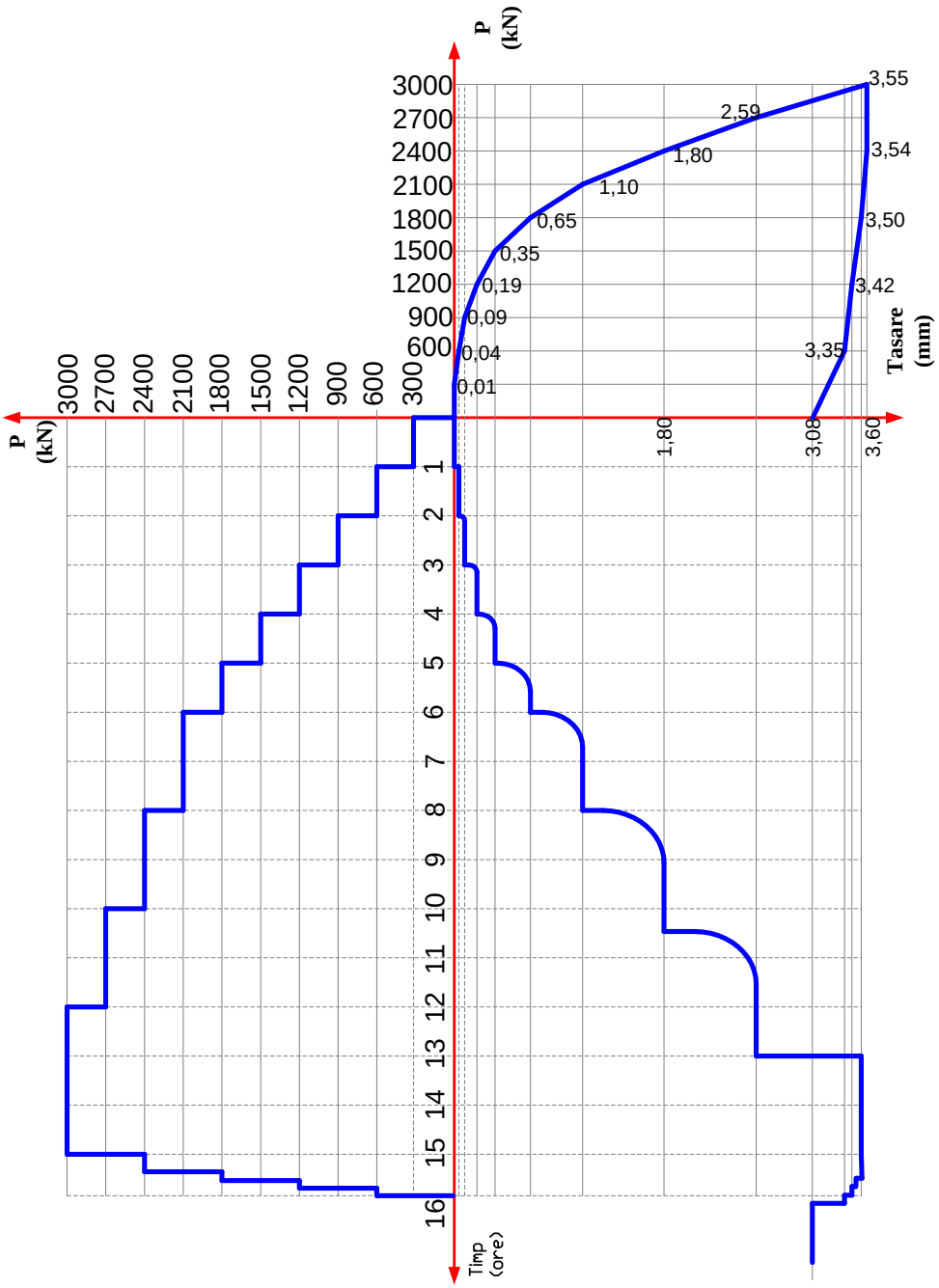

Fig. 2.3.3. Load- settlement -time diagram

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3. CONCLUSIONS

After processing and analysis of pile test results from the vertical load is found it a very good reaction resulting a continuous settlements curve.

Chart analysis load - strain - time, through normal evolution of settlements, stabilize their normal, settlements size average maximum total 3.25 mm, shows that did not reach maximum load, the column having large reserves to failure.

Overall test results of the vertical load of 3000 kN of P39 pile with a diameter of 1200 mm executed in site, confirm the values of calculation from the project.

These values are lower than the values allowed by the Normative NP 045-2000 (1 / 10 of diameter = 120.0 mm) and therefore can go further in the next phase of implementation objective.

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